Hittite vowel epenthesis and the sonority hierarchy*

Darya Kavitskaya
Yale University

Introduction

This study examines the distribution of non-etymological vowels in Hittite and finds that the distribution of these vowels is predictable and depends solely on the constraints on syllable structure. I show that certain non-etymological vowels brought to life by the use of the cuneiform writing system are purely orthographic, and certain other non-etymological vowels are linguistically real and epenthetic, and propose that vowel epenthesis in Hittite is motivated by syllable structure constraints and the sonority hierarchy.

The problem of Hittite epenthesis has ramifications for two general issues in linguistics. First, it crucially depends on the interpretation of a writing system of a language preserved only in written records. Better comprehension of the principles which govern the use of non-alphabetic cuneiform to render a language can significantly improve our understanding of the language-specific phonotactics and syllable structure (of Hittite, in our case, which is the oldest attested Indo-European language, and thus of Proto-Indo-European), as well as of general principles which are at work when syllabaries are used.

The other general issue discussed here has implications for the theory of Proto-Indo-European syllable structure. The analysis of Hittite vowel epenthesis proposed in this paper favors the view of the Proto-Indo-European syllable structure presented in Steriade (1982) (and developed further in Guion

* I would like to thank Andrew Garrett, Gary Holland, Jay Jasanoff, Craig Melchert, and two anonymous reviewers for their comments and suggestions. I am also indebted to the audiences at the presentations of the earlier versions of this paper at the 1999 LSA meeting and at the UC Berkeley Historical Linguistics Group meeting for very helpful discussion. An earlier and much shorter version of this paper appeared as Kavitskaya (1999).

Diachronica XVIII:2 (2001), **267–299.** ISSN 0176–4225

1996). The traditional view holds that all intervocalic consonant clusters are heterosyllabic in Proto-Indo-European and Proto-Greek (Hermann 1923, Meillet 1934). In her 1982 dissertation, Steriade proposed a different analysis (specifically for the development from PIE to Attic Greek) which suggested that the original treatment of consonant clusters was to maximize onsets to include clusters of equal or rising sonority. Not uncontroversial itself, Steriade's theory of onset maximization is nonetheless more consistent with Hittite syllabification and allows the explanation of the distribution of non-etymological vowels in Hittite in terms of sonority.

1. The Hittite writing system

Written records of Hittite and other Anatolian languages, such as Palaic, Luvian, Lycian, Lydian, and very poorly attested Carian, Pisidian and Sidetic, are the only evidence left for drawing conclusions about the grammars of these languages. Cuneiform used for writing Hittite is not an alphabetic writing system, and it was originally designed for non-Indo-European languages with a different structure which is not particularly well suited for the needs of Hittite phonotactics. This raises complications for the interpretation of Hittite phonology in general, and for making inferences about syllable structure in particular.

Strictly speaking, the cuneiform writing system which was used by Hittite scribes is not a 'syllabary'. In the traditional sense, syllabaries are writing systems whose inventory of signs coincides or nearly coincides with the syllable templates of languages for which they are used (as, for example, in Japanese *katakana* and *hiragana* scripts). There is no one-to-one correspondence between Hittite syllables and individual cuneiform signs. The signs can denote V, CV, VC and CVC sequences which are 'roughly' phonetic.[1] Four vowels (/i/, /e/, /a/ and /u/) and most of the possible CV and VC sequences were represented, and only a few phonetic CVC signs existed.[2] Given the limitations of the cuneiform writing system, only a limited set of consonant clusters can be faithfully represented, and the interpretation of such representations is the main

1. For full inventory of cuneiform signs, see Rüster (1989).

2. Additionally, the symbols in the script can be logographic, Sumerian or Akkadian (in which case Hittite pronunciation is often unknown), but in this paper we concern ourselves solely with the interpretation of phonetic symbols.

problem addressed in this paper.

In (1) there are some examples of transliterated words from Hittite texts, containing V, CV, VC and CVC signs with corresponding phonemic representations.[3]

(1) a. *e-ed-mi* "eat" 1SG.PRES.ACT [e:dmi]
(*KBo* III 34 III 9)
b. *har-pa-a-mi* "take to, begin; assemble" 1SG.PRES.ACT [harpa:mi]
(*KUB* LII 14 II 29)

The remainder of the paper is organized as follows. Section 2 presents the main question of the paper — what is the difference in the origin and distribution of Hittite non-etymological vowels? A brief summary of the current views on sonority and syllable structure is given in Section 3. In Section 4, cases of inherited clusters with non-etymological *a* are examined, and in Section 5, the analysis of the distribution of non-etymological *i* is presented. Section 6 deals with a complication caused by the coloring of epenthetic vowels by labiovelars and laryngeals, and Section 7 explicates the treatment of *obstruent+glide* clusters in Hittite. Section 8 presents Anatolian comparative evidence in support of the claims in the paper, and Section 9 provides a summary of the conclusions reached.

2. Non-etymological vowels: Orthographic vs. epenthetic

The fact that Hittite had consonant clusters is generally accepted and not controversial. Subsequently, since every cuneiform sign had a vowel, all inherited Proto-Indo-European or Proto-Anatolian initial or final consonant clusters, or medial triconsonantal clusters, had to be written with a non-etymological vowel. Such vowels could in principle be either phonetically empty

3. Conventional transliterations are used throughout the paper. It is generally accepted that the phonetic value of *z* is [ts], and *š* is phonetically an [s]. Textual references are given to most examples I use, and I also refer to where the examples are discussed in the literature. Orthographic representations are italicized, transliterated cuneiform signs are separated by hyphens, forms in square brackets are phonemic representations, and forms in slashes are underlying morphemic strings.

or epenthetic.[4] The use of cuneiform creates a two-way ambiguity in the rendering of Hittite consonant clusters. On one hand, the use of cuneiform presents a challenge for distinguishing between orthographic vowels, used conventionally to write certain clusters, and epenthetic vowels. On the other hand, since almost any vowel in a CV or VC sign can be in principle interpreted as etymological or non-etymological, we know which vowels are etymological only from reconstructions like those shown in (2).

(2) a. Old Hittite (OH) *e* < PIE *é (Melchert 1984: 87)
e-ka- "ice" < *yégo-
b. OH *i* < PIE *i (Melchert 1984: 95)
iš-ki-iš- "back" < *is-gh-

Sometimes, an additional V sign is used in conjunction with the CV or VC sign, as in (3). There are different views on the cause of this double, or 'scriptio plena', writing of the vowels. But whether it is taken to denote either length or accent, in most cases scriptio plena renders etymological vowels.[5]

(3) a. *e-eš-mi* "be" 1SG.PRES.ACT (*VBoT* 58 IV)
b. *a-pa-a-ša* "but this" (*KUB* XXXVI 106 Vs. 3)

In Hittite orthography, two non-etymological vowels — *i* and *a* — are regularly used for breaking up inherited consonant clusters.[6] A cluster which is broken up using an *aC* sign is shown in (4a), and a cluster which is broken up by an *iC* sign is in (4b).

---

4. By 'phonetically empty' I mean any vowel which does not have phonetic substance and is required solely by the conventions of the writing system, and I use the term 'epenthetic' exclusively for non-etymological vowels which are phonetically real.

5. There are instances of non-etymological plene vowels, as, for example, in [te:ri] "three" < *tr- (cf. also Luvian *tarri-*) discussed by Melchert (1994). See footnote 6 for discussion of this example.

6. There are some clear cases where a non-etymological vowel is represented by *e*, e.g. *te:ri-* "three", *pišeːna* "man, male" (Melchert 1994: 174, Oettinger 1982: 172). Melchert (p.c.) suggests that the epenthesis in such examples may have occurred to the left of the original accent, with the accent then retracted onto the epenthetic vowel, which regularly lengthened. There is no evidence that any such epenthesis remains a synchronic process. Still, a complete account of diachronic vowel epenthesis in Hittite may have to pay attention to stress. However, the current understanding of accentuation in Anatolian is far from adequate, so the treatment of stress as an additional factor which conditions epenthesis is beyond the scope of this paper.

(4) a. /kars-/ "to cut"
kar-aš-mi "I cut"
b. /app-ske-/ "take (iter.)"
ap-pí-iš-ki-iz-zi "They take (iter.)"

The origin and distribution of these vowels has long been debated. The main question raised by the surfacing of several distinct non-etymological vowels in Hittite consonant clusters is whether these vowels are orthographic entities with no phonetic substance, brought to life by peculiarities of the cuneiform writing system, or they reflect phonological epenthesis and thus were pronounced by the speakers of Hittite. Currently there are two major opinions about the nature of non-etymological *i* in Hittite (which regularly appears in clusters of the structure *obstruent+s,* for example, as before the distributive/iterative suffix *-ske-* and the preterite suffix *-s-*, and before word-initial *sC-* clusters). In these contexts, non-etymological *i* is either treated as a non-linguistic vowel required by writing conventions (Kronasser 1966, Melchert 1984 on word-initial *isC-*), or as an epenthetic vowel (Oettinger 1979, Melchert 1984). Eichner (1974) tends to interpret any variation as linguistically significant and thus treats both non-etymological vowels as linguistically real.

