Hittite Stressed Vowel Lengthening and the Phonology-Orthography Interface*

Anthony D. Yates
University of California, Los Angeles
adyates@ucla.edu

§1 Introduction

Almost exactly a century ago, it was proposed by Hrozný (1917:xii) that Hittite scribes in some cases used "plene writing" — the repetition of identical vowel signs in the spelling of vowels or diphthongs (cf. Kimball 1999:55) — to indicate contrasts in vowel length: vowels spelled plene are phonetically longer than non-plene vowels. In its broad sense, Hrozný's hypothesis is now standardly accepted (e.g. Melchert 1994:27; Kimball 1999:59; Kloekhorst 2008:32); however, the exact relationship between plene writing and vowel length remains controversial, and in particular, Kloekhorst (2014) has challenged a number of points on which previous scholarship had converged.

This paper focuses on just one issue that has been called into question by Kloekhorst, viz. the synchronic and diachronic treatment in Hittite of inherited **é*.[1] I advance arguments principally for the three (interdependent) hypotheses in (1):[2]

(1) i. Diachronically, the outcome of inherited **é* (and **ḗ*, tautosyllabic **éh₁*) in Hittite is [é:].[3]
ii. Synchronically, Hittite [é:] (from these historical sources) is derived from /e/, which is phonologically lengthened when stressed.
iii. This synchronic phonological lengthening process is diachronically stable within Hittite.

These positions generally accord with the analysis laid out by Melchert (1994:133–5) and adopted with only minor refinements by Kloekhorst (2008:95–100).[4] However, each directly contradicts the more recent analysis of Kloekhorst (2014), who argues that the reflexes of inherited **é* in Hittite are distinct from those of **ḗ* and **éh₁* — specifically, that in non-final syllables only the latter yield [é:] in Old Hittite (OH), while **é* develops into short [é] in closed syllables, and half-long [é·] in open syllables.

Kloekhorst's recent proposals are examined further in §2, where they are shown to be problematic on empirical and theoretical grounds. In particular, I contend that two orthographic assumptions crucial to his theory cannot be maintained: the relative frequency of plene writing cannot be used to diagnose a distinct class of "half-long" vowels in Hittite (§2.2); nor do any plene spellings represent phonemic glottal

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[1] That is, the historical reflexes of the PIE short vowel */e/ in stressed syllables that were not affected by any qualitative changes (lowering, raising, rounding, etc.) at any point in the prehistory of Hittite.

[2] The term "stress" in (1) refers to the primary word-level prosodic prominence (cf. Yates 2016b). The same feature is referred to equivalently as "accent" in Melchert 1994, Kimball 1999, and Kloekhorst 2008, 2014, and as "ictus" in Yates 2015, 2016a (cf. Kiparsky 2010, *i.a.*), where "accent" is used contrastively to refer to underlying pre-specification for prominence; I maintain the latter distinction here, using acute (´) to mark accent(s) in underlying forms (/X́/) and stress in surface forms ([X́]).

[3] The inherited short diphthong **éi* — when it does not undergo conditioned raising to Hittite [í(:)] (Eichner 1973:78; cf. Melchert 1994:145–6) — is generally assumed to pattern with **ḗ* and **éh₁*, yet due to the poverty of uncontroversial examples in non-alternating contexts (cf. n. 23 below), I have generally omitted it from the discussion here.

[4] Specifically, Kloekhorst (2008) correctly rejects the notion of a distinct PA phoneme */e:/ (< PIE **ei*); see now Melchert 2015 for discussion.

stops (§2.3). It is therefore argued that the data adduced by Kloekhorst (2014) is better explained by traditional views concerning the phonological interpretation of plene writing, and especially, the earlier assumption that inherited **é* was historically lengthened, developing into Hittite [é:] (§2.4).

Having assessed the diachronic development of Hittite [é:] in §2, I turn in §3 to its synchronic analysis. I revisit Melchert's (1994) hypothesis that Hittite [é:] was synchronically derived from /e/ via stressed vowel lengthening (see further §2.1 below). I present new evidence that this phonological process was diachronically stable within Hittite, arguing, in particular, that it applies to new instances of /e/ that emerge within (New) Hittite via sound change or analogy, e.g. (2):[5]

(2)	a.	<*ti-it-ḫa*>	[títχa] 'thunders' (3SG.NPST.MID.)	(KBo 17.11 i 9, OH/OS)
		<*ši-iš-du*>	[sís:t:u] 'let (him) prosper' (3SG.IMP.ACT.)	(KUB 12.43, 2, 3, OH/OS)
	b.	<*te-e-et-ḫa*>	[té:tχa] 'thunders' (3SG.NPST.MID.)	(KUB 32.135 i 3, 10, OH/MS)
		<*še-ḛ*[-*eš-du*]>	[sé:s:t:u] 'let (him) prosper' (3SG.IMP.ACT.)	(KBo 2.32 rev. 6, NH/NS)

The chronologically later Hittite forms in (2b) with contrast with earlier (2a) in both vowel quality and quantity ([í] > [é:]); I propose that this length discrepancy is due to stressed vowel lengthening, which was (still) synchronically operative when the Hittite-internal lowering change (*i* > *e*) took place. Finally, §4 concludes with brief summary remarks.

§2 Diachronic stressed vowel lengthening: inherited **é* yields Hittite [é:]

This section begins with a more detailed discussion of existing views on the development of inherited **é* in Hittite and how these views are informed by their divergent approaches to the relationship between vowel quantity and plene writing (§2.1). The next two subsections consider Kloekhorst's (2014) proposals that the Hittite orthographic system encodes a ternary phonetic vowel length contrast (§2.2), and that the relative incidence of plene writing in closed syllables supports a phonetic distinction in OH between [é:] (< **ḗ*, **éh$_1$*) and [é] (< **é*) (§2.3). §2.4 argues in support of the traditional view that **é* historically yielded Hittite [é:], and reconsiders some issues concerning the relative frequency of plene writing in view of the data presented by Kloekhorst (2014).

§2.1 On inherited **é* in Hittite and the theory of plene writing: The last thirty years of scholarship has converged not only in support of Hrozný's (1917:xii) hypothesis that plene writing indicates vowel length, but also of his further suggestion (*op. cit.* 186–7) that some plene spellings indicate original short vowels that have undergone (historical) lengthening under word stress ("Tondehnung").[6] With respect to inherited **é*, it has become the standard view that this short vowel was lengthened under word stress in the prehistory of Hittite, yielding the long vowel *ē* ([é:]), which was also the Hittite outcome of **ḗ* and tautosyllabic **éh$_1$* (Kimball 1999:132–49; cf. Kloekhorst 2008:95–9). Both the non-original long vowels in (3a) and the original long vowels in (3b) are therefore attested with plene writing:[7]

(3)	a.	<*e-ep-zi*>	[é:p:t͡si]	'takes' (3SG.NPST.ACT.)	< PA **h$_1$ép-ti*
		<*še-e-eš-zi*>	[sé:st͡si]	'sleeps' (3SG.NPST.ACT.)	< PA **sés-ti*
		<*ge-e-nu*>	[ké:nu]	'knee' (N.NOM.SG.)	< PA **ĝénu*
		<*ne-e-wa-an*>	[né:wan]	'new' (C.ACC.SG.)	< PA **néw-om*
	b.	<*e-eš-zi*>	[é:st͡si]	'is sitting' (3SG.NPST.ACT.)	< PA **h$_1$ḗs-ti*
		<*ú-e-ek-mi*>	[wé:kmi]	'I demand' (1SG.NPST.ACT.)	< PA **wḗĝ-mi*
		<*te-e-ez-zi*>	[té:t͡si]	'says' (3SG.NPST.ACT.)	< PA **déh$_1$-ti*
		<*mi-li-te-e-eš-t*[*u*]>	[milit:é:s:t:u]	'let (it) become sweet' (3SG.IMP.ACT)	< PA **melit-éh$_1$s-tu*

[5] Square brackets ([ ]) enclose approximate phonetic transcriptions (IPA, except [y] for [j] and stress); I assume the phonemic inventory given in Yates 2016b. Note with respect to (2a) that Hittite high vowels (/i, u/) do not lengthen under word stress in closed syllables (Melchert 1994:131–3).

