

THE SOUND OF INDO-EUROPEAN
Phonetics, Phonemics, and Morphophonemics

Edited by

BENEDICTE NIELSEN WHITEHEAD

THOMAS OLANDER

BIRGIT ANETTE OLSEN

and

JENS ELMEGÅRD RASMUSSEN

Museum Tusulanum Press
University of Copenhagen
2012

*The Sound of Indo-European: Phonetics, Phonemics, and
Morphophonemics*

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Edited by Benedicte Nielsen Whitehead, Thomas Olander,

Birgit Anette Olsen & Jens Elmegård Rasmussen

Cover design by Thora Fisker

Set by Thomas Olander

Printed in Denmark by Specialtrykkeriet

ISBN 978 87 635 3838 1

COPENHAGEN STUDIES IN INDO-EUROPEAN, VOL. 4

ISSN 1399 5308

Published with support from:

Roots of Europe – Language, Culture, and Migrations

Museum Tusculanum Press

126 Njalsgade

DK 2300 Copenhagen S

www.mtp.dk

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The phonological interpretation of plene and non-plene spelled *e* in Hittite

Alwin Kloekhorst
Leiden University

In this article, the Hittite plene spelling of the vowel *e* is studied. It is argued that plene spelling of *e* was never used for *e/i*-disambiguation; that the plene spelling of *e* in the sequences *e-eC(-)*, *(-)Ca-e-eC(-)*, *(-)Ci-e-eC(-)* and *(-)Cu-e-eC(-)* does not indicate vowel length, whereas in the sequences *(-)Ce-e-eC(-)* and *(-)Ce-e(-CV)* it does; that throughout the Hittite period there was a phonemic distinction between accented long /*é̃*/ and accented short /*é*/; that the decrease of plene spelling in MH and NH times is not due to changing scribal conventions, but rather signals a phonological shortening of OH /*é̃*/ in certain positions; and that in the Old Hittite texts evidence can be found of lengthening of original short **e* before PIE voiced stops, reminiscent of Winter's Law in Balto-Slavic and Lachmann's Law in Latin, which can be used as an argument in favor of the glottalic theory.¹

¹ This article is a preliminary overview of the outcomes of my research project dealing with the accentuation of Hittite, in which a discussion of plene spelling plays a crucial part. I refer the reader to my forthcoming monograph on this subject for a more detailed treatment of the topic, which will include the hard data on which the statistical synchronic and diachronic analyses as presented here are based.

The abbreviations OH, MH and NH stand for Old, Middle and Neo-Hittite, respectively, and the abbreviations OS, MS and NS for Old Hittite, Middle Hittite and Neo-Hittite script. The combination OH/MS denotes an Old Hittite composition that was copied in Middle Hittite times; the combination OH/NS denotes an Old Hittite composition that was copied in Neo-Hittite times; etc. Texts that were written in Old Hittite script (OS) by definition contain Old Hittite compositions; Neo-Hittite compositions (NH) are by definition written down in the Neo-Hittite period.

According to Kimball 1999: 55, Hittite plene spelling can be defined as “the repetition of identical vowel signs in the spelling of vowels.” She distinguishes five types of plene spelling:

- | | | |
|---|---|-----------------------|
| 1 | initial vowels: | $V_1-V_1C(-)$ |
| 2 | absolute final vowels: | $(-)CV_1-V_1$ |
| 3 | non-initial vowels in open syllables: | $(-)CV_1-V_1-C^\circ$ |
| 4 | non-initial vowels in closed syllables: | $(-)CV_1-V_1-V_1C(-)$ |
| 5 | non-initial vowels in closed syllables after another vowel: | $(-)CV_1-V_2-V_2C(-)$ |

Kimball moreover states that plene spelling “was never used with absolute consistency” and that “[a]s a general rule, [it] is more frequent in early texts than it is in original compositions of the NH period”.

From the beginning of Hittite studies onwards, the interpretation of plene spelling has been a hotly debated issue. Already Hrozný (1917: xii) stated that plene spelling must be interpreted as indicating vowel length, but this soon met with severe criticism. Influential scholars like Götze, Friedrich, Pedersen, Kronasser and Kammenhuber² instead viewed it as an orthographic peculiarity that had no linguistic value. Only in 1959, Rosenkranz took up the idea again that plene spelled vowels differ in a phonetically relevant way from non-plene spelled ones: he was able to show that in some grammatical categories, non-plene spelling corresponds to etymological zero grade, whereas plene spelling corresponds to etymological full grade. This view gradually gained more popularity,³ and from the end of the 1970s onwards, it had become the common opinion that plene spelling is indeed phonetically relevant.⁴ Especially Hart’s influential 1980 article “Some observations on plene-writing in Hittite” clearly showed that there is a correlation between plene spelling, etymological full grades and the place of the accent as reconstructed on the basis of the other IE languages.

2 Götze 1927: 80 n. 4; Friedrich 1931: 20; Pedersen 1938: 5, 34, 194; Kronasser 1956: 35; Kammenhuber 1969: 175.

3 But compare e.g. Otten & Souček 1969: 44–9, who keep on claiming that plene spelling “keine funktionelle Bedeutung hatte” (46).

4 Cf. e.g. Eichner 1980: 150f., who showed that in many words plene spelling is consistently used and that minimal pairs like *ap-pa-an* ‘taken’ vs. *a-ap-pa-an* ‘behind’, *a-aš-šu* ‘good’ vs. *a-aš-šu-u* ‘goods’, etc., clearly indicate that the presence of the plene vowel is significant.

Nowadays, the general opinion seems to be that plene spelling denotes vowel length, and that this is often caused by accentuation of the vowel in question.⁵ Nevertheless, many details remain unclear: why are some accented vowels not spelled plene, why is plene spelling decreasing through time, etc.

In this paper, I will study the use of plene and non-plene spelling of the vowel *e*, trying to determine how it should be phonologically interpreted, and how it can be used for the reconstruction of pre-stages of Hittite.

