Linear A and Linear B: Structural and contextual concerns
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Introduction

Of all the Aegean writing systems, Linear B is by far the best known and understood: it has the largest number of inscriptions, a signary whose repertoire we can reconstruct with a high degree of accuracy, well secured sign values for the majority of signs and a well understood underlying language, Greek. Of the other scripts of this group, only the Cypriot Syllabic script of the 1st millennium BC compares, since it can be read and its inscriptions largely understood (the majority also written in Greek), while the others (Cretan Hieroglyphic, Linear A and Cypro-Minoan) remain ill-understood. Even so, there remain some gaps in our knowledge of the Linear B writing system and its development, and it is some of these lacunae that form the basis for the present investigation.

This paper stems from a study of the relationship between Linear B and Linear A, and the reconstruction of Linear A sign values. It has been argued persuasively by a number of scholars over the years that it is possible to supply Linear B sign values to read Linear A signs.[1] Such a conclusion is supported by evidence from multiple perspectives, as we have discussed at length in a different publication, where we developed, augmented and synthesised the arguments offered by previous scholars.[2] We will not rehearse these arguments here due to lack of space, but it will be important to remember throughout this paper that its analysis has as its basis an assumption that such a view of the relationships between the two scripts must be correct: specifically that in the creation of Linear B the basic sign values of Linear A were retained with little modification. As part of this process we constructed a grid of signs whose value in Linear A can be confirmed to be identical or close to their values in Linear B via one or more comparative methods (Table 1).

Table 1. Linear A/B core signs whose values can be demonstrated to be shared in both scripts based on Steele and Meißner (forthcoming).

	a	e	i	o	u

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[1] E.g. Hooker 1975; Olivier 1975; Pope and Raison 1978; Godart 1984; Duhoux 1989.
[2] Steele and Meißner forthcoming.

	a	e	i	o	u
V	a		i		
d	da		di		
j					
k			ki		
m	ma	me	mi		mu
n	na		ni		
p	pa			po	
q					
r			ri	ro	ru
s	sa	se	si		su
t	ta	te	ti	to	tu
w					
z					

One important feature of the grid in Table 1 is that in some cases we can reconstruct and confirm the value of almost a whole consonant series: the m- and s-series stand out (with only one of the 5 missing, the o-vowel in both cases), as does the t-series, which can fill all five basic slots.

If we compare Linear A with Linear B, we will find that there are more signs that have the same or comparable shape in both scripts – they just happen to be signs for which we do not have evidence to show conclusively in these individual cases that they share the value as well as the shape, which is why they are omitted from Table 1. A grid showing all the signs shared by the two scripts (i.e. morphologically identical, whether or not we have evidence to demonstrate that they shared the same value) appears in Table 2. In fact, the overall statistics have improved since the initial decipherment of Linear B. If we look at Ventris and Chadwick's table in *Documents*,[3] they identify 53 out of 89 signs as shared between Linear A and Linear B, a 60% identity. By 2005, due to new finds and better epigraphic study, this figure had risen to 64 out of 89, giving a figure of 72%, which is comparable, for example, to the sign identities between the classical Roman and the Old Italic script out of which the Roman alphabet developed. The case of sign 48 *nwa* is instructive here: it had previously been attested in both Cretan Hieroglyphic and in Linear B, and so was expected to have existed also in Linear A, but it was only much more recently that an example of the sign was discovered in a Linear A text (SY Za 4) and confirmed that the sign was a component of all three scripts.[4] Importantly, this fact in itself shows that we must not

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[3] *Docs²* p33.
[4] See Muhly and Olivier 2008, 207-8 and 216.

automatically assume that the entire repertoire of Linear A signs is actually attested in the epigraphic record as it currently stands.