Most accounts of the distribution of non-etymological *i* and *a* make reference to the Hittite phonotactics or syllable structure and treat epenthesis as means to break unacceptable consonant clusters. However, none of these explanations have been connected to the sonority hierarchy as the principle governing the syllable structure of Hittite and as the motivation for epenthesis. This paper shows that the choice of a non-etymological vowel is not arbitrary or due to mere orthographic convention, but is in fact principled, governed by typologically familiar phonotactic factors, and dependent on the sonority hierarchy.

I claim that non-etymological *i* and *a* are in complementary distribution in Hittite; their surfacing is predictable. Non-etymological *i* is used in clusters which cannot be syllabified to obey the sonority hierarchy. Its distribution is crucially dependent on the phonotactics of Hittite and can be uncontroversially stated only by referring to syllable structure and sonority. Therefore, non-etymological *i* in Hittite is epenthetic (linguistically real). On the opposite, non-etymological *a* is used in contexts where, according to the sonority hierarchy, syllabification problems are not expected. The distribution of *a* is crucially not dependent on the phonotactics of Hittite which suggests that non-etymological *a* is purely orthographic.

3. Sonority

As stated in Blevins (1996), the relationship between syllable structure and sonority has been recognized for more than a century (cf. Thausing 1863, Sievers 1881, Jespersen 1904). The current view (that is, the relatively uncontroversial core of current views) is summarized in (5) in the form of the Sonority Sequencing Generalization principle (Blevins 1996: 210, after Selkirk 1984: 16):

(5) Sonority Sequencing Generalization (SSG):[7]

Between any member of a syllable and the syllable peak, a sonority rise or plateau must occur.

In order to interpret the SSG, a reference to the so-called 'sonority scale' or 'sonority hierarchy', which determines the respective sonority of segments in a language, is required. The sonority hierarchy is a scale determined both on the basis of typological patternings of sounds and phonetic evidence of the sounds' continuancy. Since languages differ on the extent to which they obey the sonority hierarchy, the SSG cannot and does not need to be interpreted as an absolute condition. Even though the sonority hierarchy is defined as a universal tendency by various authors, it has language-particular incarnations.

The syllable structure of Hittite seems to be almost unambiguous in respect to the universal sonority hierarchy accepted by most phonologists. In Hittite, vowels are more sonorant than liquids (which is completely uncontroversial since in Hittite there are no other syllable peaks than vowels), and liquids are more sonorant than obstruents, a claim which is consistent with the data, given that most reconstructable onsets in Hittite are of rising sonority (6a), and the reconstructable codas are of falling sonority (6b).

(6) a. Reconstructed onsets:

*<u>kr</u>awar	"horn"	*krV-
*<u>pr</u>a-	"forth"	*prV-

b. Reconstructed codas:

*kar<u>s</u>.mi	"I cut"	*CVrs-

The absence of tautosyllabic *CC (obstruent+obstruent)* clusters, including *SC (fricative+obstruent)* clusters, suggests that in Hittite there is an active phono-

7. A reviewer points out that the SSG was first formulated by Stampe (1973).

tactic constraint on tautosyllabic obstruents.[8] There is no relevant data which would allow one to judge uncontroversially if fricatives in Hittite are of equal or greater sonority than obstruents. It has been claimed in the literature that fricatives are cross-linguistically more sonorant than stops, but it is also well-known that *s* has an exceptional status, often being the only segment which does not obey the sonority hierarchy in otherwise 'well-behaved' languages, e.g. in English. The notorious problem of the sonority of *s* will be addressed in later sections.

The hierarchy in (7) represents a working Hittite sonority scale:

(7) More sonorant Less sonorant
vowels > approximants, nasals > fricatives, stops

From an examination of the data with regard to sonority, the syllable template for Hittite, that is, the set of the possible (and attested) syllables in the language, can be represented as in (8):

(8) CVC, CRVC, CVRC, RVC, RRVC
(where C = any obstruent, R = any sonorant, V = any vowel)

Steriade's (1982) theory of onset maximization in Attic Greek predicts that clusters of rising sonority should be treated as legitimate onsets, and thus should not require epenthesis for phonotactic reasons. The analysis of the distribution of non-etymological vowels presented below justifies the inventory of Hittite syllables in (8) and supports Steriade's views of Proto-Indo-European syllable structure.

---

8. Craig Melchert (p.c.) has reminded me of the significance of the existence of the alternative spellings, such as *wa-ša-pa-* and *wa-aš-ša-pa-* "garment". He suggests that in the latter case the spelling with the double *s* must be motivated by the heterosyllabicity of the *š* (as first proposed by Bernabé 1973: 446f. as the spreading of the *s* across a syllable boundary). The syllabification of such a form would be [was.spa], where *s* is geminated and heterosyllabic, and thus the onset of the second syllable is [sp]. However, the traditional interpretation of the double consonants has been that they represent the Proto-Indo-European voiced vs. voiceless opposition, and since spellings with double *š* are sporadic, they do not constitute strong evidence for analyzing the double *š* as long. Although it is not inconsistent with the general typological properties of *š*, accepting Melchert's analysis entails stipulating that *sC* is the only word-internal onset cluster of non-rising sonority in Hittite. This in turn predicts that it should behave differently from other internal consonant clusters on its type, which is not the case.

4. *a* — orthographic convention

With the notion of sonority just defined, we turn to the question of non-etymological vowels. With the reference to the sonority hierarchy, it can be demonstrated that onset clusters which are rendered with the help of non-etymological *a* are of rising sonority, and most of the coda clusters written with non-etymological *a* are of falling sonority. Thus, I claim that non-etymological *a* does not appear in clusters for sonority reasons or to obey phonotactic principles of Hittite.

The fact that non-etymological *a* is just an orthographic convention can be seen from examining the spelling of stems reconstructed with consonant clusters.

Consider the data in (9), which shows words with reconstructed initial *obstruent+liquid* (CR) clusters:

(9)	a.	*pr-	*pa-ra-a*	"forth" (*KUB* XXIX 8 IV 39)
			pa-ra-a-i	"blow" 3SG.PRES.ACT (*KUB* VIII 1 II 17.III 10)
	b.	*kr-	*ka-ra-a-wa-ar*	"horn" (*KUB* XXXI 4)
	c.	*sr-	/srai-/	"weave"
			ša-ra-an-zi	3PL.PRES.ACT (*KBo* V 1 III 53)
	d.	*sl-	/slik-/	"push"
			ša-li-ik-mi	1SG.PRES.ACT (*KUB* V 1 I 29)

All the examples in (9) and many more words with word-initial etymological CR clusters are consistently written as *Ca-RV-* [9]with an initial *Ca* sign, that is with the help of non-etymological *a*.

(10) shows the 'spelling' of coda clusters of *liquid+obstruent* (RC) type:

(10)	a.	/kars-/	"cut"	
		kar-aš-mi	1SG.PRES.ACT	[karsmi]
		(*KUB* XXIX 1 I 35)		
		kar-aš	2SG.IMPERATIVE	[kars]
	b.	/harp-/	"take, begin, set up, assemble, pile up"	
		har-ap-zi	3SG.PRES.ACT	[harptsi]
		(*KBo* VI 10 I 26)		

The data in (10) illustrates the 'spelling' of the stems of CVRC- form, when

9. The absence of word-initial /tr-/ is "undoubtedly systematic" (Melchert 1994), but it remains to be explained why epenthesis happened only in *tr- clusters, and not in *pr- or *kr-.

such stems are followed by consonant-initial suffixes. The generalization emerges that in order to render coda clusters of falling sonority, the second consonant of the cluster is almost always written with the help of *aC* sign.

There is a possibility of variation between the *aC* and *Ca* writing of the second consonant in a cluster, as exemplified in (11).

(11) a. *wa-ar-ap-zi* "wash" 3SG [warptsi]
(*KUB* VII 1 + 11 13ff)
b. *wa-ar-pa-zi* "wash" 3SG [warptsi]
(*KBo* II 8 I 21)

Since the graphic vowel appears alternately before and after the consonant, this argues that the vowel is not linguistically real. As Melchert (p.c.) points out, the standard convention for spelling -VRCCCV- was -VR-VC-CV-, but it does not mean that the scribes were bound by this convention. The existence of rare alternatives as (11b) confirms our interpretation of the standard spelling. In the system in question, the conventionalized vowel *a* is not phonologically present, and thus spelling variation can be easily introduced.[10]

In a few cases, *a* in initial CR clusters is in free variation with *i*. The variation in CR clusters is mostly restricted to the environment after word-initial velars, as shown in (12):

(12) *ga/i-ra-pV-* "devour"[11]
ga/i-ri-it "flood"

In certain cases *e* is used alongside *a* and *i* to break up the clusters, as demonstrated in (13):

(13) *ša/e-me-en-* "cause to disappear" /smen-/
ša/e/i-pi-(ik)-ku-uš-ta- "pin, needle" /spik-/
ma/i-li-it-tu "sweet" /mlitu-/

10. There is a possibility that some *-Ca-* spellings are marginally conventionalized in Old Hittite, given that words like *a-ar-ša* "arrive" 3PL.PRT (*KBo* III 22 Rs.7) or KASKAL-*za* "campain" appear as *a-ar-aš* or KASKAL-*az* in later Neo-Hittite copies. There is some conflicting evidence, though, and this topic awaits more research.