E/I-disambiguation

An extra complication that one encounters when studying the plene spelling of *e* is the theory of *e/i*-disambiguation. As is well known, some of the cuneiform signs used by the Hittites can be read both with the vowel *e* and with the vowel *i*. For instance, the sign KE/I (𐎧) can be read *ki* as well as *ke*, LE/I (𐎡) can be read *li* as well as *le*, E/IR (𐎢) can be read *ir* as well as *er*, E/IT (𐎣) can be read *it* as well as *et*, etc. We therefore call these signs ambiguous.⁶ Some scholars assume that in words where a plene *e* is written next to an ambiguous sign, the plene spelling only has the function to determine the vowel quality of that sign.⁷ For instance, in a word like PÉ/Í-*e*-E/IIḫ-*hi* ‘I give’, it is assumed that the presence of the plene spelling with the sign E indicates that PÉ/Í and E/IIḫ should be read with their *e*-value, *pé-e-eh-hi*, and that the plene spelling has no other function than

5 E.g. Oettinger 1979: *passim*; Kimball 1983; Weitenberg 1984: 347; Melchert 1984: 83–4, 1994: 27; Kimball 1999: 54–64; Kloekhorst 2008: 32.

6 The ambiguous signs are: DE/I, GE/I, ḪE/I, KE/I, LE/I, PÉ/Í, RE/I, UḪE/I, ZE/I, E/IIḫ (which can be read AḪ and UḪ as well), E/IK, E/IM, E/IP, E/IR, E/IT, E/IZ, DE/IR, KE/IP, KE/IR, KE/IŠ, KE/IT, LE/IK, LE/IŠ, NE/IR, PE/IR, PE/IŠ, ŠE/IR, TÉ/ÍN, TE/IR and TE/IŠ. The unambiguous signs are: E, I, ḪÉ, ME, MI, NE, NI (although this sign rarely can be read NÉ as well), ŠE, ŠI, TE, TI, ZÉ, EL, IL, EN, IN, EŠ, IŠ, MEŠ and MIŠ.

7 E.g. Sturtevant 1933: 64; Otten & Souček 1969: 44–9. Other scholars see disambiguation as one of several functions of plene spelling with *e*, e.g. Weitenberg 1984: 347 (besides indicating vowel length); Hoffner & Melchert 2008: 25 (besides indicating vowel length and avoiding writing a word with only one sign).

that. However, the word *pé-e-eh-ḥi* belongs to the same morphological class as e.g. *te-e-eh-ḥi* ‘I put’, in which the sign TE is an unambiguous sign. In this latter word, the plene spelling with the sign E cannot therefore have had a disambiguating function, which indicates that in *pé-e-eh-ḥi* it did not either. Similarly in KE/I-*e*-E/IZ ‘this (abl.)’. Since KE/I and E/IZ are both ambiguous signs, some scholars assume that plene spelling with the sign E is only used to indicate the *e*-value of these signs, *ke-e-ez*, and has no other function than that. However, *ke-e-ez* belongs to the same paradigm as e.g. *ke-e-el* ‘this (gen.sg.)’, where the sign EL is unambiguous and would have been enough to determine the value of the ambiguous sign KE/I. The plene spelling with the sign E in *ke-e-el* cannot therefore have had a disambiguating function, and I consequently assume that in *ke-e-ez* it did not either. Moreover, the 3sg.pres. form of imperfectives in *-ške/a-* are always spelled °š-KE/I-E/IZ-*zi*,⁸ without plene spelling. Nevertheless, on the basis of plene spelled forms like 1sg.pres. °š-*ke-e-mi*, 2sg.pres. °š-*ke-e-ši*, but also a form like 2sg.pret. °š-*ke-e-š*, spelled with unambiguous EŠ, we know for sure that the suffix contained the vowel *e*, and that °š-KE/I-E/IZ-*zi* should be read °š-*ke-ez-zi*. If there was no apparent need to disambiguate the ambiguous signs in °š-KE/I-E/IZ-*zi* = °š-*ke-ez-zi*, why would there suddenly have been in KE/I-*e*-E/IZ = *ke-e-ez*? If in a word like *e-E/IT-mi* = *e-et-mi* ‘I eat’, the plene spelling with the sign E is really used to disambiguate the ambiguous sign E/IT, why do we also find plene spelling in the morphologically comparable word *e-eš-mi* ‘I am’, where EŠ is unambiguous?

These examples can easily be multiplied, and after having looked closely at all words containing plene *e*, I have not found a single example where there was any reason to assume that this was used for disambiguation.⁹

Decrease of plene spelling

As we have seen, it is commonly assumed that plene spelling is used more frequently in older texts than in younger ones. This decrease of the usage

8 Occasionally also °š-*ke-zi*, but that need not concern us here.

9 Similarly Kimball 1983: 7–9. Also Melchert 1994: 27 explicitly does not mention *e/i*-disambiguation anymore as a function of plene spelling (which he still did in 1984: 83–4).

of plene spelling through time is often seen as determined by scribal convention. In some cases, we seem to witness such a decrease indeed. Consider for instance the word *pé-(e)eh-ḫi/ḫé* ‘I give’. In my corpus of texts, I have found the following numbers of attestations:

	<i>pé-e-eh-ḫé / pé-e-eh-ḫi</i>	<i>pé-eh-ḫi</i>	ratio	
OS	6×	0×	100%	vs. 0%
MH/MS	0×	13×	0%	vs. 100%
NH	0×	23×	0%	vs. 100%

We see that *pé-(e)eh-ḫi/ḫé* does show a decrease through time in its use of plene spelling. In fact, we see that after the OH period, plene spelling of *e* is totally absent in this word.

The word *ke-(e-)et / ke-(e-)ez* ‘this (abl.)’ shows a different picture, however:¹⁰

	<i>ke-e-et / ke-e-ez</i>	<i>ke-et / ke-ez</i>	ratio	
OS	13×	1×	93%	vs. 7%
MH/MS	6×	0×	100%	vs. 0%
NH	41×	4×	89%	vs. 11%

Here, we do not witness a decrease of plene spelling at all. In fact, the ratio of plene spelled vs. non-plene spelled forms remains constant through time, namely ca. 90% vs. 10% in all periods.