[6] For overviews of the history of scholarship on the relationship between plene writing and vowel length, see Kimball (1999:54–68, 124–9) and Kloekhorst (2014:13–8).

[7] See Melchert 2014 for the derivation of 'sit' and 'demand' in (3b) from PIE "Narten formations."

Melchert (1994:133–5) further proposed that this surface identity led to phonemic merger in Hittite, with surface [é:] from all three historical sources derived synchronically from /e/ by a stress-conditioned lengthening rule. Within Hittite, then, forms like *šēšzi* from the group in (3a) and *tēzzi* from (3b) have the same underlying short vowel /e/, which is lengthened when it is assigned word stress, i.e. (4):[8]

(4)
/ses - t͡si/	→	*šēšzi* [sé:st͡si]	'sleeps' (3SG.NPST.ACT.)
/te - t͡si/	→	*tēzzi* [té:t͡si]	'says' (3SG.NPST.ACT.)

While accepting this view in his etymological dictionary (2008:95–100), Kloekhorst (2014:222–3, *passim*) now explicitly rejects Melchert's (1994) analysis, arguing instead for a phonemic distinction in OH between /e/ and /e:/, each with a different phonetic realization in stressed non-final syllables. This phonological contrast — and its subsequent collapse in NH — is schematized in (5):

(5)
			OPEN σ	CLOSED σ		OPEN σ	CLOSED σ
PIE/PA **é*	>	OH /e/ →	[é·]	[é]	> NH /e/ →	[é·]	[é]
PIE/PA **ḗ, *éh$_1$*	>	OH /e:/ →	[é:]	[é:]			

Kloekhorst's (2014) divergent conclusions follow directly from the fundamentally different way in which his approach accounts for two well-established distributional features of plene spelling, its OPTIONALITY and its ASYMMETRIC FREQUENCY. The first of these features is generally posited to account for synchronic variation observed at the level of individual lexical items: (virtually) all well-attested words show intra- and/or inter-text inconsistency with respect to the plene spelling of long vowels in compositions of all historical periods.[9] In some individual cases, it is possible to identify a likely motivation for the non-use of plene spelling for a long vowel — for instance, when a Hittite scribe was faced with limited remaining space on a tablet (cf. Rosenkranz 1964:168); in other cases, however, no such motivation can be detected. Any analysis of Hittite plene writing must therefore admit at least some degree of OPTIONALITY: in any given instance, a long vowel might or might not be represented with plene writing.

The major difference between Kloekhorst's (2014) approach to plene writing and that of previous scholarship is the extent to which such optionality was permitted. Under the earlier view, optionality is viewed as an "essential" characteristic of plene writing (cf. Melchert 1994:27): individual attestations of a word with plene spelling indicate that the relevant vowel is long,[10] but non-plene spellings do not necessarily indicate that it is short (cf. especially Kimball 1999:56). The relative incidence of plene writing is thereby viewed as phonologically uninformative, except insofar as (i) multiple attestations with plene spelling effectively exclude the possibility of scribal error, confirming vowel length beyond a doubt; or (ii) a sufficiently attested word or morphological category shows systematic absence of plene spelling in a phonological context where it is predicted, which may be diagnostic of an alternative stress pattern.[11]

Under Kloekhorst's (2014)'s approach, however, optionality is minimal or even excluded wholesale: long vowels are in principle consistently spelled plene. Non-plene spellings of phonetically long vowels in any attestation are due to extra-linguistic factors, such as considerations of tablet space (as noted above), or else more simply to errors or omissions on the part of the scribe. Such non-plene spellings are thereby afforded the same status as other misspellings, including aberrant plene spellings of phonetically short vowels, which are generally agreed to constitute a "residue" that lies beyond the domain of phonological explanation.[12]

[8] Root-formed mobile *mi*-verbs like (4) receive "default" stress on their leftmost syllable (for details, see Yates 2016b).

[9] Thus, e.g., Kimball (1999:55): "Even within the OH period use of plene writing was inconsistent." Kloekhorst (2014), too, acknowledges the inconsistency (e.g. *op cit.* 42): "Plene spelling is in no word 100% completely consistent."

[10] Excluding here cases in which plene writing may signal a feature other than vowel length (on which see further §2.3 below).

[11] That is, the word or category may be stressed in a position other than the one expected on historical grounds, which in turn could point to a diachronic stress shift (see, e.g.,Lundquist (2015) on Vedic *–ti–* stem abstract nouns; Probert (2006) on Greek thematic nominals; Yates (2015:151–3, 169–74) on PIE nasal-infix verbs in Anatolian), or else the need to revise one's assumptions about stress in the reconstructed pre-form.

[12] For instance, *paḫḫur* 'fire' (N.NOM/ACC.SG.) is attested twice (KBo 17.10 iii 2) as <*pa-a-aḫ-ḫur*; yet since plene writing is otherwise unattested (23x non-plene) and is not predicted under any analysis of Hittite vowel length, this (effectively) single attestation is more plausibly viewed as a scribal error.

This approach leads Kloekhorst to recognize a third class of words in OH in which a vowel is sometimes spelled plene, sometimes not. He assumes that such inconsistent plene writing is an orthographic means for representing an intermediate degree of vowel length, and thus analyzes these vowels as half-long (i.e. [V·]). In contrast, then, to the views of Melchert (1994), Kimball (1999), and others, the relative incidence of plene writing in individual word forms is employed by Kloekhorst (2014) to distinguish crucially between long and half-long vowels. In the case at hand, he contends that in OH the "(almost) consistent plene spelling" of [é:] contrasts with the "plene spelling in ca. 30–50% of the cases" for [é·] (*op. cit.* 181). Moreover, once he has established the expected frequency of plene spelling for long and half-long vowels in OH, Kloekhorst finds that the frequency of plene writing for inherited **é* in closed syllables — at least in those contexts where it necessarily indicates vowel length (cf. §2.3 below) — is "significantly" lower than for the half-long and long vowels;[13] in fact, he finds that such plene spellings are sufficiently rare that they are best viewed as erroneous representations of short [é], the length of which is accurately reflected in its more common non-plene spelling.