Table 2. Core signs shared by Linear A and B (listed by Linear B value).

	a	e	i	o	u
V	a	e	i	o	u
d	da	de	di		du
j	ja	je			*65
k	ka	ke	ki	ko	ku
m	ma	me	mi		mu
n	na	ne	ni		nu
p	pa		pi	po	pu
q	qa	qe	qi		
r	ra	re	ri	ro	ru
s	sa	se	si		su
t	ta	te	ti	to	tu
w	wa	we?	wi		
z	za	ze		zo	

It must be pointed out from the beginning that the overlap between the repertoires of Linear A and Linear B can be treated largely as a separate issue from that of the phonological inventories of the underlying languages. The languages underlying Linear A (unknown) and Linear B (an early Greek dialect) respectively can be assumed to have been different from one another, perhaps to a significant degree; such differences have traditionally been assumed to account for some odd features (from a Greek language perspective) of the Linear B script, such as the failure to distinguish the liquids /l/ and /r/, and the existence of an extraneous voiced series representing /d/ while the other voiced stops /b/, /g/ and /g^w/ were not distinguished.[5] However, as mentioned above and as we have discussed at length elsewhere, whatever the differences in the phonological repertoires of the two languages, the weight of evidence points towards the Mycenaeans adopting a whole graphic system from the Minoans with very little change to the system as a whole. Perhaps the most compelling piece of evidence is the remarkable stability in value of a number of signs across the Aegean and Cypriot scripts, as judged from the shared signs/values of Linear B and the later Cypriot Syllabary of the 1st millennium: we can identify 11 cognate signs with shared value with

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[5] On these issues see Steele 2014, and also for example Packard 1974, 112-7.

confidence (*a*, *i*, *da/ta*, *na*, *pa*, *po*, *ro/lo*, *sa*, *se*, *ti*, *to*) and there are further possible correspondences.[6] These correspondences cover several consonant series and three vowels.

O-vowel signs

Even a brief glance at Table 2 above will reveal one of the major problems of the comparative study of Linear A and Linear B, namely the question of the vowels. Most strikingly, the gaps in the grid show seven consonant series in which the Linear B o-vowel sign has no known predecessor in Linear A: there is no attested Linear A sign corresponding to *do*, *jo*, *mo*, *no*, *qo*, *so* or *wo*.[7] These seven o-vowel signs in Linear B have often been assumed to constitute Mycenaean innovations, and such an assumption has been used as support of an argument that Linear A did not possess an /o/ vowel phoneme. Let us take a statement by Thomas Palaima and Elizabeth Sikkenga on this topic as an example:

"Another innovation in the Linear B system is the mid-vowel series. Linear A has a three-vowel system, using *a*, *u*, and *i*... Linear B added a mid-back-vowel series with *o* and another with *e*. Many of the Linear B *o-* signs and a lesser number of the *e-* signs were newly invented. Nonetheless, in both columns there was some retention and reassignment of Linear A signs to express sounds that Greek deemed important."[8]

While such claims that Linear A had a three-vowel system are common, it remains quite difficult to prove. David Packard presented the theory based on his analysis of sign frequencies and on potential supplementary evidence such as possible confusion between *i* and *e*, and between *o* and *u*, in non-Greek names recorded in Linear B at Knossos.[9] The low

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[6] The present work of Miguel Valério (forthcoming) has the potential to illuminate some further correspondences that are less easily detected, through an analysis of palaeographic variation.

[7] Note that there are sound morphological correspondences for all but two e-vowel signs, *pe* and *we*, and Linear B *we* could plausibly be argued to be a development of AB 75 (forthcoming in *Docs³*). Although e-vowel signs are noticeably less common in Linear A (see Packard 1974, 113), the fact that so many are attested points towards a continuation of e-vowel signs from Linear A to B. Note also that the sign *se* is attested also in the Cypriot scripts with the same value, confirming the value of the Linear A sign.

[8] Palaima and Sikkenga 1999, 603-4.