This example, which does not stand on its own, shows that the assumption that, as a general phenomenon, the use of plene spelling is decreasing through time due to scribal convention, cannot be correct. Instead, the decrease of plene spelling in words like *pé-e-eh-ḫi/ḫé > pé-eh-ḫi* must be interpreted as signaling a phonetic development.

E in closed syllables

We will start our investigation with the study of the use of plene *e* in closed syllables. As we saw above, within Kimball’s classification of types of plene

¹⁰ The development of original *ke-(e-)et* into younger *ke-(e-)ez* is just a morphological replacement of the ending *-t* by *-z* that has no bearing on the stem of the word.

spelling, three types can be found in which the plene spelled vowel stands in a closed syllable, namely:

- | | | | |
|---|-----------------------|------|---|
| 1 | $V_1-V_1C(-)$ | i.e. | $e-eC(-)$ |
| 4 | $(-)CV_1-V_1-V_1C(-)$ | | $(-)Ce-e-eC(-)$ |
| 5 | $(-)CV_1-V_2-V_2C(-)$ | | $(-)Ci-e-eC(-), (-)Ca-e-eC(-), (-)Cu-e-eC(-)$ |

Especially the latter type is common. Consider for instance the nom.pl.c. ending *-eš*: in *i*-stems (*-Ci-e-eš*, *-Ca-e-eš*) and *u*-stems (*-Cu-e-eš* and *-Ca-u-e-eš*), we often find plene spelling of *e*. It is therefore remarkable that the same ending is in consonant stems almost exclusively attested without plene spelling (*-Ce-eš*):

<i>-Ci-e-eš</i>	<i>-Ca-e-eš</i>	<i>-Cu-e-eš</i>	<i>-Ca-u-e-eš</i>	<i>-Ce-eš</i>
<i>ap-pe-ez-zi-e-eš</i>	<i>ħa-tu-ga-e-eš</i>	<i>ku-ut-ru-e-eš</i>	<i>a-ra-u-e-eš</i>	<i>a-mi-ja-an-te-eš</i>
<i>a-ú-ri-e-eš</i>	<i>pal-ħa-e-eš</i>	<i>ma-li-iš-ku-e-eš</i>	<i>a-aš-ša-u-e-eš</i>	<i>an-tu-uh-še-eš</i>
<i>ħal-ki-e-eš</i>	<i>šal-la-e-eš</i>	<i>pár-aš-tu-e-eš</i>	<i>ħa-at-ga-u-e-eš</i>	<i>ħa-a-aš-še-eš</i>
etc.	etc.	etc.	etc.	etc.

The same interesting distribution can be found with abstract nouns in *-eššar*: plene spelling of the suffix occurs when the stem of the base noun ends in *-i-* or *-u-*, but not if it ends in a consonant:

<i>-Ci-e-eš-šar</i>	<i>-Cu-e-eš-šar</i>	<i>-Ce-eš-šar</i>
<i>ħa-ar-ni-e-eš-šar</i>	<i>ħal-ku-e-eš-šar</i>	<i>a-ri-ja-še-eš-šar</i>
<i>ħa-az-zi-e-eš-šar</i>	<i>iš-ħu-e-eš-šar</i>	<i>ħa-an-ne-eš-šar</i>
<i>ši-e-eš-šar</i>	<i>la-la-ku-e-eš-šar</i>	<i>ħa-ap-pé-eš-šar</i>
etc.	etc.	etc.

Similarly in inchoatives in *-ešš-zi*: when derived from stems ending in *-i-* and *-u-*, we find plene spelling; when derived from stems ending in consonants, we find no plene spelling:

<i>-Ci-e-eš-š°</i>	<i>-Cu-e-eš-š°</i>	<i>-Ca-u-e-eš-š°</i>	<i>-Ce-eš-š°</i>
<i>ħar-ki-e-eš-š°</i>	<i>al-pu-e-eš-š°</i>	<i>a-ra-u-e-eš-š°</i>	<i>ħa-te-eš-š°</i>
<i>kar-tim-mi-e-eš-š°</i>	<i>ħa-at-ku-e-eš-š°</i>	<i>i-da-la-u-e-eš-š°</i>	<i>kal-la-re-eš-š°</i>
<i>mi-e-eš-š°</i>	<i>pa-an-ku-e-eš-š°</i>	<i>pár-ga-u-e-eš-š°</i>	<i>mar-še-eš-š°</i>
etc.	etc.	etc.	etc.

Another case is the 3sg.pres.act. forms in *-ezzi* of thematic verbs. When the suffix is *-je/a-* or *-ue/a-*, we find plene spelling of the *e*, when the suffix is *-ške/a-*, we do not find plene spelling:

-Ci-e-ez-zi	-Cu-e-ez-zi	-Ce-ez-zi
<i>a-ni-e-ez-zi</i>	<i>ḫu-iš-ú-e-ez-zi</i>	<i>ak-ku-uš-ke-ez-zi</i>
<i>ar-ši-e-ez-zi</i>	<i>kap-pu-u-e-ez-zi</i>	<i>an-ni-iš-ke-ez-zi</i>
<i>ḫu-it-ti-e-ez-zi</i>	<i>šar-ku-e-ez-zi</i>	<i>da-aš-ke-ez-zi</i>
etc.	etc.	etc.

In all these examples, the following pattern emerges: plene spelling of the *e* of a certain morpheme after another vowel corresponds to non-plene spelling of the same *e* after a consonant.

Ci-e-eC, Ca-e-eC, Cu-e-eC, Ca-u-e-eC vs. *Ce-eC*

How should this be interpreted? Does this distribution mean that e.g. the nom.pl.c. ending *-eš* contains a long vowel when attached to a stem ending in a vowel, °V-ēš, but a short one when attached to a stem ending in a consonant, °C-ěš? If so, how should such an allomorphy be explained from a historical point of view? Or, in the case of the 3sg.pres. forms, do we have to assume that the *e* in *-Ci-e-ez-zi* and *-Cu-e-ez-zi* is long, *-Ciēzzi, -Cuēzzi*, whereas in *°š-ke-ez-zi* it is short, *-škězzi*, although in all three cases the vowel represents the same morpheme?