11. In Friedrich (1952) also *karip-* = *karap-*. There are also forms like *ga-a-ra-pí* (Melchert 1994: 30), *ša-a-li-ga* and *ša-a-ra-pi* with the 'sporadic' epenthesis in initial CR- clusters. Since these forms are spelled with scriptio plena, they cannot be interpreted as having a CR- onset. Melchert (1994 and p.c.) is compelled to assume some synchronic variation in such cases and to treat these exceptions as pronounced with the epenthetic vowel (stressed, and thus lengthened).

In sum, non-etymological *a* is used to render prevocalic clusters of rising sonority and postvocalic clusters of falling sonority. In other words, all consonant clusters which are rendered with the help of non-etymological *a* obey the sonority hierarchy. I therefore infer that the vowel is present not for phonotactic reasons, but rather is merely orthographic, and that its sole purpose is to provide a sign for clusters otherwise inexpressible in the writing system.[12] There are alternate *Ce* and/or *Ci* spellings of certain clusters, regularly rendered with the help of *Ca*. I treat these alternates as instances of spelling variation, together with the existence of -VR-CV-CV- spelling variants. Importantly, there are no contemporary alternations between *Ce* and *Ci* without the existing alternates written with the help of *Ca* (Melchert, p.c.), which provides additional evidence that these vowels are merely orthographic.

We have now determined that non-etymological *a* is introduced by the writing convention. The next logical question to investigate would be the grounds on which *aC* or *Ca* signs are used to render consonant clusters, as in (14), rather than signs which contain other vowels, say *iC/Ci* or *uC/Cu*. That is, is *a* a randomly chosen vowel, a true orthographic convention, or, perhaps, simply the most frequent vowel in Hittite? Or is it a copy vowel of the preceding or the following nucleus?[13]

---

12. The fact that the word-final Proto-Anatolian *i is consistently written as *a* after word-final ts suggests that final *i was lost after *t* (final *ti > *ts*) in Hittite (Melchert 1994: 183, Kimball 1999: 191–192 see also Joseph 1984 on the *-ti > -z(a) final development).

i. *hanza* "in front" [hants] < *$h_2$énti
za reflexive particle [ts] < *ti

Melchert (1994: 176) assumes, following most recently Eichner (1975: 80) and Oettinger (1979: 96), that the final vowel in "he swore", as well as in other third singular preterite forms, is linguistically real since the spelling *li-in-kat* would be sufficient to render /linkt/. Examples of how /linkt/ is spelled are shown in (ii).

ii. *li-in-ik-ta* "he swore" [linkt]
li-ik-ta
li-in-kat-ta

The existence of the *li-in-kat-ta* spelling seems to imply yet a different type of epenthesis in word-final *obstruent+obstruent* clusters. At this time, I cannot offer more insight into this problem. Melchert (p.c.) also points out that there are rare exceptions to the generalization above: e.g. *namma=war=as hanti tuhsanzi* "Furthermore, it (the bee) is especially cut off" (i.e. truncated; expect *tuhsanza*).

13. As Miller (1994) points out, this is an option that is generally available in syllabaries.

(14) a. *wa-ar-ap-zi* "wash" 3SG.PRES.ACT [warptsi]
(*KUB* VII 1 + 11 13ff)
b. *kar-aš-mi* "cut" 1SG.PRES.ACT [karsmi]
(*KUB* XXIX 1 I 35)

To answer at least some of these questions, we need to examine CCVC and CVCC roots, where V is any other vowel but *a*. Forms in (15) demonstrate that Hittite generally used graphic *a* for writing onset clusters regardless of the quality of the following nucleus in roots of CRVC (CNVC) type.

(15) a. *ša-li-ik-mi* "push" 1SG.PRES.ACT [slikmi]
(*KUB* V 1 I 29)
b. *ga-ni-eš-mi* "recognize" 1SG.PRES.ACT[14] [gnesmi]
(*KUB* XXX 10 Vs. 24–25)
c. *ga-nu-ut* "by the knee" [gnut]

Notice that even though the root vowel is *i* in (15a), *e* in (15b), and *u* and (15c), CV signs with non-etymological *a* are used to write onset consonant clusters in all three cases, thus arguing against the "copy" technique.

It is more problematic to answer the same question in the case of CVCC roots. Most of the examples of the extra-linguistic *a* at least in such roots are similar to those in (10), where the root vowel is also *a*. Various historical processes like the merger of the zero-grade of liquids and their *o*-grade as *aR* lead to a preponderance of *a* before clusters of RC type. NC clusters are not a good test case either, because they are predominantly treated in the literature as not having the internal nasal (Sturtevant 1933:69, Kronasser 1956:71, 1966:89ff). According to the summary given in Melchert (1994), the general consensus is that *n* is relatively unstable in Hittite before a following stop, *ts*, or a laryngeal. Reichert's (1963) inverse dictionary of Hittite lists only one root of a type CVRC (15) which has a vowel other than *a*:

(16) a. /guls-/ "carve, engrave, inscribe, write, trace, mark"
b. *gul-aš-mi* 1SG.PRES.ACT [gulsmi]
(*KUB* XVII 9 I 8–9)
c. *gul-aš-zi* 3SG.PRES.ACT [gulstsi]
(*KUB* XV 34 IV 18)

14. Puhvel (1997:45) states that *ganeš(š)* 'reflects IE *gne-, gno- "know"'; also see Melchert (1994:94) regarding *ganešš-* < *gneːh$_3$s-.

Notice that even though the root-vowel in /guls-/ "to mark" is *u*, the *-as-* sign is used to render the root-final consonant cluster of falling sonority. This can be used as a proof that non-etymological *a* at least does not have to be a copy of the root vowel in coda clusters and in this case is used purely for orthographic reasons.[15]

5. Epenthetic *i*[16]

We have just seen that the non-etymological vowel *a* is not necessary to make clusters obey any phonotactic principles of the language; clusters which are written with *a* are already well-formed. *aC* signs are used in order to render consonant clusters which cannot be written as such, since all cuneiform signs must have a vowel in them. As we shall see, the surfacing of epenthetic *i*, on the contrary, crucially depends on syllable structure. Like any epenthetic vowel, *i* breaks up phonotactically unacceptable consonant clusters.

5.1 Hittite cluster types which require epenthesis

In practice, because of the fact that only certain cluster types were possible in Proto-Indo-European, and also because of the properties of Hittite morphology, the contexts which are consistently not permitted by Hittite's syllable template and the sonority hierarchy amount to the clusters shown in (17):

(17) **Morpheme-internal**
- word-initial *s* + obstruent (stop or laryngeal)
- obstruent + *s* [+ obstruent (a heteromorphemic obstruent of an ending)]
- stem-final *s* + obstruent

At morpheme boundaries
- stem-final obstruent + [*s* + stop (iterative *-ske-*)]

15. As a reviewer points out, forms like *li-in-ik-ta* "he swore" (which is most likely should be interpreted phonetically as [linkt]) show that for coda clusters the Hittites used the 'copy' technique as well as the 'empty' *a* (see Kimball 1999: 112 for the argument that Hittite scribes used both options of a 'dummy', or default, and an 'echo', or copy, vowels).

16. I use the general term 'epenthesis' to refer to any vowel insertion. Word-initially, the insertion of vowels can be also referred to as 'prothesis'.

– obstruent + stem-final obstruent + [*s* + stop (iterative *-ske-*)]
– stem-final obstruent + [*s* (preterite *-s-*)]

Most examples of word-medial *-Cs(C)-* clusters are morphologically derived and involve either the distributive/iterative suffix *-ske-* or the preterit suffix *-s-*. These morphological environments are discussed in Section 5.2 to exemplify the process of epenthesis at morpheme boundaries.

5.2 Clusters at morpheme boundaries

5.2.1 *Distributive/iterative suffix* -ske-. The distribution of non-etymological *i* before the iterative suffix *-ske-* can be uncontroversially stated only by referring to syllable structure, which seems to be the best proof of the epenthetic nature of the vowel in question. Usually, if reference to syllable structure is required in order to state a particular environment for the surfacing of a vowel, an analysis in terms of a phonotactically conditioned epenthesis or syncope is called for.

There is no *i*-epenthesis when the *-ske-* suffix is added to vowel-final roots, as in (18):

(18) /da-/ /daske-/ "take"
/pai-/ /peske-/ "give"

There are two possible syllabifications of the forms in (18): as, e.g., /das.ke-/, with a heterosyllabic consonant cluster, or /da.ske/, with an onset cluster. In the first case, there are no complex onsets or codas, so epenthesis is not required. If the second case represented the syllabification, we would have to posit a special status of *sC* onset clusters, as was discussed in Section 3. For the rest of the paper, I will argue for cluster minimization, as in the syllabification that yields /das.ke-/.

When the root-final consonant is a liquid, in particular in instances like those in (19), no tautosyllabic clusters violating the sonority hierarchy are formed either. No epenthesis is required, and the sign with the conventional *a* is used.

(19) /ar-/, /er-/ "come (to), light (upon), arrive (at), come around"

		/ar-ske-/	
a.	*a-ar-aš-ki-iz-zi* (*VBoT* 24 I 32)	iter.	[arskitsi]
b.	*a-ar-ša-ki-iz-zi* (*KUB* XIII 2 I 24–25)	iter.	[arskitsi]

The syllabification of (19) is probably [ars.ki.tsi], where *rs* is an acceptable coda.[17] Note the possibility of *aC/Ca* variation in (19), which also points to the orthographic nature of *a*, as was discussed above.