[9] Packard 1974, 112-4. Duhoux (1989, 72) tentatively suggested that the statistics could even point in the opposite direction, i.e. towards the existence of more vowel phonemes in Minoan than in Mycenaean Greek. Davis' analysis of sign frequencies more recently has assessed the relative frequencies of the vowels as follows: a 39.3%, i 25.7%, u 18.1%, e 14%, o 2.9% (Davis 2014, 240-2). It is also interesting to note Beekes's view (2014, 8) regarding his "Pre-Greek" (which, however, he nowhere explicitly equates with Minoan although the strong similarities between the hypothetical Pre-Greek and what is often assumed for Minoan are striking):

frequencies of Linear A signs that correspond to Linear B e- and o-vowel signs may indeed suggest that these vowels were less common in the Minoan language underlying Linear A.

The argument presented above in the quotation by Palaima and Sikkenga, however, requires a further step, namely that not only did Linear A have no /o/ phoneme, but furthermore that the Linear A signs that correspond to Linear B o-vowel signs did *not* represent an /o/ (or similar) in Linear A: hence the suggestion of reassignment of signs. This has been raised as a possibility even by Michael Ventris and John Chadwick in *Documents*, with a caution that "a wholesale reshuffling process" could have intervened between the repertoires of Linear A and Linear B.[10] Presumably what is intended is something akin to the sorts of value reassignments seen in the development of the Greek alphabet from a pre-existing Phoenician model (where, for example, the o-vowel sign *omicron* originated as a Phoenician consonant sign *ayin*), although we must remember that in that case the script type as well as the inventory of signs was changed (i.e. consonantal-only 'abjad' > alphabet representing both consonants and vowels), making reassignment a necessary feature of the new script's creation.[11] If this were the case for Linear A > B, then it would follow that those signs that in Linear B represent o-vowel values represented something completely different in Linear A.

This is where a problem with the argument arises. The suggestion that Linear A had a three-vowel system, and that it lacked /o/ and /e/ phonemes, was based on the observation of the frequencies of individual signs. But if the shared signs that in Linear B represent o-vowel values did not represent o-vowel or e-vowel values in Linear A, then the frequencies of these signs in Linear A cannot be indicative of either low frequencies or non-existence of these vowel sounds in the language underlying Linear A. One cannot have it both ways: either the sign values were reassigned and so the sign frequencies are unrelated to the existence or otherwise of /e/ and /o/ phonemes, or the frequencies indicate that e- and o-vowel sign values existed but were rarer than other vowels. Actually we will argue that the latter is a much more plausible interpretation of the evidence.

"Originally, I thought that Pre-Greek had only three vowels: *a*, *i*, *u*" – in other words, exactly what Palaima and Sikkenga, as well as others, assume for Minoan Linear A. But then: "Recently, I have become more inclined to assume a system with the usual five vowels, because there seems to be a distinction between the two variations α / ε and α / o on the one hand and a stable, not interchanging α, on the other. This would point to a system with *a*, *e* and *o*." While much of this concept of "Pre-Greek" is questionable (see Meißner 2013), it is nevertheless interesting to see that by looking at patterns in first-millennium Greek words of unclear etymology exactly the same problem surfaces.

[10] *Docs*[2] p.39.

[11] On the details of the development of the Greek alphabet from Phoenician, see Woodard 2010.