I think that the solution to this problem lies in comparing the orthographical behaviour of the vowel *e* in these cases to that of the vowel *a*:¹¹

Ci- e - eC, Cu- e - eC, Ca-u- e - eC vs. *Ce-eC*
Ci-ia-aC, Cu-ua-aC, Ca-u-ua-aC vs. *Ca-aC*

We see that when the vowel *a* follows another vowel, it is preceded by the signs IA and UA that spell the glide, i.e. the transition from one vowel to the other. The presence of the signs IA and UA is never interpreted as indicating length of the *a*. I believe that in the case of the vowel *e*, the sign E is used in the same function as IA and UA (in this regard it is crucial that the Hittite cuneiform script does not possess separate signs for *-je-* or *-ue-*¹²),

¹¹ The spelling *Ca-e-eC* may then be compared to *Ce-ia-aC*.

¹² Only in MH the usage of the sign GEŠTIN as *ui*₅ (sometimes also used as *ue*₅) comes up, but this sign has never been used on a wide scale.

i.e. it spells the transition from the preceding vowel to the *e*. And just as the presence of $\bar{\text{I}}\text{A}$ and $\bar{\text{U}}\text{A}$ in $\text{Ci-}\bar{\text{i}}\text{a-aC}$, $\text{Cu-}\bar{\text{u}}\text{a-aC}$ and $\text{Ca-u-}\bar{\text{u}}\text{a-aC}$ does not indicate length of the *a*, I think that the presence of the sign E in Ci-e-eC , Ca-e-eC , Cu-e-eC and Ca-u-e-eC does not express length of the *e* either.

The same considerations explain the distribution of plene spelling vs. non-plene spelling in the *mi*-verbs of which the strong stem contains an *e*.

Cu-e-eC-	ú-e-eC-	e-eC-	vs.	Ce-eC-
<i>ḥu-e-ek-</i>	<i>ú-e-eḥ-</i>	<i>e-ep-p^o</i>		<i>le-en-k^o</i>
<i>ḥu-e-et-t^o</i>	<i>ú-e-ek-k^o</i>	<i>e-eš-</i>		<i>me-er-</i>
<i>ku-e-en-</i>	<i>ú-e-en-</i>	<i>e-ed-</i>		<i>ša-me-en-</i>
<i>ku-e-er-</i>	<i>ú-e-eš-</i>			<i>še-eš-</i>

If in verbs of the structure *Cu-e-eC-* and *ú-e-eC-* the plene spelling would really indicate length of the *e*, then it is difficult to explain why a preform **k^wérti* ‘he cuts’ would yield Hitt. *ku-e-er-zi* = *kuērzi*, with a long vowel, whereas a preform **mérti* ‘he disappears’ yielded Hitt. *me-er-zi* = *mērzi*, with a short vowel. Or why **uést^o* ‘he wears’ would yield Hitt. *ú-e-eš-ta* = *uēšta*, with a long vowel, whereas **sésti* ‘he sleeps’ yielded Hitt. *še-eš-zi* = *šēšzi*, with a short vowel. Again, the plene spelling in *Cu-e-eC-* and *ú-e-eC-* must be regarded as spelling the transition from the preceding vowel to the *e*, and not as indicating vowel length.

An interesting point is the fact that this category also contains a few verbs that are spelled with the pattern *e-eC-*, i.e. according to type (1) in Kimball’s list, $V_1-V_1C(-)$. For these verbs the same questions can be asked: why would **h₁ésti* ‘he is’ yield Hitt. *e-eš-zi* = *ēšzi*, with a long vowel, whereas e.g. **sésti* yielded *še-es-zi* = *šēšzi* with a short vowel? I have argued before that I believe that the plene vowel seen in *e-eš-zi* spells the initial glottal stop: *’e-eš-zi* = /ʔest^oi/, and does not indicate vowel length.¹³

If the above considerations are correct, then we must conclude that the plene spelling in type (1), $V_1-V_1C(-)$, and type (5), $(-)CV_1-V_2-V_2C(-)$, is not indicative of a long vowel: rather, it indicates the presence of an initial glottal stop (in type (1)) or spells the transition from the preceding vowel to the vowel *e* (type (5)). It cannot be coincidental that type (1) and type (5) are exactly the types that in Akkadian linguistics are not regarded as plene

13 Kloekhorst 2004: 47 n. 55; 2006a: 79–8; 2008: 75.

spelling, in the sense that they spell the presence of a syllable initial *alef* instead of the presence of a long vowel.¹⁴

This means that we are now left with type (4), (-)CV₁-V₁-V₁C(-), i.e. (-)Ce-e-eC(-).

(-)Ce-e-eC(-)

Since in some words plene spelling is lost in the course of time, it is best to focus first on the oldest attested stage of the Hittite language. In OS texts, we find a few words spelled with (-)Ce-e-eC(-), where that vowel reflects accented **é*, **ói* (when monophthongized) or **éh₁*: *da-aš-ke-e-er* ‘they take’ < **dh₃-sk-ér*; *pé-e-eh-ḫi* ‘I give’ < **h₁p-ói-h₂ei*;¹⁵ *te-e-ez-zi* ‘he says’ < **d^héh₁-ti*. These contrast with words that go back to a preform containing accented short **é* and do not show plene spelling of their *e*: *ke-eš-šar* ‘hand’ < **ḡ^hésr*, *ú-uš-ke-ez-zi* ‘he is looking’ < **Hu-ské-ti*. Moreover, they contrast with words containing reflexes of unaccented **ē* and **eh₁*,¹⁶ which do not show plene spelling of their *-e-* either: *la-a-le-eš* ‘tongues’ < **lól-ēs* (which contrasts with e.g. *iš-ḫe-e-eš*¹⁷ ‘lords’ < **h₁esh₂-ēs*¹⁸); *e-še-er* ‘they were’ < **h₁és-ēr*¹⁹ (which contrasts with e.g. *da-aš-ke-e-er* < **dh₃-skér*); *pé-e-ḫu-te-ez-zi* < **h₁pói-h₂u-d^heh₁-ti* (which contrasts with *te-e-ez-zi* < **d^héh₁-ti*). For the sake of completeness, it is necessary to mention that an unaccented short **e* yields the vowel *i*: *ne-(e-)pí-iš* ‘heaven’ < **néb^hes*. Moreover, in monosyllables, the result of any accented vowel, also short ones, seems to be spelled plene: *še-e-er* ‘on top’ < **sér*; *me-e-ek* ‘much, many’ < **még^hh₂*.