The differing assumptions concerning optionality of Kloekhorst (2014) and earlier scholarship also have consequences for their analyses of the other notable distributional feature of plene writing, i.e. its ASYMMETRIC FREQUENCY. This property is discussed by Melchert (1994:27) and in greater detail by Kimball (1999:55–6), who observe that — as already noted by earlier scholars — the relative incidence of plene vs. non-plene spelling is correlated with the factors in (6):[14]

(6) i. Chronology: plene spelling decreases over time, occurring most frequently in OH compositions, less frequently in post-OH compositions (and copies of OH texts).

ii. Syllabic position: vowels are spelled plene less frequently in closed syllables (i.e. preceding a consonant cluster or geminate consonant) than in open syllables.

Under the traditional approach, the (i) lower relative frequency of plene writing in chronologically later texts reflects only a decrease in the use of an orthographic practice that was, already at the earliest stage, optional. Meanwhile, (ii) is likely motivated by general principles of orthographic economy: the lower incidence of plene writing in closed syllables is due to the higher "cost" (in terms of scribal effort and physical tablet space) of using plene writing in this context, where it requires three signs (<*CV-V-VC*>), versus open syllables, where just two signs are necessary (<*CV-V*>) (cf. Melchert 1994:27). Significantly, the same calculation may in part explain why plene writing is more consistent in vowel-initial words with first syllable stress — including inherited **#é* — than in other closed syllables (cf. §2.4 below): plene writing here requires just two signs (<*V-VC*>), and is therefore relatively "cheap." These two factors conspire to limit plene spellings of vowels in closed syllables in late texts to a relatively low number.

In contrast, Kloekhorst (2014) sees in (i) a series of historical vowel shortenings: all OH long vowels in non-final syllables undergo (some) shortening by NH including [é:], which is reduced to [é] in closed syllables and [é·] in open syllables, thereby leading to the elimination of the OH phonemic distinction between /e:/ and /e/. The (ii) positional asymmetry has two causes. On the one hand, it is due to the non-lengthening of inherited short vowels in closed syllables (e.g. **éC.* > Hitt. [éC.]), and on the other, due to the more thoroughgoing historical shortening of long vowels in this environment, which for Kloekhorst in some cases has begun already within OH (cf. §2.3 below). The logic behind the lower relative incidence of plene writing in chronologically late texts and especially in closed syllables is therefore that in the post-OH period there were fewer surface long vowels than in OH, since they were generally subject to reduction diachronically and especially so in closed syllables.

In broad terms, then, the difference between these approaches is whether the observed diachronic decrease in the relative incidence of plene writing is purely a change in orthographic practice or the result of phonological change. If the traditional approach is correct that plene writing is fundamentally

[13] Kloekhorst's (2014:7, *passim*) use of "significant" in discussing the frequency of plene spelling is not equivalent to "statistically significant," since no statistical testing methods are applied to his data; rather, all figures are reported in terms of raw frequency or percentages and evaluated by impressionistic comparison (cf. Melchert's (to appear) criticism on this point).

[14] For references to earlier scholarship, see Kimball (1999:55).

optional, then it would not be surprising if, outside of a few mostly very common words in which plene writing became conventional (see further §2.4 below), it gradually came to be used less frequently. However, it is also plausible that most long vowels were shortened during the roughly four centuries over which Hittite is attested, and that such shortening especially affected long vowels in closed syllables, where at the phonetic level, the duration of vowels tends to be decreased.[15]

Without the benefit of modern descendant languages, the relative likelihood of these competing theories must be evaluated by their ability to explain the data. This data is basically captured under the traditional approach, but at the expense of a highly imperfect correlation between plene writing and vowel length in individual word attestations (i.e. across tokens). Kloekhorst's (2014) approach attempts to fit the more data more closely by positing additional phonological and phonetic distinctions, yet questions have been raised about the empirical status of these distinctions, as well as the plausibility of some of Kloekhorst's assumptions concerning the phonological interpretation of plene writing (Kimball 2015; Melchert to appear). The remainder of this section therefore considers Kloekhorst's hypotheses in more detail.

§2.2 Against a ternary length contrast: Under Kloekhorst's (2014) analysis, Hittite non-high stressed vowels show three degrees of phonetic vowel length: short [V], half-long [V·], and long [V:]. This ternary surface length contrast is orthographically encoded by varying degrees of plene writing — for the front mid vowel, [é] is (in principle) never spelled plene; [é·] is spelled plene in "ca. 30–50%" of attestations; and [é:] is (again, in principle) always spelled plene.

This hypothesis raises a number of questions. On the one hand, there are purely empirical questions about the status of these groups — can three distinct groups really be identified? And are these groups associated with the phonemic and etymological differences argued for by Kloekhorst? Discussion of these issues is deferred to §2.3 below; here, I consider first two (interrelated) typological questions raised by Kloekhorst's proposal: is it reasonable to assume that (i) the proposed ternary length contrast existed in Hittite and (ii) is represented in the Hittite orthographic system?

The first of these assumptions is plausible. Languages regularly exhibit three or more degrees of phonetic vowel length, as vowel duration is subphonemically influenced by the segmental and suprasegmental properties of the vowel and its phonological context; factors that clearly correlate with increased duration include tongue height (low > high); voicing of a following consonant (voiced > voiceless); syllabic position (open > closed); and (degree of) stress (primary stress > secondary stress > unstressed) (see, e.g., Lehiste 1970). It is therefore reasonable that two of these factors are implicated in Kloekhorst's (2014) analysis of Hittite: in stressed open syllables, /e/ has the partially lengthened allophone [é·], but in closed syllables, it is realized without lengthening as [é].

The second assumption, however, is problematic. It has long been recognized that orthographic systems strongly tend to represent only phonemic contrasts (e.g. Stockwell and Westbrook 1951; McIntosh 1956; Penzl 1957; cf. Lass 1997:45–60). Even salient phonetic differences are often omitted in writing in the interest of maintaining (morpho)phonemic identity — for instance, in the well-known case of German word-final obstruent voice neutralization, both <*Rat*> 'advice' and <*Rad*> 'wheel' are pronounced with final voiceless [t], but the graphemes <*t*> and <*d*> are indicative of underlying /t/ and /d/, which are perceptible in their plural forms *Rä*[t]*e* and *Rä*[d]*er* respectively. In contrast, the practice of representing purely allophonic distinctions is relatively uncommon, although nevertheless attested (e.g. Classical Nahuatl, Sanskrit; see Stockwell and Westbrook 1961).[16]

[15] Cross-linguistically, it is almost always the case that vowels are shorter in closed syllables (see, e.g., Maddieson 1985), although there are interesting exceptions like Tokyo Japanese, where they are instead longer (Homma 1981).

[16] In fact, even the phonological analysis of Hittite /e/ (→ [é:]) advocated in this paper must contend with the allophonic writing problem. I assume that the length of [é:] was represented (with plene writing) because this feature was, on the one hand, distinctive (in the sense of Kiparsky 2015:575), and on the other, because it was contrastive elsewhere in the system (i.e. in the high/low vowels and most consonants; cf. n. 5 above); in other words, since the phonetic difference between [e] and [é:] would have been similar to the difference between (e.g.) [a] and [á:] (where it is contrastive), it might have seemed natural to express it by the same orthographic means.