We must be clear at this stage that we are not arguing that, whatever vowels are represented by the o- and e-vowel signs, they must be identical to the Mycenaean Greek /o/ and /e/ phonemes. What we are arguing is that the series of signs existed in Linear A.[12] For one basic corroboration we can return to the Cypriot scripts: the shared shape and value of the signs *po*, *ro/lo*, *se* and *to* would be a highly remarkable coincidence if Linear A did not also share these values. In fact, of these the *ro/lo* and *to* signs are the two most frequently attested o-vowel signs in Linear A (see below), suggesting perhaps that -*r/lo*- and -*to*- sequences were more common in Minoan than other combinations with -*o*- (whatever exactly *o* itself represented in phonetic terms); this could perhaps have played a role in the continuation of these particular signs in the Cypriot scripts. Another compelling piece of evidence comes from the small set of words that are attested both in Linear A and in Linear B, which includes some place names. The sign *to* is found in two place names attested in both scripts, *pa-i-to* and *se-to-i-ja*;[13] while conservative spelling is not impossible (but relies on assumptions about the transmission of writing from the Minoans to Mycenaeans), the consistency in the use of *to* in these place names strongly suggests that they were pronounced in such a way that both Minoans and Mycenaeans chose to represent them with the same sequence of signs, indicating also closely matching values for those signs.[14] These pieces of evidence mentioned in the last paragraph do make it likely that the o-vowel signs in Linear A represented a vowel sound sufficiently close to the Greek /o/ phoneme for the Mycenaeans not only to use them to represent their /o/ phoneme, but also to continue using them in spelling non-Greek place names.

The comparative rarity of the e- and especially the o-vowel signs in Linear A could indeed point towards a phonological system where /e/ and /o/ phonemes were much rarer than /a/, /i/ and /u/ phonemes,[15] but what is important for our purposes is that it looks like the

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[12] It is highly unlikely that Linear A should have had the e- and the o-series as subphonemic, i.e. allophonic series. The indication of allophones is not to be expected in sound-based writing systems, and in the few, and unsystematic, instances where such indication is found (as, for example in the indication of 3 allophones of the phoneme /k/ in Early Latin by means of <C>, <K> and <Q>), eventually this will become regularised (in this instance by the generalisation of <C>, the specialisation of <Q> to indicate, in conjunction with <U>, the phoneme /kʷ/, and the near complete loss of <K>. Put differently: if Linear A was created for the Minoan language then it is very hard to see how such a graphic distinction should ever have arisen if it was not phonemic. If Linear A was adapted later on for the Minoan language (and there is nothing to suggest this) then we would still firmly expect a regularisation.

[13] The place name *se-to-i-ja* is unattested in the later historical record, and it is impossible to be certain whether the -*o-i*- sequence represents a diphthong. However, the place name *Phaistos* (Φαιστός) remains to the modern day (still with o-vocalisation in the final syllable).

[14] See further Steele and Meißner forthcoming.

[15] Cf. Davis' suggestion (Davis 2014, 240-2) that the Minoan possessed all five vowels, but that it originally had (or was descended from an earlier language that had) only three (a, i, u) and the other two (e and o) were secondary developments.

whole series of e- and o-vowel signs existed (the latter set only partially attested). Such a conclusion does of course then pose the question of why so many of the Linear B o-vowel signs are not attested in Linear A. On the face of it, the proposition that the seven missing signs (*do*, *jo*, *mo*, *no*, *qo*, *so*, *wo*) existed but have not yet been found in any surviving inscription may seem unlikely. However, a consideration of the statistical evidence for sign frequencies may be helpful here.

Table 3 gives the frequencies of the six attested Linear A o-vowel signs alongside frequencies for the rest of the core signs belonging to that series (consonant-series in five cases as well as the vowel-only series).[16]

Table 3. Frequencies of the Linear A o-vowel signs and the other signs in their series. (* indicates that sign is attested only as logogram.)

	a	e	i	o	u	Total
V	a: 198	e: 18	i: 151	o: 11	u: 57	435
k	ka: 109	ke: 15	ki: 96	ko: 14	ku: 143	377
p	pa: 88	-	pi: 54	po: 7	pu: 17	166
r	ra: 105	re: 101	ri: 71	ro: 82	ru: 82	441
t	ta: 139	te: 94	ti: 97	to: 15	tu: 60	405
z	za: 37	ze: 0*	-	zo: 0*	-	37