14 E.g. Aro 1953: 3–4.

15 Cf. Kloekhorst 2006b for this reconstruction.

16 I know no good examples of unaccented monophthongized **oi* in a closed syllable.

17 Although this form is attested in an OH/MS text, it still attests to the OH situation.

18 The place of the accent is determined by e.g. nom.sg. *iš-ḫa-a-aš*, acc.sg. *iš-ḫa-a-an*, dat.-loc.sg. *iš-ḫi-i*, etc.

19 The place of the accent is determined by the fact that **h₁és-* > Hitt. *eš-*: a preform **h₁es-ér* should have yielded Hitt. ***išér*.

In a table:

		PIE	OH
accented	polysyllables	* <i>CĕC</i>	(-)Ce-e-eC(-)
		* <i>Có<i>i</i>C</i>	
	* <i>Cé<i>h</i>₁C</i>		
	monosyllables	* <i>CĕC</i>	(-)Ce-eC(-)
* <i>CĕC</i>		Ce-e-eC	
unaccented		* <i>CĕC</i>	(-)Ce-eC(-)
		* <i>Cé<i>h</i>₁C</i>	
		* <i>CeC</i>	Ci-iC

On the basis of this table, we can conclude that plene spelling of the type (-)Ce-e-eC(-) is not a direct graphic representation of the accented vowel,²⁰ as there are also accented vowels, namely short **é*, that yield non-plene spelled vowels. Instead, we must conclude that plene spelling of the type (-)Ce-e-eC(-) indicates vowel length. It is *a priori* likely that PIE **ē*, **oi* (when monophthongized) and **eh₁* merged into pre-Hitt. **ē*, and this **ē*, when accented, apparently retained its length into OH, but was shortened when unaccented. An original short accented **é* remained short, unless it was present in a monosyllable, where it was lengthened. This means that for OH we must assume two separate phonemes, namely a long /*ē*/ (which always carries the accent, and is spelled (-)Ce-e-eC(-)) and a short /*e*/ (which can be accented as well as unaccented, and is spelled (-)Ce-eC(-)).

This situation as attested in OH texts changes in the course of time. If we look at texts from the MH and NH period, we see that in polysyllabic words the plene spelling of the type (-)Ce-e-eC(-) is lost:

OH		MH/NH
<i>pé-e-eh-<i>h</i>i</i> ‘I give’	>	<i>pé-eh-<i>h</i>i</i>
<i>te-e-eh-<i>h</i>i</i> ‘I put’	>	<i>te-eh-<i>h</i>i</i>
<i>te-e-ez-zi</i> ‘he says’	>	<i>te-ez-zi</i>
<i>še-e-ek-nu-</i> ‘cloak’	>	<i>še-ek-nu-</i>

In monosyllabic words, however, plene spelling is retained:

²⁰ Contra Carruba 1981.

OH		MH/NH
<i>ke-e-et</i>	>	<i>ke-e-ez</i>
<i>ke-e-el</i>	>	<i>ke-e-el</i>

This means that after the OH period, long /ē/ is shortened and merges with short /e/, except in monosyllables, where long /ē/ remains long.

E in open syllables

In Kimball's classification, two types of plene spelling can be found in which the plene spelled vowel occurs in an open syllable: type (2) (-)CV₁-V₁ (absolute final vowels), and type (3) (-)CV₁-V₁-C°. It seems to me that these two types can be combined into one, namely (-)CV₁-V₁(-C°), i.e. in this case (-)Ce-e(-C°).

If we again start our investigation in the oldest attested stage of the Hittite language, namely the language from the OH texts, we find the following interesting fact. Statistical analysis shows that we must distinguish between three "kinds" of *e*:

- 1 an *e* that is spelled plene in ca. 90–100% of the attested forms: e.g. *ke-e* 'these', *le-e* 'not', *pé-e-da-* 'to bring', *pé-e-ḫu-te-* 'to lead', *me-e-ḫur* 'time'.
- 2 an *e* that is spelled plene in ca. 50% of the attested forms: e.g. *pé-(e-)ra-an* 'in front', *ne-(e-)pí-iš* 'heaven', *te-(e-)pu-* 'small'.
- 3 an *e* that is never spelled plene: e.g. *da-a-aḫ-ḫé* 'I take', *te* '(and) they', *nu-uš-še* '(and) to him', *pé-e-ḫu-te-ši* 'you lead'.

It is interesting to see that these three types are etymologically distributed:

- 1 the *e* that is spelled plene in ca. 90–100% of the attested forms goes back to accented **ói*, **éi* and **éh₁*: *kē* < **kói*; *lē* < **léh₁*; *pēda-* < **h₁pói-deh₃₋*; *pēḫute-* < **h₁pói-h₂u-d^heh₁₋*; *mēḫur* < **méh₂ur*.²¹

²¹ Cf. Kloekhorst 2008: 567–8 for the latter reconstruction. Note that the reconstruction **mēh₂ur* as usually found in the handbooks (going back to Eichner 1973) would fit these considerations as well.

- 2 the *e* that is spelled plene in ca. 50% of the attested forms²² goes back to an accented short **é*: *pěran* < **pérom*; *něpiš* < **néb^hes*; *těpu* < **d^héb^h-u*.
- 3 the *e* that is never spelled plene goes back to unaccented **oi*, **ei* and **eh*₁: *dāh^he* < **dóh₃-h₂ei*; *t=e* < **t=oi*; *nu=šše* < **nu=soi*;²³ *pěhuteši* < **h₁pói-h₂u-d^heh₁-si*.