These cross-linguistic orthographic tendencies speak against the idea that half-long vowels are non-phonemic but still represented in the Hittite writing system. Yet this general typological issue is further compounded by the specific facts of the feature in question: even in the (very rare) languages in which ternary *phonemic* length contrasts have been established, they are not encoded in the orthographic system. Probably the two best known cases of ternary phonemic length are found in Estonian (e.g. Odden 1997; Asu and Teras 2009) and Dinka (Anderson 1987; Remijsen and Gilley 2008);[17] minimal triplets are given in (7) with both orthographic and phonetic representations:

(7)

	Estonian			Dinka	
<*sada*>	[sata]	'hundred'	<*lel*>	[-lèl]	'isolate.2SG'
<*saada*>	[sa:ta]	'send.IMP'	<*leel*>	[-lè:l]	'isolate.3SG'
<*saada*>	[sa::ta]	'get.INF'	<*leel*>	[-lè::l]	'provoke.3SG'

In each case, the ternary vowel length contrast is in spelling reduced to a binary contrast: both long and over-long vowels are graphically doubled, while short vowels are distinguished by their singleton spelling.

In view of these facts, one might genuinely wonder whether the standard orthography of any natural language represents a ternary vowel length contrast. Yet even if such a language should turn up, it remains the case that Hittite is a very unlikely candidate for one.[18] Not only are half-long vowels in Hittite purely allophonic and so *a priori* less likely to be written, but its script is notoriously ill-adapted to representing even those phonemic length distinctions that definitively exist in the language. A case in point is the Hittite imperfective suffix /-sk:é-/ (< PIE/PA **–sk̂e–*), which has a geminate (= long) velar stop [k:] via Sturtevant's Law. This [k:] is overwhelmingly spelled with a singleton sign (19x <*-Vš-ke/i-*> in OS texts), e.g. <*za-aš-ke-ez-zi*> 'places'; but in a few cases, it is spelled with an orthographic geminate (1x <*-ik-ke/i-*> in OS texts). Applying the same reasoning that guides the half-length analysis would lead to the conclusion that the velar stop of the suffix is 5% long, and so spelled geminate in roughly 5% of (OS) attestations.

However, not only is such an analysis intuitively unlikely, it also misses an important generalization, viz., that the geminate is represented only when an epenthetic vowel emerges between the /s/ and /k:/ of the suffix,[19] e.g. <*zi-ik-ke-ez-zi*> 'id.', although even then, not in all cases, e.g. <*zi-ke-e-et*> 'placed';[20] it seems unlikely to be due to chance that, in this phonological context, it was possible for scribes to represent the length of /k:/ without inserting an "empty" vowel into the suffix.[21] Yet whatever the exact motivation for this orthographic pattern, it is clear that the frequency with which [k:] is written geminate has no bearing on its phonological length, which was optionally represented despite being contrastive.

More generally, this orthographic practice suggests that the Hittite scribes were not operating like trained phoneticians, strictly representing (vowel) length contrasts at the level of subphonemic detail; rather, it is consistent with the hypothesis adopted under the traditional approach to plene writing that the inclusion or omission of such phonological information was optional, and that the choice was partially determined by extra-linguistic factors.

§2.3 Against a phonetic distinction between [é] and [é:]: As discussed in §1 and §2.1, Kloekhorst (2014) has argued that Hittite preserves the inherited PIE/PA phonemic distinction between /e/ (< **é*)

[17] See Odden (2011) for discussion, including reanalysis of several other languages which have been held to show a ternary length contrast.

[18] A still further issue raised by Kimball (2015:27) is that, even if Hittite had half-long vowels, it is totally unclear why this feature would be encoded by *inconsistent* plene writing; Kloekhorst (2014) offers no explanation for this orthographic principle.

[19] The epenthetic vowel appears suffix-internally specifically when the final consonant of the root is coronal; see Melchert 2013b:178–9, and for the phonotactic conditions on epenthesis, Kavitskaya 2001 and Yates 2016a.

[20] The cited forms are OH/OS; for attestations (in all periods), see Kloekhorst 2014:108–116.

[21] Spellings of the type ^{x}<*-ša-ak-ke/i-*> for the imperfective suffix are possible in principle but unattested; their absence is consistent with the idea that suffix-internal "empty" vowels were strongly avoided, although in at least one case an empty vowel was employed: <*a-ar-ša-ke-ez-z*[*i*]> [á:rsketsi] 'arrives' (KUB 13.2 i 25).

and /eː/ (< **ḗ*, **éh$_1$*). These phonemes contrast only in OH, and only in non-final stressed syllables, where /e/ is phonetically shorter than /eː/ in both open syllables ([é˙] vs. [éː]) and closed syllables ([é] vs. [éː]). If this fleeting period of contrast could be established, it would undermine the traditional analysis whereby **é*, **ḗ*, and **éh$_1$* had merged already by the earliest attested stage of Hittite as /e/, which was subject to synchronic lengthening under word stress (i.e. /e/ → [éː]).

I focus here on the alleged distinction between [éː] and [é] in closed non-final syllables for several reasons. First, Kloekhorst's (2014) analysis makes clear empirical predictions about the relative incidence of plene writing for these vowels (in principle, always vs. never; cf. §2.1 above) and there is sufficient (OH) evidence to evaluate these predictions.[22] Furthermore, it will become clear in what follows that rejecting the "glottal stop hypothesis" entails rejecting the claim that the relative incidence of plene spelling is phonologically meaningful, and so in turn, the putative evidence for a class of surface half-long vowels (which were already argued to be unlikely in §2.2).

Under Kloekhorst's (2014) analysis, the phonetic realization of /eː/ in OH non-final stressed syllables is [éː], and so predicted to exhibit the same "virtually consistent" plene spelling as in monosyllables (cf. n. 33). However, a closer look at the evidence that allegedly supports this analysis reveals a different picture; the table in (8) reports the OS frequency of plene writing for words or morphemes held by Kloekhorst to contain OH [éː] in a non-final syllable that have relatively secure etymologies and are attested four or more times in OS texts:[23,24]

(8)

	PLENE	NON-PLENE	%PLENE
pēḫḫe/i 'I give'	6x	0x	100%
tēḫḫe/i 'I place'	9x	5x	40.7%
appēzziya– 'last'	1x	4x	20%
tēzzi 'says'	2x	9x	18.2%
–ēššar/–ēšn– '(noun suffix)'	1x	21x	4.5%[25]
pēššiye/a– 'throw'	0x	11x	0%
ḫantēzziya– 'first'	0x	4x	0%
TOTAL	19x	54x	26%

What (8) shows is that the relative incidence of plene writing varies considerably across items. The consistency predicted by the analysis is observed only in *pēḫḫe/i*, while for all other items plene writing is a minority pattern; especially striking is *pēššiye/a–*, which shows no plene writing in eleven OS attestations. To account for this distribution, Kloekhorst (2014:50, *passim*) proposes that, already during

[22] The poverty of OH evidence for [é˙] (< **é*.) makes its status difficult to assess independently. Kloekhorst (2014:175–6) identifies just two lexical items as clear examples of OH [é˙] (*pēran* 'before' and *nēpiš–* 'heaven'), and just a single example of [éː] (*pēda–* 'carry off') in a phonological context in which the frequency of plene writing for these allegedly contrastive items can be directly compared (i.e. open non-final syllable). Moreover, both examples are problematic: as pointed out by Melchert (to appear), the post-OH trajectory of plene spellings of *pēda–* do not fit Kloekhorst's model; and for *nēpiš–*, it is uncertain whether the word etymologically reflects **é*, since it probably had both **ḗ* and **é* in its prehistoric paradigm (see Oettinger to appear and Yates 2014, contra Kloekhorst 2008:618–9).