However, if the suffix *-ske-* follows an obstruent-final stem, *i* is inserted between the stem and the suffix, as in (20):[18]

(20)	a.	/ep-/	"take, seize, grab, pick, capture"	/ap-ske-/
		ap-pí-iš-ki-iz-zi	3SG.PRES.ACT.ITER	[apiskitsi]
		(*KUB* XXI 20 I 161)		
	b.	/ak-/	"die"	/ak-sk/
		akkiškizzi	3SG.PRES.ACT.ITER	[akiskitsi]
		(*KUB* IX 31 IV 45)		
	c.	/sanh-/	"seek; clean"	/sanh-sk/
		ša-an-hi-eš-ki-mi	1SG.PRES.ACT.ITER	[sanhiskimi]
		(*HT* 97, 7)		
	d.	/kars-/	"cut, separate, segregate, sequester"	/kars-sk/
		kar-ši-eš-ki-iz-zi	3SG.PRES.ACT.ITER	[karsiskitsi]
		(*KUB* XLIV 60 III 8, 12, 13)		
	e.	cf. *kar-aš-zi*	"cut" 3SG.PRES.ACT	[karstsi]
		(*KUB* XXX 20 I 2 + XXX 22, 15)		
	f.	*kar-ša-an-zi*	"cut" 3PL.PRES.ACT	[karsantsi]
		(*KUBXX* 10 IV 8)		

In the cases like those illustrated in (20), *i* is inserted to resolve unacceptable syllable structure which arises through morphology. After the iterative suffix is added to an obstruent-final stem, the resulting onsets and codas would not obey the sonority hierarchy any longer. Thus, *i* is epenthesized to avoid onsets of equal or falling sonority or codas of equal or rising sonority. Note that the environment for the vowel insertion is superficially similar in (20d), *kar-ši-eš-ki-iz-zi*, and (20e), *kar-aš-zi*. In both cases, *a* and *i* can be described as written or inserted before an *sC* cluster. The difference between these two cases is entirely in their syllabification.

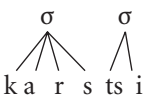
Stems which end in *s*, like /kars-/ "to cut", provide a clear illustration of the difference in the distribution of *i* and *a*. [kars.tsi] "he cuts" is written as *kar-aš-zi*, (20e), with a 'dummy' *a*, although the stem-final *s* followed by a conso-

17. A reviewer suggests that if the syllabification of this form were /ar.ski-/, the spelling should have only been *a-ar-ša-ki-*.

18. See the discussion in Melchert 1984 on *i*/*e* variation.

nant-initial ending, superficially, on the segmental level, meets the environment where epenthetic *i* usually surfaces. The only possible syllabification of *kar-aš-zi* is shown in (21):

(21)



The consonant cluster in (21) is completely legitimate for syllabification purposes since *r* is more sonorous than *s* and thus they can both be syllabified in the coda.[19]

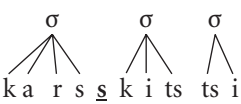
In forms like *kar-ša-an-zi* (20f), the syllabification of which is shown in (22), *š* in *-ša-* is syllabified as an onset of a syllable [san]. In this case, *ša* is followed by a vowel-initial sign *-an-*. The vowel in *-ša-an-* is not written as plena and is interpreted as short by the conventions of the writing system. The inventory of the available signs makes the use of the empty vowel unnecessary.

(22)

[20]

When *š* cannot be syllabified as a coda, an epenthetic *i* has to be inserted to break offensive clusters, as was exemplified in (20d) and shown in (23) for the crucial case form *kar-ši-eš-ki-iz-zi*.

(23)



19. There are languages like Russian which do not obey the sonority hierarchy and allow onsets of the RC type (sonorant-obstruent) and codas of CR type (obstruent-sonorant), but, as was discussed above, Hittite does not seem to be one of them.

20. The alternative syllabification in the spirit of Melchert's (p.c.) suggestion about double *s* in Hittite is given below:

Thus, I propose that in Hittite there is a constraint on syllable structure that prohibits onsets of equal or falling sonority and codas of equal or rising sonority. When such a situation arises through morphology, it creates a phonotactic violation and has to be fixed by epenthesis.

An alternative solution of the *i*-epenthesis problem would be to propose two allomorphs for the iterative suffix. The environment for the allomorphy is straightforward: *-ske-* after a stem which ends in a sonorant, *-isk-* elsewhere. However, aside from this solution being just a distributional statement, it has to be explained how such allomorphy would arise. Since the iterative suffix is reconstructed as the thematic *-ske/a-* < *ske/o- with no preceding vowel, the allomorphy should have arisen in Hittite (or in some Proto-Hittite stage), necessarily starting from *i*-epenthesis.

5.2.2 *Dental stems and -ske- suffix.* Stems which end in a dental stop form their iteratives in an exceptional way. The final obstruent of a stem and the following *s* of the iterative suffix merge, yielding the affricate *z* [ts], as in (24):

(24)	a.	/dai-/	"seat"	
		/tsikke-/	iter.	/d-ske-/
		zi-ik-ki-mi	1SG.PRES.ACT.ITER	[ts̲ikimi]
	b.	/ed-/	"eat"	
		/atstsike-/	iter.	/ad-ske-/
		az-zi-ki-iz-zi	3SG.PRES.ACT.ITER	[ats̲ikitsi]
		(*KUB* VII 1 II 5)		not [atskitsi]!

Since the initial cluster in the iterative form in (24a) is not of rising sonority, the account proposed above predicts *i*-epenthesis. However, the location of epenthetic vowel is unexpected; instead of a hypothetical [di̲skimi], the surface form is [ts̲ikimi]. The form in (24b) poses an even more serious problem: since [ts] is a perfectly legitimate coda elsewhere in Hittite, and the syllabification of the hypothetical form [ats.kits.tsi] is straightforward, we predict no epenthesis and a non-occurring 'spelling' *az-(za-)ki-iz-zi in this case.

The solution might appeal to the fact that the iterative stem of the verb /dai/ "to seat" is just *d-* (or *t-*) (24a). The suffixation of the iterative *-ske-* to this dental stem creates a word-initial homorganic cluster /t-s/. It is conceivable that epenthesis does not break such a cluster for phonetic reasons, since it is heard

by the listeners after the /ts/ cluster, rather than between [t] and [s].[21] If the phonetic interpretation is plausible, the site of epenthesis is after /ts/, which yields [tsike-]. After the *zikke-* form was created, one can hypothesize that the analogical extension of this form to other dental stems took place.[22]

Even though the analogical solution is logically conceivable, it would only be possible to prove (or disprove) it with confidence by demonstrating the existence of attested intermediate stages. There is one dental-stem verb that shows the spelling with *a* when followed by the iterative suffix, that in (25):

(25)	/spant-/	"libate"
	/spant-ske-/	iter.
	ši-pa-an-za-ki-iz-zi	3SG.PRES.ACT (*KUB* XX 34 Rs. 6)

The Old Hittite form in (25) demonstrates that the process of *i*-epenthesis did not yet apply to stems like /spant-ske-/. The absence of a form *ši-pa-an-az-ki-iz-zi* is regular, since Hittite never uses the -VC-VC-CV option in the case of *-antsC-* sequences (Melchert, p.c.).

The possibility of an analogical account can shed at least some light on variations in iterative stems, like those in (26).[23]

---

21. As stated in Blevins & Garrett (to appear), "a number of studies suggest that, in consonant clusters containing sibilants, the sibilant noise somehow distracts the listener, leading to high confusion rates with respect to the linear order of segments. Pickett (1958) demonstrates that [ts] and [st] have the highest confusability rates of clusters presented in noise, while Hirsh (1959) has shown for a variety of acoustic stimuli that a duration of 15–20 msec of silence is required between two successive acoustic events in order for a listener to correctly perceive the temporal order of these events. Given that sibilants are inherently noisy, there is no silent interval between a sibilant and an adjacent stop."

22. Melchert (1994:174) rejects Oettinger's claim of anaptyxis in cases with spelling variants, such as *azzikke-* and *zikke-* among others. He contends that "it cannot be accidental that all cases involving spelling variation involve a dental as the first consonant", and thus the anaptyxis should be restricted. I argue for the opposite solution precisely because in cases when the consonants in the cluster in question are homorganic, the phonetic reinterpretation of the epenthesis is more plausible.

23. Oettinger (1979:321) lists another iterative stem which follows the pattern shown in (29):

/ar-/	"wash"	*ar-ši-ik-ki-it*	ITERATIVE

(26) /tar-/ "say"

a. *tar-aš-ki-iz-zi* 3SG.PRES.ITERATIVE (*VBoT* 58 I 9 usw)

b. *tar-ši-ki-iz-zi* 3SG.PRES.ITERATIVE (*KBo* XIV 1 Vs. 34)

Since the form /tar-ske-izzi/ is easily syllabifiable as [tars.ki.zi], no epenthesis is predicted in the iterative stem of the verb in (26), which is the state of affairs in (26a). The fact that the *-as-* sign is used in the iterative form points to the orthographic nature of the non-etymological vowel in /tar-ske-/. However, in (26b) there is another variant of the same form that is written with the help of a non-etymological *i*. I propose an analogical solution of this problem. Once /atsike-/ was the iterative form of /ad-/, one could analogically create [sike] as an allomorph of the iterative [ske], since there is still a transparent relationship between the iterative form and the non-iterative stem /ad-/. The use of the new allomorph of the iterative suffix would result in alternate forms as in (26b).