In the case of the first *e*, it seems clear to me that the virtually consistent plene spelling indicates that here we are dealing with a long vowel. Moreover, this vowel always seems to have been accented: /*é̃*/. The case of the third *e* is clear as well: the consistent absence of plene spelling indicates that here we are dealing with a short vowel. This vowel is always unaccented: /*e*/. The case of the second *e* is less clear, however. The fact that it sometimes shows plene spelling indicates that it must have been longer than short /*e*/, which is never spelled plene. Yet, it is not spelled plene as often as long /*é̃*/, which is virtually always spelled plene. In my view, this indicates that phonetically, the second *e* must have been half-long, i.e. [eː̃], which contrasts with long /*é̃*/, i.e. [éː̃], as well as with short /*e*/, i.e. [e]. Since this half-long vowel was always accented, [éː̃], there is no problem to interpret this vowel phonologically as the accented variant of short [e], which was always unaccented. Thereby, we would be dealing with a phonologically short vowel /*e*/, that remains phonetically short when unaccented, [e], but is phonetically half-lengthened in open syllables when accented, [éː̃] (but remains distinct from long /*é̃*/ = [éː̃]). This means that also in open syllables we must distinguish between two separate phonemes, namely a long /*é̃*/ (which always carries the accent, e.g. /*ké̃*/, /*měhor*/) and a short /*e*/ (which can be accented as well as unaccented, e.g. /*péran*/, /*nébis*/, /*táHe*/, /*te*/).

For the sake of completeness, it should be mentioned that a pre-Hitt. unaccented short **e* yields Hitt. *a* in an open syllable, cf. e.g. *paiṽani* ‘we go’ < **pái-ueni* vs. *appuēni* ‘we seize’ < **h₁p-uēni*.

²² From now on, I will use in bound transcription the symbol *ě* to denote an *e* that is spelled plene in ca. 50% of the cases.

²³ The sentence initial conjunctions *nu*, *ta* and *šu* are used proclitically, which means that they, and the particles attached to them, are unaccented.

This situation as attested in OH texts changes through time. We see that in polysyllabic words, the *e* that is spelled plene in ca. 90–100% of the attested forms, begin to be spelled plene in only ca. 50% of the attested forms in texts from the MH and NH period. This must be interpreted as a shortening of OH /*ē*/ to younger /*é*/:²⁴

OH		MH/NH		OH		MH/NH
<i>pé-e-da-</i>	>	<i>pé-(e-)da-</i>	i.e.	/péda-/	>	/péda-/
<i>pé-e-ḫu-te-</i>	>	<i>pé-(e-)ḫu-te-</i>		/péhode-/	>	/péhode-/
<i>me-e-ḫur</i>	>	<i>me-(e-)ḫur</i>		/méhor/	>	/méhor/

In monosyllabic words, the consistent plene spelling of /*ē*/ is retained, however:

OH		MH/NH
<i>ke-e</i>	>	<i>ke-e</i>
<i>le-e</i>	>	<i>le-e</i>

This means that in these words, the /*ē*/ remained long.

Note that the diachronic development of OH /*ē*/ in open syllables is exactly the same as in closed syllables.

General conclusions

On the basis of the foregoing observations, we can set up the following conclusions:

- 1 Of the five types of plene spelling as given by Kimball, type (2), (-)Ce-e, type (3), (-)Ce-e-C°, and type (4), (-)Ce-e-eC(-), indicate vowel length. Type (1), e-eC(-), and type (5), (-)Ci/u/a-e-eC(-), do not: instead, they spell the presence of an initial glottal stop and the transition from the preceding vowel to the vowel *e*, respectively.
- 2 In OH there is a phonemic distinction between /*ē*/ and /*e*/, in both closed and open syllables.

²⁴ Words that are spelled plene in ca. 50% of the attested forms in OH texts, remain thus spelled in younger texts as well: e.g. OH *nēpiš* = MH/NH *nēpiš*; OH *tēpu-* = MH/NH *tēpu-*.

- 3 OH long /ē/ is shortened in post-OH times and merges with short /e/. However, this did not take place in monosyllables, where /ē/ remains.

We can now set up the following phonological developments:

	PIE	pre-Hitt.	OH	MH/NH
polysyllables:	*ē, éi, ói, éh ₁	> /ĕ/	> /ĕ/	> /é/
	*é	> /é/	> /é/ ²⁵	> /é/
monosyllables:	*ē, éi, ói, éh ₁	} /ĕ/	> /ĕ/	> /ĕ/ ²⁶
	*é			
poly- and monosyllables:	*ē, ei, oi, eh ₁	> /ē/	> /e/	> /e/
	*e	> /e/	> /a, i/	> /a, i/

‘Exceptions’ from NH texts

In NH texts, we find several words that are spelled in a way which at first sight seems to contradict the developments described above. As we will see, all these words can be explained as being secondary.

OH *šēr* /sēr/ ‘on top’ is in younger texts spelled without plene spelling: *šer* (whereas we would expect retention of long /ē/ in monosyllables); OH *pěran* /péran/ ‘in front of’ is in younger texts attested without any plene spelling: *peran* (whereas we would expect short accented /é/ to keep on

25 In closed syllables, this /é/ was phonetically realized as a short [é], and therefore spelled non-plene. In open syllables, this /é/ was phonetically realized as a half-long [éː], and therefore spelled plene in ca. 50% of its attestations.