[23] The table in (8) includes not only the etymological reflexes of **ḗ* and **éh$_1$*, but also the surface [éː] that results from monophthongization of **ói* and **éi*; under Kloekhorst (2014)'s account, the long vowel [éː] from all four sources is expected to behave identically with respect to plene writing. I am skeptical, however, of the synchronic phonemic analysis of Kloekhorst, who assigns all the examples in (8) to phonemic /eː/. Issues of length aside, I prefer to view [éː] in *pēḫḫe/i* — which participates in regular paradigmatic alternations with the diphthong [á(ː)i], e.g. *pāi* 'gives' (3SG.NPST.ACT.) — as an allophone of /a(ː)i/. In the same vein, while (e.g.) *apēzziya–* may have an underlying monophthong (< **éi* per Eichner 1973:77), the alternation between (e.g.) *utnē* 'land' (N.NOM/ACC.SG.) and *utniyaš* (N.GEN.SG.) suggests synchronic /ei/ in the stem-final syllable.

[24] The cut-off point of four attestations in (8) is somewhat arbitrary, and chosen in the interest of inclusiveness. It should be noted that Kloekhorst (2014:179, *passim*) is appropriately cautious about using plene spelling in very low frequency items as diagnostic for vowel length, since the observed ratio of plene to non-plene spelling may be simply due to chance. Although several of these fit his generalizations (e.g. *zēri–* 'cup', OS 2x : 0x; < PIE **tyéh$_1$-ri–*), other examples would be problematic — for instance, the unexpectedly high ratio of plene in *tēpu* 'small' (OS 3x : 1x; < (Post-)PA **débu*), which is especially remarkable in view of its relatively low ratio in MS texts (cf. Kimball 2015:33).

the OH period, [é:] was subject to conditioned shortening in closed syllables"before dental consonants" (i.e. /t(:), t͡s, l(:), n(:)/). Yet this further assumption not only suffers from a lack of phonetic motivation,[26] it also effectively posits an *ad hoc* division of OH texts into "early" and "late" depending solely on whether the vowel is spelled plene or not in this phonological context. In addition to these serious issues, this proposal still leaves unexplained the ratio of plene spelling in *tēḫḫe/i*, which is aberrantly low under Kloekhorst's theory; for this form, Kloekhorst (2014:49) raises the possibility of a similar (but separate) OH-internal conditioned vowel shortening, yet this analysis faces the same set of objections as shortening before "dental consonants" and — to the extent that it is empirically falsifiable — is falsified by *peḫḫe/i*, which fails to exhibit shortening in the same environment.

The broad take-away from (8) is that there is little compelling OH evidence for a long vowel [é:] from **ē* and **éh$_1$* in non-final syllables that is consistently written plene; rather, these forms suggest that plene writing of [é:] in closed non-final syllables is simply infrequent and that, if this vowel [é:] can be distinguished from the reflexes of inherited **é* in this environment by its elevated frequency of plene writing, then it must be because the latter shows (virtually) no plene spellings at all. Yet as can be seen in (9) (cf. (3a) above), plene spellings of inherited **é* are attested in closed non-final syllables, exactly where they are predicted under the traditional account, which posits stressed vowel lengthening in this environment:

(9)	a.	<*ku-e-en-zi*>	[kʷéːnt͡si]	'kills' (3SG.NPST.ACT.)	< PA **gʷén-ti*
		<*ḫu-e-ek-ta*>	[χʷéːkta]	'slaughtered' (3SG.PST.ACT.)	< PA **Hʷég-ta*
		<*tu-e-ek-ki*>	[twéːkːi]	'body; self' (C.DAT./LOC.SG.)	< PA **twék–*
	b.	<*me-e-er-tu$_4$*>	[méːrtːu]	'let him disappear' (3SG.IMP.ACT.)	< PA **mér-tu*
		<*še-eš-ke-e-ed-du*>	[seskːéːtːu]	'let him sleep' (IPFV-3SG.IMP.ACT.)	< PA **–sk̂é-tu*
	c.	<*še-e-eš-ta*>	[séːsta]	'slept' (3SG.PST.ACT.)	< PA **sés-t(a)*
		<*ke-e-en-zu*>	[kéːnt͡su]	'lap' (N.NOM/ACC.SG.)	< PA **ĝénh$_1$-su*
	d.	<*e-eš-zi*>	[éːst͡si]	'is' (3SG.NPST.ACT.)	< PA **h$_1$és-ti*
		<*e-eš-ḫar*>	[éːsχːar]	'blood' (N.NOM/ACC.SG)	< PA **h$_1$ésH-r̥*

In order to explain why the forms in (9) do not show that **é* regularly yields [é:] in Hittite, Kloekhorst (2014) advances several disparate hypotheses: in (9a), that plene writing does not reliably indicate vowel length after a labio-velar glide (/w/) or labialized obstruent (/kʷ(:), χʷ(:)/); in (9b), that the long vowel is due to a special process lengthening stressed vowels in imperatival forms; in (9c), that the plene spellings are scribal errors; and in (9d), that plene writing indicates the presence of a initial glottal stop rather than a long vowel.

These hypotheses are problematic in various ways.[27] Since not all imperatives show plene spelling, the imperatival lengthening process posited for (9b) cannot be analyzed as a phonologically regular development, and so its use to "explain" unexpected plene spellings is fundamentally stipulative;[28] moreover, while there is little or no evidence for imperatival lengthening in contexts where a long vowel is

[26] Paradoxically, Kloekhorst (2014:307, *passim*) even suggests that the same consonants had a *lengthening* effect on a preceding [á:] vowel, delaying the general historical shortening process that is argued to target this OH long vowel in closed syllables.

[27] Possible but uncertain is the explanation for (9a). One of Kloekhorst's (2014) important findings is that plene spellings of type <°*u/ú-e-eC*> — well-attested in (e.g.) fientives (*–ēšš–*) and nominative plurals (*–ēš*) — do not necessarily mark vowel length, yet it is not wholly clear whether this orthographic rule holds for plene spellings after (initial) labialized obstruents, and if so, starting at what date (cf. the skepticism of Kimball 2015:24–5). It seems significant that for words like *ḫuek–* and especially *kuen–* in (9a) plene spellings are better established in the earliest texts — e.g. <*ku-e-en-zi*> (KBo 6.2 i 3; OS) vs. <*ku-en-zi*> (frequent in MS+ texts) — and so show the same historical trajectory as is generally observed in the language. However, the identification of more plene spellings of unstressed long vowels (e.g. in the nominative plural suffix) after labialized obstruents (especially at an early date) would provide compelling evidence for Kloekhorst's (2014) argument that plene spelling in this environment is non-probative for vowel length.