5.2.3 *Preterite -s-*

The formation of the preterite third singular further exemplifies the process of *i*-epenthesis. Just as in the case of the iterative suffix *-sk*, epenthesis only happens in clusters which violate the phonotactic requirements of Hittite. Thus, there is no epenthesis in (27) and (28), since adding the preterite suffix *-s* to sonorant-final stems does not create clusters which violate Hittite syllable structure requirements.

(27) /da-/ "take"

/da-s/

da-a-aš 3SG.PRET [das]

(28) /ar-/ "come"

/ar-s/

a-ar-aš [ars] (*KBo* XXXVI 101 II 2)

a-ar-sa [ars] (*KBo* XXII 2 Rs. 7)

However, the addition of the preterite suffix *š* to the consonantal stems creates a sonority violation in (29), (30), and (31). The violation is resolved by *i*-epenthesis.

(29) /ak(k)-, ek(k)-/ "die"

/ak(k)-s/

akkiš 3SG.PRET [akkis] (*KBo* VI 2 IV 3)

(30) /sak(k)-/ "know"

/sak(k)-s/

šakkiš 3SG.PRET [sakkis] (*BoTU* 21 I 3)

(31) /sa(n)h-/ "seek"
/sa(n)h-s/
šahiš 3SG.PRET [sahis]
(*KUB* XX 63 + XXXVI 70 Ro 9 & 16)

5.3 Morpheme-internal clusters

The precise formulation of epenthesis morpheme-internally poses some interesting problems for the phonotactic account. In the remainder of this section, I turn to the epenthesis in morpheme-internal initial and medial clusters, hopefully providing at least some explanation of these notoriously difficult cases.

5.3.1 *Initial sC- clusters*

sC- (initial *s+consonant*) is the only monomorphemic cluster in Hittite which continues Proto-Indo-European forms with word-initial clusters of non-rising sonority. No other complex onsets of equal or falling sonority (e.g. *sonorant+stop, fricative other than s+stop, liquid+stop*, etc.) are present in the language. In principle, there are many possibilities of writing inherited word-initial *sC* clusters (for example, the C_1C_2V- initial sequences can be spelled as C_1a-C_2V-, aC_1-C_2V-, C_1i-C_2V-, iC_1-C_2V-), but nearly all Hittite reflexes of the word-initial *s followed by an obstruent are spelled consistently as *iš-CV-*. Some of the examples with such non-etymological *i* are listed in (32) (examples taken from Melchert 1984):

(32) *išpant-* "night" < *k^wsp-ent-
ištapp- "cover, stop up" < *step/b-
ištarnink- "sicken" < *sterk-
išgar-"stick" < *sker-

While some scholars (e.g. Kronasser 1956, Eichner 1975, Oettinger 1979) argue that the word-initial *i* in *isC-* sequences represents a prothetic vowel, others (e.g. Sturtevant 1933, Kronasser 1966, Melchert 1984) hold that the initial *i* in such clusters is not linguistically real.[24] Melchert (1984) treats the initial *i* as entirely graphic, except in cases when the word-initial *i* can be reconstructed back to PIE, emphasizing that he hardly needs "to cite the use of empty vowels

24. For a full literature review see Kimball (1999).

to express consonant clusters in Hittite". Of course, empty vowels are used consistently in Hittite to render consonant clusters, but, as we saw before, the conventional empty vowel is just *a* or *a* in alternation with some other vowel, such as *e* or *i*. As shown above, the non-etymological *a* is used to express all consonant clusters which obey the sonority hierarchy, including those which have *s* in them. However, the spelling of word-initial *sC-* clusters is fixed, and is almost always *isC-* which points to the linguistic nature of the non-etymological vowel.

Since Melchert (1984) cannot predict the occurrence of the *i*, he has to treat it as random in this case. It also poses a problem for the phonotactic account. If Hittite did not allow any onset clusters of equal or falling sonority, the phonotactic approach predicts that such clusters will be resolved by epenthesis. The fact that word-initial non-etymological *i* is never written as a plene vowel is consistent with the claim that *i* is epenthetic since it is a well-known fact that epenthetic vowels are usually short and unaccented. However, the site of the epenthesis is unexpected. As in the case of /d-ske-/ ∅ /ts-ke-/ ∅ /tsike-/ discussed above, we would expect /sitapp-/ rather than the actual /istapp-/ "cover", etc. This provides evidence that the *i*-prothesis is a different kind of a phonological process, and cannot be unified with *i*-epenthesis analyzed above.[25]

25. Melchert (p.c.) offers a possible account of *i*-prothesis. He suggests that accent is the key factor in this case, and forms with initial *išC-* reflect a different epenthesis process, only partly determined by the sonority hierarchy. It is possible that in all the instances of *išC-*, there were cases in the prehistoric paradigm where the accent was not on the initial syllable *sTV-. These items, which were formed directly from the root with non-initial accent (like *išpantuzzi-*), received regular *išC-* treatment. As to the exceptions like *ša/e/ipikkusta-* "pin, needle", we can assume that the accent was not on the first syllable. For the apparent exception *išpand-* / *šipand-* "libate" (cognate with Greek spevndw and Latin *spondeo* "pledge; promise"), where there is an alternative spelling *si-CV-*, Melchert accepts the account of Forssman (1994), who assumes a *hi*-verb from an old perfect *spe-spónd-, which then underwent dissimilation to produce *šipand-*. Thus, no prothesis was ever required, and the *išpand-* variant can be treated as an analogical formation after *išC-* derivatives.

iii. *išpand-/ šipand-* "libate"
iš-pa-an-ti 3SG.PRES.ACT (*KBo* XVII 3 IV 6)
šipanti 3SG.PRES.ACT (*KBo* IV 13 III 27)

5.3.2 *Morpheme-internal obstruent* +s *clusters*

Since final consonant clusters are highly restricted in Hittite, examples of the morpheme-internal clusters of equal or falling sonority which are undoubtedly in the coda are very few. Apart from *laryngeal+s* sequences (discussed in §6.2), only a few uncontroversial examples are to be found of a root-final *obstruent+obstruent* cluster, shown in (33) and (34):

(33) /taks-/ "undertake, make"
  a. *takkišta* 3SG.PRET (*BoTU* 7, 8. 45)
  b. *takkešteni* 2PL.PRES (*KBo* V 12 IV 14f)
  c. *taggašteni* 2PL.PRES (*BoTU* 23 A II 60)

(34) /hatk-/ "close (door)"
  a. *hatki* 3SG.PRES
  b. *ha-at-kán-zi* 3PL.PRES (*StBoT* 12)
  c. *hatkišk-* ITERATIVE (*Bo* 3070 16)
  d. *hatgašk-* ITERATIVE (*KUB* XXX 32 I 17)

The forms in (33) and (34) have vowel alternations which present a problem for the phonotactic account. Such forms appear to have several coexisting stem allomorphs (*takk̲iš-/takk̲eš-/tagg̲aš-* or *hatk̲išk-/hatg̲ašk-*), in which the vowel/zero alternation can be interpreted as synchronically real (Melchert, p.c.).

5.4 Local conclusion

In sum, the phonotactic account developed in this study treats epenthesis in Hittite as following from restrictions on tautosyllabic consonant clusters. I have proposed that onsets of equal or falling sonority and codas of equal or rising sonority are not acceptable by Hittite phonotactics. Such clusters can be inherited or might arise through morphology and have to be fixed by epenthesis.

6. Coloring of epenthetic vowels

There are certain environments where the analysis presented above predicts *i*-epenthesis, but nonetheless the non-etymological vowel does not surface as [i]. This happens after labiovelar segments, where epenthetic vowel appears as [u], and in the vicinity of Hittite reflexes of Proto-Indo-European laryngeals, where the epenthetic vowel surfaces as [a]. In the following sections I argue that in these cases epenthesis still occurs, and the vowel is 'colored by', i.e., assimilated to, its neighboring segments.

6.1 Labiovelars

As Melchert (1994) argues, there are synchronic labiovelars in Hittite. The stems of the type /eku-/ "drink" are underlyingly /ek^{w}-/, as exemplified in (35).

(35)

/ek^{w}-/	"drink"	
/ak^{w}sk-/	ITER	/ak^{w}sk-tsi/
ak-ku-uš-ki-iz-zi	3SG.PRES.ACT.ITER	[akkuskitstsi]
(*KUB* VII 1 II 5)		not [ak^{w}iskizzi]!

As can be seen in (36) and (37), stems with labiovelars epenthesize *u*, and stems with plain velars epenthesize *i*:

(36) *na-na-ku-uš-zi* "gets dark" < *no-nok^{w}-s-
(*KUB* XII 60 I 5–6)

(37) *lalu(k)kišzi* "gets light" < *lo-louk-s-
(*KUB* VIII 24 + XLIII 2 II 10–13)

Clusters like [k^{w}sk] in (35) cannot be successfully syllabified for reasons of sonority and thus require some kind of epenthesis. There are two possible explanations of the fact that the surface form of the iterative stem is /akuske-/ and not /ak^{w}iske-/, as one might expect. Melchert (1994) proposes a separate iterative allomorph of the stem of the verb "to drink" — /akuske-/, but this explanation does not really address the question of how such allomorphy would arise. I propose a different solution, one which is more in spirit of the present analysis: the epenthetic vowel is colored by the preceding labiovelar, possibly with the following dissimilative labialization loss on the consonant.