26 According to this table, long /ĕ/ would in MH and NH times be limited to monosyllabic words. Since in monosyllabic words the short vowel /é/ does not occur, there would be no opposition between /ĕ/ and /é/ in this environment, and we would therefore be allowed to reinterpret the phonetically long vowel [éː] as a phonologically short vowel, /é/ (its length being automatic in monosyllables). This would mean that in MH and NH times, no phonemically long /ē/ would exist anymore. This is not entirely the case, however. Compare the following footnote, where we see that the long [éː] from monosyllabic forms is in MH and NH times analogically introduced in polysyllabic forms, by which a new opposition between long /ĕ/ and short /é/ has been created. It is therefore best to also interpret the long [éː] of monosyllables as a phonologically long vowel, /ĕ/.

being spelled with plene in ca. 50% of its attestations); OH *mēnaḥḥanda* /*mēnaHanta*/ ‘opposite’ is in younger texts spelled without plene spelling: *menaḥḥanda* (whereas we would expect long accented /*ē*/ to develop into short accented /*é*/, which should be spelled plene in ca. 50% of its attestations). These three words are all adverbs, and we must assume that after the OH period they lose their independent accentuation, since they start to be used clitically. Their spelling reflects this unaccentedness: OH *šēr* /*sēr*/ > MH/NH *šer* = /*ser*/; OH *pēran* /*péran*/ > MH/NH *peran* = /*peran*/; OH *mēnaḥḥanda* /*mēnaHanta*/ > MH/NH *menaḥḥanda* = /*menaHanta*/.

The NH forms *kēdani* ‘this (dat.loc.sg.)’, *kēnzan* ‘these (gen.pl.)’ and *kēdaš* ‘these (dat.loc.pl.)’ show a long vowel in a polysyllabic word, whereas we would expect these all to have been shortened in the post-OH period. I assume that they have taken over their /*ē*/ from the forms *kēl* ‘this (gen.sg.)’, *kēz* ‘this (abl.)’ and *kē* ‘these (nom.pl.c./nom.-acc.pl.n.)’, which are part of the same paradigm and in which the long /*ē*/ has been regularly retained, as they are monosyllables.²⁷

The NH forms *apēl* ‘that (gen.sg.)’, *apēdani* ‘that (dat.-loc.sg.)’, *apē* ‘those (nom.pl.c./nom.-acc.pl.n.)’, *apēnzan* ‘those (gen.pl.)’ and *apēdaš* ‘those (dat.-loc.pl.)’ show a long /*ē*/ in polysyllabic words that should have been shortened in the post-OH period. I assume that their long /*ē*/ is taken over from the paradigm of ‘this’: *kēl*, *kēdani*, *kē*, *kēnzan*, *kēdaš*.

The NH form *šumēš* ‘you (nom.pl.)’ shows a long /*ē*/ in a polysyllabic form, that should have been shortened in the post-OH period. I assume that this long /*ē*/ was taken over from *uēš* ‘we’, where it is regular as it stood in a monosyllable.

The imperatival forms *mērtu* ‘he must disappear!’ and *lēkten* ‘swear!’ show a long /*ē*/ that is etymologically unexpected: we would expect the preforms **mēr-tu* and **h₁léng^h-ten* to yield *mertu* and *lekten*, with short *e*. I assume that their long /*ē*/ is analogical after the 2sg.imp. forms ***mēr* ‘disappear!’ and ***lēk* ‘swear!’, where the original short **é* was regularly lengthened due to the monosyllabicity of these words.

²⁷ Since long /*ē*/ is in this way secondarily reintroduced in polysyllabic words, it has gained a new phonemic status again (cf. the preceding footnote).

Three exceptions from OH texts: Winter's Law in Hittite?

In OH texts, we find three words that show a long /ē/ which is unexpected on etymological grounds. The word for 'place' is in OS texts spelled with plene *e* in 90% of its attested forms, that is, *pé-e-da-*, pointing to /pēda-/. On the basis of e.g. Gr. *πέδον* 'ground, floor', we would reconstruct a preform **pédo-* with short **e*, however. The word for 'earth' is in OS texts spelled with plene *e* in 100% of its attestations, *te-e-kán*, pointing to /tēgan/. From an IE point of view, we would expect normal *e*-grade in such a structure, however: **d^héĝ-(ō)m*. The oldest attestation of the word for 'naked' is spelled with plene vowel, *ne-e-ku-m[a-an-t^o]*,²⁸ pointing to /nēg^wmant-/. On the basis of e.g. Skt. *nágna-* 'naked', we would reconstruct a preform **nég^wmo-*, with short **e*, however.

If we compare these forms, we see that they all have one thing in common: in all three forms the reconstructed short **é* is followed by a voiced stop:

<i>pēda-</i>	/pēda-/	< <i>*pédo-</i>	(Gr. <i>πέδον</i>)
<i>tēkan</i>	/tēgan/	< <i>*d^héĝ-(ō)m</i> ²⁹	(Gr. <i>χθών</i> , Skt. <i>kṣās</i> , gen. <i>jmás</i>)
<i>nēkumant-</i>	/nēg ^w mant-/	< <i>*nég^wmo-</i>	(Skt. <i>nágna-</i>)

This is reminiscent of Winter's Law in Balto-Slavic (where a voiced stop causes acute intonation and often subsequently lengthening of a preceding vowel) and Lachmann's Law in Latin (where a voiced stop followed by a consonant causes lengthening of a preceding vowel). For both Winter's and Lachmann's Law it is crucial that PIE voiced aspirated stops do not affect the preceding vowel, and this is the case in Hittite as well: e.g. **néb^hes* yields Hitt. *nēpiš* /nébis/ 'heaven' and *d^hébh-u-* > Hitt. *tēpu-* /tēbu-/ 'small', both with plene spelling of *e* in only 50% of their attestations, pointing to short /é/.

²⁸ Since the first syllable of this word is closed, this plene spelling from an OH/MS text (KUB 29.55 ii 10), even though it occurs only once, is relevant and points to /nēg^wmant-/.

²⁹ My reconstruction **d^héĝ-(ō)m* with voiced **ĝ* instead of with aspirated **ĝ^h* (as can be commonly found in the handbooks), is based on Skt. gen.sg. *jmás* (and not ***hmás*) 'earth', which unambiguously points to a preform **d^hĝ-m-ós* and not to ***d^hĝ^h-m-ós*. In the other IE languages, the cluster **d^hĝ-* assimilated to **d^hĝ^h-*, yielding Gr. *χθ-*, Lat. *h-*, Got. *g-*, etc.