[28] Especially *ad hoc* is Kloekhorst's (2014:94 n. 348) proposal that *samēzzi* [smét͡si] 'withdraws' (3SG.NPST.ACT) — an ordinary indicative form — underwent imperatival lengthening in a modal context.

not predicted under the traditional approach,[29] there is at least one clear case in which imperatives contrast with indicative forms specifically because they were *not* lengthened. This situation is observed in ablauting *ḫi*-verbs of the *dāi*-class in OH, where imperatives with short final diphthongs (e.g. *pai* 'give!') and indicative forms with long diphthongs (*pāi* 'gives') constitute minimal pairs for vowel length (Cowgill *apud* Melchert 1994:148).

In the same vein, ascribing examples like (9c) to scribal error is purely stipulative. It is true, of course, that some "residue" of orthographic errors is to be expected (cf. §2.1), but there are nevertheless strong reasons to doubt Kloekhorst's (2014) analysis of these examples as misspellings of a phonetically short vowel [é] on the grounds of their very low frequency of plene writing. Given that even in OS texts plene writing of [é:] in closed syllables was fairly uncommon and that the strong stem of (e.g.) *šeš–* 'sleep' is attested only in later texts where it is known to be less common (cf. Kimball 2015:23–5), its ratio of plene spelling — at least twice (KBo 19.128 vi 29, OH/NS; KUB 31.39 iv 3, NH/NS) in 60x+ attestations (~3% plene) — is not low with respect to the group in (8) above where Kloekhorst predicts a long vowel, but in fact rather high.[30] If imperatival lengthening is excluded, the strong stems of other *mi*-verbs exhibit similar profiles: *s(a/e)men–* 'withdraw' is attested 17x (4x OS) with one plene spelling of the root vowel (HKM 5 14, MH/MS; 5.8% plene), and *mer–* 'disappear' 15x (0x OS) with two plene spellings (KUB 41.23 ii 5, iii 11, OH/NS; 13.3% plene). In any case, relative incidence of plene writing provides no grounds for splitting the reflexes of inherited **é* like *šeš–* from those in (8) that continue **ḗ* or **éh₁*.

Finally, there is the issue of examples like (9d), whose consistent and diachronically stable plene writing (<*e-eC*->) appears to systematically violate Kloekhorst's (2014) hypotheses. For this class, Kloekhorst argues that plene writing that does not (necessarily) indicate a long vowel ([é(ː)]), but is instead the orthographic representation of a word-initial glottal stop plus vowel sequence ([#ʔé(ː)-]). This theory — championed by Kloekhorst in earlier works (2004, 2006, 2008:75–6) and referred to here as the "glottal stop hypothesis" — assumes that this (phonemic) glottal stop is the Hittite reflex of PIE word-initial laryngeals, which merged as /ʔ/ in precisely those positions where earlier scholarship had assumed the laryngeal was historically lost and the Hittite word was thus synchronically vowel-initial.

In the intervening years, the glottal stop hypothesis has been seriously critiqued. The alleged evidence for an orthographic distinction in Hieroglypic Luwian between word-initial <*á*> [#ʔ(a)-] and <*a*> [#a-] has been shown to be non-probative by Melchert (2010a). Weeden (2011:62–8) has convincingly refuted the idea that the Hittite spelling of glottal stops was imported from Akkadian cuneiform, as well as raised doubts about the phonemicity of /ʔ/ in Hittite and, more generally, the explanatory power of glottal stop hypothesis (cf. Rieken 2010). To the weight of these criticisms, I add here the three cases in (10) where — under its current formulation — this hypothesis makes empirically false predictions:[31]

(10) a. PIE **h₁esh₂-ó-* > Hitt. <*iš-ḫa-a-aš*> [isχːáːs] 'master' (C.NOM.SG.) (ˣ<*i-iš-ḫa-a-aš*>

b. PIE **h₁eh₁-s-ḗ* > Hitt. <*iš-ši-i*> [isːíːi] 'mouth' (N.LOC.SG.) (ˣ<*i-iš-ši-i*>)

c. PIE **h₁̥rs-énti* > Hitt. <*ar-ša-an-zi*> [arsántsi] 'flow' (3PL.NPST.ACT.) (ˣ<*a-ar-ša-an-zi*>)

Both (10a) and (10b) are relatively well-attested words with historically expected oxytone stress, which

[29] Kloekhorst (2014:95) cites an interesting hapax *newāḫḫ* 'renew!' (2SG.IMP.ACT.), which exceptionally shows a long vowel in the factitive suffix (*–aḫḫ–*). A historical explanation might here be possible: after the regular loss of word-final **h₂* (Melchert 1994:85–6), the suffixal vowel would have undergone stressed vowel lengthening in an open syllable; the resulting long vowel was retained after this consonant was analogically restored.

[30] Note, too, that the vowel in *šeš–* occurs before a "dental consonant" in a closed non-final syllable, where Kloekhorst (2014) argues for early vowel shortening; probably the closest phonological comparandum for *šeš–* is therefore the suffix *–ēššar/–ēšn–* in (8), which shows a similar frequency of plene writing (4.5%) across a large number of attestations.

[31] The etymology of (10a) is standard; see Kloekhorst 2008:390 (cf. Nussbaum 2014:244–5). (10b) follows Melchert's (2010b) analysis (though Kloekhorst's (2008:166–7) etymology should yield the same initial spelling under his phonological assumptions). Kloekhorst's (2014:338–9) hesitant phonetic interpretation of the word-initial syllable in (10c) as "/(ʔ)ərs-/" suggests his awareness that Hittite [#ʔVrs-] — with regular "vocalization" of the syllabic sonorant and theoretically expected preservation of **h₁* as [#ʔ] — is incorrectly predicted to show initial plene spelling. An alternative diachronic scenario whereby **h₁* is treated as the syllabic nucleus rather than the adjacent sonorant (yielding *[ərs-] via "vocalization" of the laryngeal) is untenable under any systematic phonological analysis of syllabification in the ancient IE languages (see, e.g., Byrd 2015:27–34).

is confirmed in Hittite by clear evidence for plene writing of the final syllable; similarly, non-initial stress in (10c) is the norm for the weak stem of simplex root *mi*-verbs like *arš*– in Hittite. Since the initial syllable is unstressed, the traditional approach correctly predicts non-plene writing; in contrast, the glottal stop hypothesis predicts plene writing of the initial syllable, which is unattested.

The implications of this incorrect prediction are significant because the glottal stop hypothesis and the traditional approach overwhelmingly predict (non-)plene writing in the same positions — for instance, plene writing is expected in the strong stem of *epp*– 'take' (i.e. <*e-ep-*>) because this spelling represents [é:p:-] under the traditional approach or [ʔép:-] under the glottal stop hypothesis. Since the examples in (10) are some of the few lexical items in which the glottal stop hypothesis makes different, empirically testable predictions from the traditional approach, the fact that these predictions are demonstrably incorrect constitutes strong counter-evidence to the validity of the hypothesis.[32]

Of course, the glottal stop hypothesis could be modified to account for exceptions like (10): it might be stipulated that word-initial glottal stops were lost before unstressed vowels. Yet if modified in this way, the theory would lose virtually all of its unique predictive power while requiring two additional assumptions to account for the same facts as the traditional approach: (i) that Hittite has a phonemic glottal stop /ʔ/; and (ii) that this glottal stop is orthographically encoded with vocalic signs. Neither assumption is cost-free, and as pointed out by Weeden (2011), Rieken (2010), and others, there are good reasons to be skeptical of both.