Since the environments for the surfacing of a non-etymological vowel are identical for (36) and (37), *i*-epenthesis is a more straightforward account. Epenthesis would presumably happen in both forms in (36) and (37) with the consequent assimilation, or coloring of epenthetic *i* by labiovelar, as in (36), but not by plain velar segment, as in (37). Since there is no evidence (e.g. from alternations) that the epenthesis in (36) and (37) is synchronic, original epenthesis could in principle give rise to distinct iterative allomorphs, as proposed by Melchert (1994), which renders the two proposed solutions indistinguishable.

6.2 Laryngeals

According to most reconstructions, Anatolian is the only Indo-European language branch in which the Proto-Indo-European laryngeals survive as

consonants.[26] Hittite reflexes of Proto-Indo-European laryngeals are of two types: the ones which colored surrounding vowels to *a*, and the ones which did not induce any coloring. Since *a*-coloring laryngeals had an effect of lowering the second formant of neighboring vowels, they were probably phonetically post-velar (that is, pharyngeal) (Beekes 1989). In this section I address the interaction of epenthesis and laryngeal coloring.

The analysis developed in this paper predicts that an [i] is epenthesized to break up onset clusters of falling sonority and coda clusters of rising sonority. It seems that in Hittite at least tautosyllabic clusters of equal sonority are not allowed either.[27] The examples in (38) are reconstructed without vowels, so non-etymological *a* in the examples in (38) can be orthographic or epenthetic. It is evident that epenthesis is required to break up a *laryngeal+s+obstruent* cluster in (38a); it is a tri-consonantal cluster, and epenthesis always happens before *s* in *s+obstruent* clusters (see discussion in 5.2.1). The example in (38b) is less clear, but since segments in the *laryngeal+stop* cluster in (38b) are of falling sonority, epenthesis is also predicted. The fact that the epenthetic segment surfaces as *a* in a vicinity of a laryngeal can be regarded as an instance of laryngeal coloring.

(38)	a.	/haster-/	"star"	< PIE *$h_2$ster-[28]
		ha-aš-te-ir-za	"star" NOM.SG	[ha̲sterza]
		(*KBo* XXVI 34 IV 9)		
	b.	/hatuk-/	"frightful, terrible"	< *Ht-
		ha-tu-ga-aš		[ha̲tugas]
		(*KUB* XXXIII 69 III 7)		

Non-controversial examples of epenthesis in the environment of laryngeal are not numerous. In (39), there is one more possible example of epenthesis in the environment of a laryngeal followed by an obstruent. Again, my analysis predicts an epenthetic *i* before *s* in this environment, and the epenthetic vowel surfaces as *a* both in Old Hittite and Middle Hittite. Thus, (39) is another instance of

26. Hamp 1965, however, has proposed that at least some instances of initial consonantal [h] in Albanian reflect a PIE laryngeal directly.

27. There are no uncontradictory examples of tautosyllabic *obstruent+obstruent* clusters in Hittite, so it can be viewed as a morpheme structure constraint.

28. Reconstruction according to Otten — von Soden 1968: 40f; Schindler 1969: 144 (contra Puhvel 1991: 238). Cf. also Melchert 1994: 175: "A synchronic /Haster/ 'star' < *$h_2$ster- with anaptyxis and coloring also seems likely".

epenthesis with laryngeal coloring of the epenthetic vowel morpheme-internally, as in (38), and not a case of the 'empty' *a*, which it would be, if *-hs-* clusters were treated as of falling sonority according to the sonority hierarchy.

(39) /pahs-/ "to protect"

a. **Old Hittite** /pahs-mi/
pa-ah-ha-aš-mi 1SG.PRES.ACT [pahasmi] (*KUB* 29.1 I 19)

b. **Middle Hittite** /pahs-hi/
pa-ah-ha-aš-hi 1SG.PRES.ACT [pahashi] (*KUB* 13.4 III 26)

There is a different possible interpretation of the example in (38). If the sonority hierarchy treated laryngeals as less sonorous than the *š* (for which there are no unambiguous examples), [hs] would be a phonotactically acceptable coda in Hittite which would not have to be altered by epenthesis (Melchert, p.c.). However, the hypothetical [pahshi] would still be written as in (39) (with the help of the 'empty' *a*), since, as was discussed above, this is how the writing system expresses synchronic consonant clusters.

The two hypotheses just discussed are indistinguishable on the basis of the available data, if we restrict ourselves only to the examples of morpheme-internal situations. The example in (38a) (where non-etymological *a* surfaces between laryngeal and *s*) does not add much to this controversy, since the same kind of epenthesis is predicted and observed before *s* in word-initial *s+obstruent* clusters even without the laryngeal. However, the fact that there is *i*-epenthesis in the morphologically complex form [sahis] in (34) (repeated in (40)) suggests that the cluster *-hs-* is not a well-formed coda. It is hard to establish if *s* is of higher or lower sonority than *h*, but, presumably, laryngeals surface as fricatives in Hittite (Melchert 1994:97), so they are probably of equal sonority.

(40) *ša(n)h-* "seek" < PIE *sénh$_2$-s
/sa(n)h-s/
šahiš 2SG.PRET [sahis]
(*KUB* XX 63 + XXXVI 70 Ro 9 & 16)

The absence of laryngeal coloring in (40) sheds light on the relative sonority of *s* and *h* and helps to establish that epenthesis happened regularly between laryngeals and other obstruents, but morpheme-internally, that is, in non-derived environments, laryngeals regularly colored epenthetic vowels. However, the fact that there is no laryngeal coloring in derived environments, as in (40) requires some explanation.

According to Melchert (1994), the form *šahiš* could be a regular outcome of

a pre-Hittite preterite second singular *sánh-s. The synchronic form arose after the loss of *-n-*, probably with compensatory lengthening, and "anaptyxis of an unaccented vowel in a word-final cluster of obstruent plus *s*". We would expect the anaptyctic vowel to be colored by the laryngeal and surface as *a*. To explain its surfacing as *i* in the form in (40), Melchert proposes that expected *sahas* (which is "synchronically very irregular" from the point of view of morphology) was replaced by *sahis* on analogy with other second preterite forms which regularly had the *i* (cf. *akkiš* "died", *sakkiš* "knew", etc.).

Melchert (1997) entertains an analogical solution only to explain the preterite form *sahis* and does not make any further generalizations. I propose that the absence of coloring in derived environments is the outcome of an analogical process which generalized the *i*. This process leaves only instances of *a* in the vicinity of laryngeals in underived environments.

In (41) I present schematically one of the hypothetical historical scenarios, illustrating diachronic steps which could lead to analogy. Some kind of vowel was epenthesized at *Stage 1* to break up an unacceptable consonant cluster. The vowel in question had to be different from the regular etymological *i*, since etymological *i* does not undergo laryngeal coloring in the vicinity of a laryngeal. This vowel could be just shorter than the regular *i*, or it could differ from it in other respects, such as height. Here I write it as a capital [I], without speculating further about its phonetic identity.[29] *Stage 2*, the coloring, is a possible but not attested state of affairs (which is not a necessary step, since analogy could proceed directly from *Stage1* to *Stage3*), and *Stage 3* shows analogy in action.

(41)	PIE	*sénh$_2$-s
	Stage 1 (epenthesis)	[sahIs]
	Stage 2 (coloring)	[sahas]
	Stage 3 (analogy)	[sahis]

In short, the non-etymological vowel in *laryngeal+obstruent* clusters is *a* by virtue of laryngeal coloring in non-derived environments, that is, morpheme-internally, and *i* in derived environments, which can be explained by analogical extension.

A question arises as to why analogical restoration of epenthetic *i* happened in derived environments after laryngeals (42a) but not after labiovelars (42b):

29. Melchert (1994:174), following Oettinger (1979:41), discusses a possibility that the epenthetic vowel was a short [e] (lengthened with the accent shift as in *te:ri* "three" cited above), colored to [a] by laryngeals, to [u] by labiovelars, and raised to [i] otherwise by regular rule.

(42) a. /sanh-ske-/ "seek" 1SG.PRES.ITER
ša-an-hi-eš-ki-mi [sanhiskimi]
b. /ak^{w}-ske-/ "drink" 1SG.PRES.ITER
ak-ku-uš-ki-mi [akkuskimi]

I propose that the explanation of this split is connected to the synchronic phonology of laryngeals and labiovelars. As has been argued by Melchert (1994), labiovelars are synchronic in Hittite, so labiovelar coloring is still a productive synchronic process. However, laryngeals are arguably not post-velar in Hittite any more, which prevents synchronic coloring of neighboring vowels to *a*. Thus, labiovelar coloring remains phonetically transparent in Hittite, while laryngeal coloring becomes phonetically opaque. I hypothesize that phonetic opacity is the factor which makes the cases of laryngeal coloring in Hittite more susceptible to analogy. This might have implications for general theories of analogy, at least suggesting that leveling of phonetically opaque processes happens more readily than of phonetically transparent ones.