Winter's Law in Balto-Slavic is best explained by the glottalic theory, which states that the series traditionally reconstructed as PIE voiced stops, $*d$, $*g$, $*g^w$, was in fact pre-glottalized, $*ʔd$, $*ʔg$, $*ʔg^w$.³⁰ In the prehistory of Balto-Slavic, the glottalic element of these stops merged with the outcomes of the PIE laryngeals, which is the reason why voiced stops cause acute intonation of the preceding vowel, just like laryngeals do. For Hittite, we may therefore also assume that the glottalic element of the pre-glottalized stops at a certain pre-Hittite stage merged with the glottal stop that is the result of $*h_1$, which then caused lengthening of the preceding vowel:

	PIE		pre-Hitt.		OH		spelled
with voiced stops	$*péʔdo-$	>	$*péʔdo-$	>	/péda-/		pēda-
	$*néʔg^wmo-$	>	$*néʔg^wmo-$	>	/nég ^w ma-/		nēkumant-
	$*dʰéʔg-(ō)m$	>	$*déʔg(ō)m$	>	/tégan/		tēkan
with $*h_1$	$*dʰéh_1ti$	>	déʔti	>	/tét ^s i/		tēzzi
without voiced stops or $*h_1$	$*nébʰes$	>	*nébes	>	/nébis/		nēpiš
	$*dʰebʰu-$	>	*débu-	>	/tébu-/		tēpu-

Note that after the OH period, the long /ē/ of *pēda-*, *nēkumant-* and *tēkan* is regularly shortened, just as in all other polysyllabic words: MH/NH *pēda-*, *nekumant-*,³¹ *tēkan*.

Bibliography

- Aro, Jussi. 1953. Abnormal plene writings in Akkadian texts. *Studia Orientalia* 19, 3–19.
- Carruba, Onofrio. 1981. Pleneschreibung und Betonung im Hethitischen. *Zeitschrift für vergleichende Sprachforschung* 95, 232–248.
- Eichner, Heiner. 1973. Die Etymologie von heth. *mehur*. *Münchener Studien zur Sprachwissenschaft* 31, 53–107.

³⁰ E.g. Kortlandt 1988.

³¹ Again, the *-e-* in *nekumant-* /nég^wmant-/ is found in a closed syllable and therefore follows the rules of spelling of short /é/ in closed syllables.

- Eichner, Heiner. 1980. Phonetik und Lautgesetze des Hethitischen – ein Weg zu ihrer Entschlüsselung. In Manfred Mayrhofer, Martin Peters & Oskar E. Pfeiffer (eds.), *Lautgeschichte und Etymologie: Akten der VI. Fachtagung der Indogermanischen Gesellschaft, Wien, 24.–29. September 1978*, 120–165. Wiesbaden: Reichert.
- Friedrich, Johannes. 1931. *Hethitisch und "Kleinasiatische" Sprachen*. Berlin & Leipzig: de Gruyter.
- Götze, Albrecht. 1928. *Madduwattaš*. Leipzig: Hinrichs.
- Hart, Gillian R. 1980. Some observations on plene-writing in Hittite. *Bulletin of the School of Oriental and African Studies* 43, 1–17.
- Hoffner, Harry A., Jr. & H. Craig Melchert. 2008. *A grammar of the Hittite language*. Winona Lake (IN): Eisenbrauns.
- Hrozný, Friedrich. 1917. *Die Sprache der Hethiter*. Leipzig: Hinrichs.
- Kammenhuber, Annelies. 1969. Hethitisch, Palaisch, Luwisch und Hieroglyphenluwisch. In *Handbuch der Orientalistik 2.1/2.2: Alt Kleinasiatische Sprachen*, 119–357. Leiden: Brill.
- Kimball, Sara E. 1983. *Hittite plene writing*. University of Pennsylvania Dissertation.
- Kimball, Sara E. 1999. *Hittite historical phonology*. (IBS 95). Innsbruck: Institut für Sprachwissenschaft der Universität Innsbruck.
- Kloekhorst, Alwin. 2004. The preservation of $*h_1$ in Hieroglyphic Luwian: Two separate *a*-signs. *Historische Sprachforschung* 117, 26–49.
- Kloekhorst, Alwin. 2006a. Initial laryngeals in Anatolian. *Historische Sprachforschung* 119, 77–108.
- Kloekhorst, Alwin. 2006b. Hittite *pai-/pi-* ‘to give’. *Indogermanische Forschungen* 111, 110–119.
- Kloekhorst, Alwin. 2008. *Etymological dictionary of the Hittite inherited lexicon* (Leiden Indo-European Etymological Dictionary Series 5). Leiden & Boston (MA): Brill.
- Kortlandt, Frederik H. H. 1988. Remarks on Winter’s Law. *Dutch contributions to the 10th International Congress of Slavists: Linguistics* (Studies in Slavic and General Linguistics 11), 387–396. Amsterdam: Rodopi.
- Kronasser, Heinz. 1956. *Vergleichende Laut- und Formenlehre des Hethitischen*. Heidelberg: Winter.
- Melchert, H. Craig. 1984. *Studies in Hittite historical phonology*. Göttingen: Vandenhoeck & Ruprecht.

- Melchert, H. Craig. 1994. *Anatolian historical phonology*. Amsterdam & Atlanta (GA): Rodopi.
- Oettinger, Norbert. 1979. *Die Stammbildung des hethitischen Verbuns*. Nürnberg: Carl.
- Otten, Heinrich & Vladimír Souček. 1969. *Ein althethitisches Ritual für das Königspaar* (Studien zu den Boğazköy-Texten 8). Wiesbaden: Harrassowitz.
- Pedersen, Holger. 1938. *Hittitisch und die anderen indoeuropäischen Sprachen*. Copenhagen: Levin & Munksgaard.
- Rosenkranz, Bernhard. 1959. Zur hethitischen Orthographie und Lautlehre. In R. von Kienle et al. (eds.), *Festschrift Johannes Friedrich zum 65. Geburtstag am 27. August 1958 gewidmet*, 417–426. Heidelberg: Winter.
- Sturtevant, Edgar H. 1933. *A comparative grammar of the Hittite language*. Philadelphia (PA): LSA.
- Weitenberg, Joseph J. S. 1984. *Die hethitischen u-Stämme*. Amsterdam: Rodopi.