In sum, the glottal stop hypothesis cannot be maintained. Word-initial plene spellings of the type in (9d) must therefore represent long vowels [é:], which then speak against Kloekhorst's (2014) proposal that the Hittite outcome of inherited **é* in closed non-final syllables was short [é]. Furthermore, the consistency of plene spelling in these items against nearly all other examples (whether from **é* or **ḗ, *éh$_1$*) suggests more broadly that the relative incidence of plene writing in a given word or morpheme is essentially uninformative about vowel length. This finding constitutes further evidence against the idea that there is a half-long vowel [é˙] that contrasts with [é:] in open non-final syllables by its lower incidence of plene writing (as argued in §2.2 on independent grounds). The lack of evidence for a phonetic distinction between [é:] and [é] in closed syllables or [é˙] in open syllables in turn undermines any claim of a phonemic distinction between /e:/ and /e/ at any attested stage of Hittite.

§2.4 Assessing hypotheses: Kloekhorst's (2014) careful philological investigation of Hittite plene writing has brought to light a wealth of data, which has offered new insight into certain old problems concerning its usage (cf. n. 27), and made it possible to seriously reevaluate traditional hypotheses concerning its phonological interpretation. However, there are simply too many theoretical and empirical issues with the new phonological interpretation of plene writing that Kloekhorst himself has advanced on the basis of this data. This interpretation requires typologically unprecedented assumptions about the relationship between phonology, phonetics, and orthography (§2.2); moreover, it undergenerates the attested plene spellings of inherited **é* in closed non-final syllables, which therefore require special explanations that are variously problematic at the individual level, and viewed collectively, implausible (§2.3). These plene spellings instead support the traditional view that inherited **é* became Hittite [é:].

The rarity of plene spellings of [é:] from **é* in closed syllables are best explained in the same way as the rarity of plene spelling of [é:] from historically bimoraic **ḗ* and **éh$_1$*, whose infrequent plene spelling already in OH — especially relative to the historical reflexes of these vowels in open syllables — has now received empirical confirmation from the data amassed by Kloekhorst (2014) (cf. (8) above). Since there is no compelling reason to believe that the latter have shortened, it is best to adopt the assumption of Melchert (1994), Kimball (1999) and most subsequent scholarship that this rarity is an orthographic

[32] Especially significant is (10c), since Kloekhorst (e.g. 2008:208–10) argues that the strong stem of this verb — spelled plene in some attestations (*n.b.* not consistently), e.g. <*a-ar-aš-zi*> — provides crucial evidence for his theory, since plene is unexpected in this verb under the traditional approach. Yet with tremendous weight placed on this single verb's strong stem forms (cf. Weeden 2011:62), it seems non-trivial that the theory fails on its weak stem. Melchert (1994:125) offers an alternative explanation of plene in the strong stem that is now supported by his recent analysis of Hittite sonorant "vocalization" (Melchert 2015).

effect: the use of plene writing was optional and subject to considerations of scribal economy, and so used less frequently in closed than syllables because of the additional cuneiform sign it requires (cf. §2.1 above).

The exceptionally high relative incidence of plene spelling in words with initial stressed vowels (i.e. [#V́ː-]) fits naturally into this typology: plene here requires just two signs (<*V-VC-*>), and so these items pattern more closely with open syllables (<*CV-V-*>). The diachronic stability of plene writing in these words likely in part reflects the persistence of such principles of economy, but there can be little doubt that emerging spelling conventions played a role. It seems very unlikely to be due to chance that many of the Hittite words exhibiting this stability are some of the most frequent in the entire corpus, encoding basic everyday concepts like 'be' (<*e-eš-*>), 'take' (<*e-ep-*>), and 'eat' (<*e-et/d/z-*>); the "correct" spelling of such words would have been established at an early date, and consequently, these words would have resisted the general diachronic decrease in the use of plene spelling as an optional orthographic practice.[33]

§3 The synchronic status of Hittite stressed vowel lengthening

Having established in §2 that the historical outcome of **é* in Hittite is [éː] in both open and closed syllables and thus identical to the outcomes of **ḗ* and **éh$_1$*, I turn now to its synchronic analysis. As discussed in §2.1, Melchert (1994:133–5) proposed that [éː] from all three sources is derived from the same phoneme /e/ via a synchronic process of vowel lengthening under word stress (i.e. /e/ → [éː]). There can be little doubt about the (eventual) phonemic merger of these entities.[34] Once the stressed vowel lengthening process had become categorical, neutralizing the underlying contrast between these historically distinct phonemes in all stressed syllables, the phonemic distinction would have been opaque; that the next generation would then learn a restructured grammar in which all [éː] was derived from a single phoneme is expected under standard theories of language acquisition and change (see, e.g., Kiparsky 1982).

Less immediately clear is whether [éː] was synchronically derived from /e/ within the Hittite period, and if so, until what stage of the language was the relevant stressed vowel lengthening process operative. While it seems phonologically plausible, as well as economical, to analyze this synchronic mapping as a persistent effect of the same process that gave rise to the historical merger of **é* with **ḗ* and **éh$_1$*, it is difficult to distinguish this analysis from one that assumes a purely historical lengthening process, a Neogrammarian-style sound change that had run its course already in the prehistory of Hittite. Moreover, besides disputing the (historical or synchronic) lengthening of /e/ in closed syllables, Kloekhorst (2014) has argued that [éː] in closed syllables — together with other surface long vowels in this position — underwent diachronic shortening in the post-OH period, a claim that directly opposes Melchert's (1994) lengthening analysis.

I suggest here that there is direct evidence for the synchronic operation of the phonological process lengthening stressed /e/ within Hittite. This evidence comes from its application to "secondary" — or perhaps more precisely, non-etymological — /e/ when this phoneme arises within the historical period via sound change or analogy. As might be expected, there are relatively few cases of this kind; however, several fairly secure examples are given in (11):[35]

[33] A distributional asymmetry of plene writing that I cannot address here is why plene spelling is so (diachronically) consistent in stressed monosyllabic words. I note only that I disagree with Kloekhorst (2014:216–8, *passim*) that it must be because they contain vowels that are *longer* than other vowels spelled with inconsistent plene writing, especially since length is non-contrastive in non-high vowels in this position. For a possible alternative explanation, see Kimball (2015:24).

[34] Under Kloekhorst's (2014) theory, the merger occurs but only in the post-OH period (cf. §1); however, §§2.2–2.3 have disputed the evidential basis for this late dating.

[35] Most of the forms in (11) are discussed by Kloekhorst (2014:69, 73, 76, 94–5, 116), who explicitly ascribes them to scribal errors (of various kinds) except for the imperatival forms, which are held to undergo "imperatival lengthening" (see §2.3 above).