7. Obstruent + Glide Clusters

The situation with the orthographic rendering of *obstruent+glide* sequences in Hittite is different from the spelling of other onsets of rising sonority, as, for example, /pr/, /kr/, /sl/, etc. As we saw earlier, onsets of the latter type are written with the help of the 'empty' vowel *a*, as in *pa-ra-a* "forth" which was most likely pronounced as [pra:] (see examples in (9)). Contrasting with *obstruent+liquid* and *obstruent+nasal* onsets, Hittite historical *obstruent+glide* sequences are never written with the help of *a*: clusters of a *-Cw-* type are consistently written with the help of *u* (43a-c), and clusters of a *-Cy-* type are written with the help of *i* (44a-c).[30]

(43) a. *tw *tuwan-* "far"
tuwarni/a- "break"
b. *kw /kuwas-/ "kiss" < PA *kwás
ku-wa-aš-kán-zi "kiss" 3PL.PRES.ACT (*XV* 37 V 33–34)
/kuwa(n)-/ "dog, hound" (*KBo* VII 48, 10)

30. Following Melchert (1994), I assume that voicing of word-initial position is not distinctive in Hittite. This assumption, however, does not affect the substance of the present argument.

	c.	*sw	*šu-wa-ru*	"heavy"
	d.	*hw	*hu-u-iš-šu-u-ez-zi*	"is alive" (*KBo* V 3 III 31)
(44)	a.	*py	*pi-ya-an-zi*	"give" 2PL.PRES.ACT
	b.	*ty	*ti-ya-an-zi*	"put" 2PL.PRES.ACT
	c.	*ky	*gi-e-mi*	"in winter"

There are two possible interpretation of the data in (43) and (44). One involves proposing a separate kind of epenthesis in *obstruent+glide* onsets. The obvious objection to the treatment of the non-etymological vowels in (43) and (44) as having no phonetic substance is that these vowels seem to assimilate in quality to the following segment (John Ohala, p.c.).[31] So, at first sight it seems more logical to assume epenthesis with coloring of the epenthetic vowel than to entertain a possibility of the 'coloring' of a 'non-linguistic' vowel. This would mean that Hittite does not tolerate onsets of the *obstruent+glide* type, even though they are of rising sonority, which considerably weakens the analysis proposed here.

Another (more uncontroversial and generally accepted) analysis of the facts just presented holds that *i* and *u* are bifunctional in the cuneiform and can serve to write glides as well as vowels. It is quite transparent in the case of the cuneiform *-ya-* sign which is written as the sequence of *-i-* and *-a-* signs (the *-wa-* sign is not decomposable into separate elements). This, in turn, means that *i* and *u* are used to mark respectively palatalization and labialization of the preceding consonant.

The latter analysis is preferable for two independent reasons. First, it is consistent with the writing system; palatalization or labialization of consonants can be conveyed only by some kind of CV sign, and since *-ya-* is composed of *i+a,* at least *i* can be demonstrably used both as a glide and a vowel. Second, it is also consistent with the general analysis of the epenthesis facts in Hittite

31. Another possible objection to considering these vowels non-linguistic comes from comparison with the writing of non-pronounced copy vowels in Cyprian Greek (cf. Miller 1994, Guion 1996). Since the Cyprian writing system is a syllabic script, reminiscent of Hittite, consonant clusters are regularly written with the help of a non-linguistic vowel. This vowel is not fixed (as the writing convention *a* in Hittite), but it is a copy of the following vowel in clusters of rising sonority, and a copy of the preceding vowel in clusters of falling or equal sonority. E.g., the *stop+liquid* cluster [tr] in πατρί "to father" is written with the copy of the following *i,* as *pa-ti-ri,* and the *liquid+stop* cluster [rt] in ʾΑρτεμίδι "to Artemis" is written with the copy of the preceding *a*, as *a-ra-te-mi-ti* (Guion 1996). The Cyprian writing system represents another possibility of using non-linguistic vowels to write consonant clusters, quite different from the case of rendering Hittite *obstruent+glide* clusters.

proposed in this paper. *Obstruent+glide* onsets are of rising sonority and thus obey the sonority hierarchy, so there is no reason for epenthesis in such environment.

8. Anatolian comparanda

There are several Anatolian languages (Lycian, Milyan, Lydian, Carian, Pisidian, and Sidetic) which were written in an early form of the Greek alphabet or other types of alphabetic writing. These alphabetically written languages could in principle shed light on some of the complicated issues which arise because of the fact that the cuneiform writing system could not faithfully render consonant clusters. Unfortunately, these languages are very poorly attested, and there is only a handful of cognates available for comparison. There is still no consensus on the decipherment of Carian, and the short inscriptions we have in Pisidian and Sidetic do not provide enough information to resolve syllabification questions. Both Lycian and Lydian have undergone considerable syncope that makes it hard to distinguish original from newly arisen consonant clusters.

The following is a short summary of the available data which can possibly provide some insights on the chronology of *i*-epenthesis in Anatolian.

Lydian is an Anatolian language which appears to have the insertion of prothetic *i* in word-initial *s+obstruent* clusters (Melchert 1994:371). The environment of *i*-epenthesis in Lydian is identical to initial *i*-epenthesis in Hittite.

(45) **Lydian**: /istamin-/ "family" < *stomVn-

Palaic is another Anatolian language, written in cuneiform however, which might have prothetic *i* before word-initial *sC-* clusters.

(46) **Palaic** (Melchert 1994:206): *iška* "be!" < *skó

According to Melchert (1994:271) and Oettinger (1982:235), Luvian shows *sT- > *T*, as in (47).

(47) **Luvian**: *tummant-* "ear; hearing" < *stemnt- "orifice"

The result of the development of the initial Proto-Anatolian *sT- in Lycian is not certain, but according to Melchert (1994:304–305), *sT- > *hTT-*.

In sum, if (45) is a valid example,[32] the data suggest that *i*-prothesis is a common innovation of just Hittite, Palaic, and Lydian, which could be relevant to the question of the dialectal subgrouping of Anatolian. It also provides additional support for the argument that *i*-prothesis is a different process from *i*-epenthesis.

Lycian forms are very obscure and difficult to interpret, but assuming that the current interpretation of the example (48) is correct, it provides one of the proofs of the linguistically unreal character of non-etymological *a*.

(48) **Lycian** (Melchert 1994: 314)
*pr *pri-* < *pro (cf. Hittite *pa-ra-a* "forth")

The cognate, which in Hittite is written with the help of non-etymological *a,* is spelled without it in Lycian, providing comparative evidence consistent with positing extra-linguistic and purely orthographic nature for *a* in *pa-ra-a* and thus for all non-etymological vowels in onsets of rising sonority.

Additionally, while there are no *nasal+nasal* clusters in Hittite, Cuneiform Luvian has *m(a)na-* "look at, favor" < *mneh$_1$- (Melchert 1994: 156), which suggests that at least in Luvian, and maybe in Anatolian in general, onsets of equal sonority were allowed.

The data presented in this section is consistent with the conclusions drawn in this paper about the purely orthographic nature of non-etymological *a* in Hittite. Initial *i*-epenthesis may well have been a pre-Hittite and possibly Proto-Anatolian development, but the data is too scarce to assert it with confidence.

9. Conclusion

I have proposed a phonotactic account for the distribution of non-etymological vowels in Hittite which had to be treated as random by previous accounts. I have shown that epenthesis in Hittite has to be distinguished from the use of empty vowels to write consonant clusters. Non-etymological *a* is used in contexts where syllabification problems are not expected, which suggests that *a* is purely orthographic. Non-etymological *i* is used in clusters which cannot be syllabified to obey the sonority hierarchy and violate constraints on tauto-

32. Melchert (1994: 371) comments that the word "family" is the best example thus far, but still "is merely possible".

syllabic clusters in Hittite. Therefore, *i* is linguistically real and epenthetic. Its distribution is crucially dependent on the phonotactics of Hittite and can be uncontroversially stated only by referring to syllable structure. I have also proposed a solution for the apparent counterexamples to the phonotactic account and showed that the phonetic shape of epenthetic vowels in the vicinity of labiovelars and laryngeals is due to coloring.

References

Beekes, R. S. P. 1989. "The nature of the Proto-Indo-European laryngeals". *The New Sound of Indo-European: essays in phonological reconstruction* ed. by Theo Vennemann, 23–34. Berlin/New York: Mouton de Gruyter.

Benveniste, Émile. 1937. "Hittite hatugi-". *Mélanges linguistiques offerts à M. Holger Pedersen* ed. by Louis Hjelmslev, 496–499. (= *Acta Jutlandica* 9.496–499).

Bernabé, Alberto. 1973. "Geminación de *s* y sonantes en hetita". *Revista española de linguística* 3.415–456.

Blevins, Juliette. 1996. "The Syllable in Phonological Theory". *The Handbook of Phonological Theory* ed. by John A. Goldsmith, 206–244. Oxford, Cambridge: Blackwell Publishers.

Blevins, Juliette & Andrew Garrett. To appear. "The evolution of metathesis". *The phonetic basis of phonology* ed. by B. Hayes, R. Kirchner & D. Steriade. Cambridge University Press.