The frequencies of o-vowel signs in these series, as given in Table 3, are almost always far lower than for the a-, i- and u-vowel signs of the same series.[17] In other words, the o-vowel sign of the series is significantly more rare: *ko* accounts for only 3.71% of attestations of k-series signs, *po* for 4.21% of p-series signs, *to* for 3.70% of t-series signs and *o* for 2.53% of vowel-only signs.[18] The z-series is not a full series, and two of its signs, *ze* and *zo*, are so far attested only as logograms in Linear A, making it difficult to assess the relative

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[16] Note that obvious or probable logographic uses of individual signs are not counted in these totals. The use or non-use of any particular sign as a logogram is not closely related to the use of that sign in writing out sign-sequences, the latter reflecting language use while the former only reflects an administrative feature. It would be possible for a word beginning with a rare sound (i.e. rare in the Minoan language) to be abbreviated as a logogram and repeated; this may be the case for *ze*, which features many times as a logogram but is thus far unattested as a syllabogram in sign sequences.

[17] The e-vowel signs are also often attested in lower frequencies, but these vary; this analysis in restricted to the o-vowel signs.

[18] The figures are worked out based on those of Table 3, i.e. counting only the core signs. Extra signs of these series sometimes also appear in Linear A (e.g. *ta₂* and *au*). If we were to count the extra signs as well, this would only lower the already small percentages of o-vowel signs.

frequencies; nevertheless, it is clear that *za* was a sign used commonly in writing sign sequences while *ze* and *zo* appear to have been rare (if they were used at all) in such a role.

The outlier of the o-vowel signs in Table 3 is *ro*, which accounts for 18.59% of attestations of core r-series signs, an unusually high frequency for an o-vowel sign compared to the other totals. This may point towards -ro- representing a sequence that happened to be much more common than most sequences with o-vowels in the Minoan language, but it is also possible that the statistics in this case are skewed by multiple appearances of common words. Out of the 82 attestations of *ro*, the common "totalling" word *ku-ro* accounts for 36 examples and the "grand total" word *po-to-ku-ro* for 2, while another common administrative word probably indicating a deficit, *ki-ro*, accounts for a further 13. These are words that must have been common in the context of the large proportion of surviving texts that relate to administration, but may have been less commonly used in the language outside such contexts. In this regard we might say that the nature of the extant texts has affected the distribution of the sign *ro*, which happens to feature in some very common administrative terms. Furthermore, if *ku-ro* is a Semitic loanword as has been suggested,[19] then the frequency of an o-vowel here could be unrelated to the frequency or existence of an /o/ phoneme in Minoan.

With the exception of *ro*, the very low relative frequencies of o-vowel signs in Linear A is a strong indication that whatever the exact vowel sound that they represented, it was not as common as the Minoan vowels represented by a-, i- and u-vowel signs. So much was already clear from the work of Packard and others, but it is worth remembering that it holds true only if these signs have not been subject to value reassignment in the development of Linear B from Linear A. In the case of those signs that are attested very few times, it is easy to imagine a scenario in which we did not have any extant examples of the sign, if a different set of texts had survived other than the ones we have. The extreme example is *zo*, attested only twice and probably as a logogram in each case, and *po* and *o* are little better with only 7 and 11 examples respectively. This strongly suggests that other o-vowel signs may have existed but are not yet attested, including some or maybe all of the Linear B o-vowel signs that are as yet unattested in Linear A. Just as with *nwa*, it is possible that they will be discovered in the future. Furthermore, again just as with *nwa*, this means that we could envisage these signs as functioning elements of the Linear A script, albeit ones that in practice were relatively very rare.

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[19] See Hooker 1975.

A proposal that Mycenaean Greek speakers borrowed the whole Linear A system from the Minoans, with five vowels intact, would fit in well with a scenario in which the transmission of writing was closely related to the administrative use of the script: the Mycenaeans were borrowing a whole administrative system (complete with clay document types that they would adapt to their own needs), a major part of which was a writing system that required only minor adjustments to record adequately enough the Greek language.