(11)	a.	<*ḫé-e-eš-zi*>	[χé:st͡si] 'opens' (3SG.NPST.ACT.)	(KBo 17.94 iii 23, NH/NS)
		<*ḫé-e-eš-du*>	[χé:st:u] 'let (him) open' (3SG.IMP.ACT.)	(KUB 36.89 obv. 39, NH/NS)
		<*ḫé-e-eš-tén*>	[χé:st:en] 'open!' (2PL.IMP.ACT.)	(KUB 33.106 iii 50, MH/NS)
		<*ḫé-e-šu-u-en*>	[χé:swen] 'we opened' (1PL.PST.ACT.)	(KBo 22.116 obv. 14, NH/NS)
		<*ḫé-e-šu-u-ar*>	[χé:swar] 'opening' (N.NOM/ACC.SG.)	(KUB 3.94 i 25, NH/NS)
	b.	<*le-e-el-ḫu-an-zi*>	[lé:lχ^{w}an͡tsi] 'pour' (3PL.NPST.ACT.)	(KUB 31.121 ii 36, NH/NS)
	c.	<*te-e-et-ḫa*>	[té:tχa] 'thunders' (3SG.NPST.MID.)	(KUB 32.135 i 3, 10, OH/MS)
		<*te-e-et-ḫu-u-wa-š(=a)*>	[té:tχwas] 'of thundering' (N.GEN.SG.)	(KUB 32.135 i 8, OH/MS)
	d.	<*še-e*[*-eš-du*]>	[sé:s:t:u] 'let (him) prosper' (3SG.IMP.ACT.)	(KBo 2.32 rev. 6, NH/NS)
		<*še-e-eš-ša-u-wa-a*[*š*]>	[sé:s:was] 'of prosperity' (N.GEN.SG.)	(KUB 24.1 iv 16, NH/NS)

The verbal forms in (11a) are late paradigmatic forms of what was originally a *ḫi*-verb with *ā/a* ablaut, which can be observed in oldest layer of texts, e.g. *ḫāši* : *ḫaššanzi* 'open(s)' (3SG/PL.NPST.ACT). The exact analogical mechanisms that gave rise to *ē*-vocalism (as well as some unambiguous *mi*-verb forms) in (11a) are disputed;[36] whatever the source, however, it seems clear that /e/ was introduced into this verb within the Hittite period, and that this /e/ was subject to lengthening under word stress, surfacing with plene spelling as [é:].

Even more interesting are the forms in (11b–11d), all of which were subject to the phonological change referred to as "New Hittite lowering" (see especially Yakubovich 2010:309–15, 321–33). In each case, the oldest attested forms of these verbs show consistent short *i*-vocalism — never spelled plene — which is the expected Hittite outcome of **í* in a closed syllable.[37] However, in later texts — typically NS, but occasionally earlier as in (11c) — the same lexical items are attested with plene spelled [é:]. The forms with [é:] appear to have undergone two changes: (i) lowering of /i/ to /e/; and (ii) stressed vowel lengthening, i.e. /e/ → [é:].[38] The latter change can be explained straightforwardly by assuming that stressed vowel lengthening — still operative even in NH — has applied to the new phonemic vowel /e/.

An alternative explanation of the plene spellings in (11a–11d) is that they are all scribal errors, which is essentially the position adopted by Kloekhorst (2014) (cf. n. 35). Yet it seems remarkable that in these verbs plene spellings are never found prior to NH lowering. If such spellings are simply errors — i.e. extra-linguistic insertions of additional cuneiform signs — there is no clear reason why this distribution should be observed. Under the interpretation presented above, however, this distribution is not a coincidence; rather, the phonological change lowering /i/ to /e/ feeds the stressed vowel lengthening process, whence Hittite [é] predictably emerges.

It is difficult to determine the precise inner-Hittite chronology of the changes introducing /e/ into the words in (11), and therefore, to assign a possible *terminus post quem* for the synchronic operation of the stressed vowel lengthening process posited by Melchert (1994). However, the data in (11) requires that this process was operative within the Hittite period, and strongly recommends the hypothesis that it persisted stably into NH, given its application to forms in (11a–11d) exhibiting NH lowering which, by Yakubovich's (2010:330–3) analysis, was a gradual, lexically diffusing change that began prior to NH but spread especially during the NH period. In fact, there is no compelling reason to believe that synchronic lengthening of Hittite /e/ under word stress ceased to operate so long as the language was spoken. I therefore take the forms in (11) as further evidence against Kloekhorst's (2014) claim that /e/ did not lengthen in closed syllables, and more broadly, against his proposal that long vowels in closed syllables were generally subject to phonetic shortening in post-OH. On the contrary, these forms suggest in turn that the decreased relative incidence of plene writing of these long vowels in later texts reflects a change

[36] See the differing accounts of Kloekhorst (2012:154-5) and Melchert (2013a:141–2, 5–6). The /e/ cannot in any case be original, since an etymological (PIE/PA) */e/ would have undergone prehistoric coloring next to **h$_2$*.

[37] Historically, the examples in (11b) and (11c) —and possibly also (11d) — continue inherited forms with **i*-reduplication, on which see Dempsey 2015 (on (11d), cf. Kloekhorst 2008:756–7).

[38] Other examples of NH lowering that target a long vowel — e.g. *īššai* > *ēššai* 'does'; *šīna–* > *šēna–* 'figure, doll' — might be explained by assuming that the bimoraic vowel had its length "transferred" in the change. However, the total absence of plene writing in the items in (11b–11d) prior to NH lowering strongly argues that the original [í] vowel was monomoraic.

that was purely orthographic rather than phonological, as is traditionally assumed (cf. §2.1).

§4 Conclusions

This paper has argued that, diachronically, the Hittite outcome of inherited **é* was [é:] and that, synchronically, this surface [é:] vowel was synchronically derived from /e/ via stressed vowel lengthening throughout the attested period of Hittite. These arguments support the traditional analysis of the relationship between plene writing and vowel length set out, especially, by Melchert (1994) and Kimball (1999) and generally adopted in subsequent scholarship (including in Kloekhorst 2008) against the new phonological interpretation of plene writing advanced in Kloekhorst (2014): plene writing was most frequent in early texts, but optional at all periods of Hittite (cf. Kimball 2015).

This finding is, to some extent, an unwelcome result. The optionality of plene writing imposes serious limitations on both diachronic and synchronic phonological analysis of the Hittite vowel system and its interaction with word stress, making it difficult or in some cases impossible to determine what the phonological significance of the presence or absence of plene spelling is. Yet it is clear from the problems encountered by Kloekhorst's (2014) analysis that the evidence cannot be reconciled in a way that is linguistically plausible with any hypothesis that does not admit fairly extensive optionality.

Not all is grim, however. The analysis advanced here allows certain chronologically late plene spellings which Kloekhorst (2014) is forced to dismiss as errors to instead be phonologically informative. Such plene spellings include those in (11) above, which made it possible to diagnose the persistent synchronic operation of stressed vowel lengthening into NH. Taking such late plene spellings seriously (i.e. as real indicators of vowel length) thereby makes it possible to more precisely diagnose word stress and stress-related innovations in the history of Hittite.

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