Eichner, Heiner. 1973. "Die Etymologie von heth. mehur". *Münchener Studien zur Sprachwissenschaft.* 31.53–107.

Eichner, Heiner. 1974. *Untersuchungen zur hethitischen Deklination.* (Diss. Teildruck). Erlangen.

Eichner, Heiner. 1975. *Die Vorgeschichte des Hethitischen Verbalsystems. Flexion und Wortbilding* ed. by Helmut Rix, 71–103. Wiesbaden: Dr. Ludwig Reichert Verlag.

Forssman, Bernhard. 1994. "Zu hethitisch sipand- und ispand-". *In honorem Holger Pedersen* ed. by J. E. Rasmussen, 93–106. Wiesbaden: Reichert.

Friedrich, Johannes. 1940. *Hethitisches Elementarbuch.* Heidelberg: Winter.

Friedrich, Johannes. 1952. *Hethitisches Wörterbuch.* Heidelberg: Winter.

Friedrich, Johannes & Annalies Kammenhuber. 1975. *Hethitisches Wörterbuch.* 2nd edition. Heidelberg: Winter.

Jespersen, Otto. 1994. *Lehrbuch der Phonetik.* Leipzig and Berlin: B. G. Teubner.

Guion, Susan. 1996. "Greek syllable structure: evidence from Cyprian". *Diachronica* 13.63–82.

Güterbock, Hans G. & Harry A. Hoffner, eds. 1980ff. *The Hittite dictionary of the Oriental Institute of the University of Chicago.* Chicago: The Institute.

Hamp, Eric P. 1965. "Evidence in Albanian". *Evidence for Laryngeals* ed. by Werner Winter, 123–141. The Hague: Mouton & Co.

Hermann, Edward. 1923. *Silbenbildung im Griechischen und in den andern indogermanischen Sprachen.* (Repr., Göttingen: Vandenhoeck & Ruprecht. 1978).

Hirsh, I. J. 1959. "Auditory perception of temporal order". *Journal of the Acoustical Society of America* 31.759–67.

Joseph, Brian D. 1984. "A Note on Assibilation in Hittite". *Die Sprache* 30:1.1–15

Kavitskaya, D. 1999. "Vowel epenthesis and syllable structure in Hittite". *Proceedings of the Tenth Annual UCLA Indo-European Conference, Los Angeles, May 21–23,1998*, 49–64. Washington, DC. Institute for the Study of Man.

Kimball, Sara E. 1999. *Hittite historical phonology*. Innsbruck: Innsbrucker Beiträge zur Sprachwissenschaft.

Kiparsky, Paul. 1979. "Metrical structure assignment is cyclic". *Linguistic Inquiry* 10.421–441.

Kronasser, Heinz. 1956. *Vergleichende Laut- und Formenlehre des Hethitischen*. Heidelberg: Winter.

Kronasser, Heinz. 1966. *Etymologie der Hethitischen Sprache*. Wiesbaden: Harrassowitz.

Meillet, Antoine. 1934. *Introduction à l'étude comparative des langues indo-européennes*. 7th ed. Paris: Hachette.

Melchert, H. Craig. 1984. *Studies in Hittite historical phonology*. Göttingen: Vandenhoeck und Ruprecht.

Melchert, H. Craig. 1994. *Anatolian historical phonology*. Amsterdam-Atlanta: Rodopi B. V.

Melchert, H. Craig. 1997. "Syncope and anaptyxis in Hittite". *Sound Law and Analogy: papers in honor of Robert S. P. Beekes on the occasion of his 60th birthday* ed. by Alexander Lubotsky, 177–180. Amsterdam & Atlanta: Rodopi.

Miller, D. Gary. 1994. *Ancient scripts and phonological knowledge*. Amsterdam & Philadelphia: John Benjamins.

Oettinger, Norbert. 1979. *Die Stammbilding des hethitischen Verbums*. Erlanger Beiträge zur Sprach- and Kunstwissenschaft. Band 64.

Oettinger, Norbert. 1980. "Review of Johann Tischler, Hethitisches Etymologisches Glossar, Lfg. 2". *Zeitschrift der deutschen morgenländischen Gesellschaft* 131.386–388.

Oettinger, Norbert. 1982. "Reste von e-Hochstufe im Formans hethitischen n-Stämme einschliesslich des 'umna' Suffixes". *Investigationes philologicae et comparativae: Gedenkschrift für Heinz Kronasser* ed. by Erich Neu, 162–177. Wiesbaden: Harrassowitz.

Otten, Heinrich & Wolfram von Soden. 1968. *Das Akkadisch-Hethitische Vokabular KBo I 44 + KBo XIII 1 (= StBoT 7)*. Wiesbaden: Harrassowitz.

Pickett, J. M. 1958. "Perception of compound consonants". *Language and Speech* 1.288–304.

Puhvel, Jaan. 1984. *Hittite etymological dictionary*. Volume 1–2. Berlin–New York: Mouton de Gruyter.

Puhvel, Jaan. 1991. *Hittite etymological dictionary*. Volume 3. Berlin–New York: Mouton de Gruyter.

Puhvel, Jaan. 1997. *Hittite etymological dictionary*. Volume 4. Berlin–New York: Mouton de Gruyter.

Reichert, Pierre. 1963. *Glossaire inverse de la langue Hittite*. Paris. Librairie C. Klincksieck.

Rüster, Christel. 1989. "Hethitisches Zeichenlexikon : Inventar und Interpretation der Keilschriftzeichen aus den Bogazkoy-Texten". *Studien zu den Bogazkoy-Texten*. Beiheft; 2. Wiesbaden : Harrassowitz, 1989.

Schindler, Jochem. 1969. "Die idg. Wörter für 'Vogel' und 'Ei'". *Sprache* 15:144–167.

Selkirk, Elisabeth. 1984. "On the major class features and syllable theory". *Language, Sound, Structure: Studies in Phonology for Morris Halle* ed. by Mark Aronoff & Richard Oehrle, 107–136. Cambridge, Mass.: MIT.

Sievers, Eduard. 1881. *Grundzüge der Phonetik*. Leipzig: Breitkopf and Hartel.

Stampe, David. 1973. "Speech as Music: Toward an understanding of the prosodic characteristics of language". Paper presented at *the Annual Meeting of the Linguistic Society of America*.
Steriade, Donca. 1982. *Greek prosodies and the nature of syllabification*. Doctoral dissertation, MIT, Cambridge, Mass.
Sturtevant, Edgar H. 1933. *A comparative grammar of the Hittite language*. Philadelphia: Linguistic Society of America.
Thausing, Moritz. 1963. *Das natürliche Lautsystem des menschlichen Sprache*. Leipzig: Verlag von Wilhelm Engelmann.
Watkins, Calvert. 1985. "Hittite and Indo-European Studies II". *Münchener Studien zur Sprachwissenschaft* 45.245–255 (549–559).
Watkins, Calvert. 1982. "A Greco-Hittite Etymology". *Serta Indogermanica. Festschrift für Günter Neumann* ed. J. Tischler, 455–457. Innsbruck: Inst. für Sprachwissenschaft der Univ. Innsbruck.

Summary

This study examines the distribution of non-etymological vowels in Hittite and shows that non-etymological *a* is used in contexts where syllabification problems are not expected, suggesting that *a* is purely orthographic and brought on only by the practices of the cuneiform writing system. Non-etymological *i* is used in clusters which cannot be syllabified to obey the sonority hierarchy. Therefore, *i* is linguistically real and epenthetic. The paper argues that the distribution of these vowels is thus predictable and depends solely on the constraints on syllable structure and the sonority hierarchy.

Résumé

Cette étude examine la distribution des voyelles non étymologiques en Hittite et montre que le /a/ non étymologique est utilisé dans les contextes où aucun problème de syllabation n'est attendu. Ceci suggère que ce /a/ est purement orthographique et qu'il résulte du système d'écriture cunéiforme. La voyelle non étymologique /i/ est utilisée dans les groupes consonantiques qui ne peuvent être syllabés à cause de la hiérarchie de sonorité. Ce /i/ est donc réellement phonologique et épenthétique. Cet article supporte l'idée que la distribution de ces deux voyelles est prévisible et dépend seulement des contraintes de structure syllabique et de la hiérarchie de sonorité.

Zusammenfassung

Die vorliegende Studie untersucht die Distribution nicht-etymologischer Vokale im Hetitischen und zeigt, daß nicht-etymologisches *a* in Kontexten vorgefunden wird, in denen keine Silbifizierungsprobleme zu erwarten wären. Dies deutet auf einen rein ortho-

graphischen Charakter des *a* hin, dessen Ursprung in der Keilschrift liegt. Nicht-etymologisches *i* hingegen wird in Konsonantenfolgen verwendet, die nicht im Einklang mit der Sonoritätshierarchie silbifiziert werden können. *i* muß daher als linguistisch real sowie als epenthetisch im eigentlichen Sinne eingestuft werden. Es wird gezeigt, daß die Erscheinung dieser Vokale systematisch ist und allein auf der Basis von Silbenregeln und der Sonoritätshierarchie ermittelt werden kann.

Author's address

Darya Kavitskaya
Yale University
Department of Linguistics
P. O. Box 208236
NEW HAVEN, Conn. 06520–8236 U. S. A.
e-mail: darya.kavitskaya@yale.edu