On this reasoning, we are thus forced to admit that the Linear A script, at least, had a five vowel system, and that the vowel which we transcribe as the o-vowel was, for whatever reason, a rare vowel in the Minoan language. Given the paucity of Linear A that we have (only about 7100 signs in total, compared to over 60,000 for Linear B) it may well be that a good number of the gaps in the Linear A syllabary that we can see are accidental, meaning that most of the o-signs but also some of the others such as *pe* and *zi* existed but simply are not yet attested.

But what does it mean for the language underlying Linear A, 'Minoan', to say that it had five vowels? This is a much more difficult question to answer and in the current state of knowledge we are unlikely to be able to do so with any certainty. Linear A *graphically* distinguishes five vowels, and on the strength of the Linear B evidence, these vowels are identified as the same that we have in Greek, namely a, e, i, o and u. We must be careful when it comes to interpreting these. For it does not automatically follow from this that Minoan had a simple five vowel system a, e, i, o, u. The position of each vowel could be quite or very different from that of the corresponding vowel in Linear B, and cases of vowel confusion such as those called upon by Packard could very well indicate some significant differences.

One other aspect needs to be mentioned here. Linear A vowels are classified by presumed vowel *quality* only. This is legitimate insofar as the same is done for Linear B, and demonstrably correct here. Whether Minoan had a phonemic vowel quantity opposition, however, remains unknown. If it did, it is not in any way certain that all vowels must have occurred as long and short vowels, and Davis's suggestion that e and o might have arisen secondarily (by contraction of i-diphthongs) certainly goes in this direction. By way of example, we may point to Proto-Germanic where the o-vowel existed only as a long vowel phoneme /o:/, save *perhaps* in loan words, and unsurprisingly, the grapheme <A> is about 4.5 times more frequent than <O>. <O> occurs most frequently in case endings of certain noun classes (gen. sg. and all pl. cases of fem. ō-stems, all cases of fem. ōn-stems and the nom./acc. sg of neuter n-stems), i.e. as far as its distribution is concerned it is most commonly

found in final syllables – a situation not unlike that of Minoan Linear A. But we can go even further than this: if we neglect vowel quantity entirely and just concentrate on the 5 different basic vowel graphemes that Gothic has the results are quite striking: <A> accounts for 31% of all vowel occurrences in Gothic, <I> for 18%, <U> for 9%, and <E> for a mere 4%. The rest is shared among the graphic diphthongs <AI>, <AU>, <EU> and <IU>.[20] Even more radical are differences in vowel distribution in Classical Sanskrit.[21] Here, the phoneme /a/ alone accounts for 45.4% of all vowel occurrences, its long counterpart /a:/ for 18.8%, meaning that the a-vowels alone make up nearly two thirds of Sanskrit vowel attestations. /i/ as the next vowel in descending order of attestation accounts for a mere 4.85%, i.e. has an occurrence of only about 10% of that of /a/. All non-a vowels combined (/i/, /i:/, /u/, /u:/, /e:/, /o:/, /a:i/, /a:u/, /r̥/, /r̥̄/ and /l̥/) account for only 35.7% and are thus significantly rarer than /a/ alone, and the last two vowels /r̥̄/ and /l̥/ are so rare (about 0.01% each) that they are all but invisible. To put not too fine a point on it: one has to be extremely careful when extrapolating a phonemic system on the basis of a statistical distribution.

Furthermore, it is typologically common, even in cases where the script was designed for the language that it transmits, to underrepresent vowel phonemes, and the Greek alphabet is a good case in point here, with <E> representing /e/, /ẹ:/ and /ę:/. This is another reason to be cautious about using statistical evidence as a basis for reconstructing a language's phonemic system, because a single grapheme could cover more than one phonemic distinction. We know this to be the case for the consonant series in Linear B, where for example the p-series covers the phonemes /p/, /pʰ/ and /b/. Of these, the /b/ phoneme in Mycenaean times would have been considerably less frequent than the other two, though this can be recovered only through historical reconstruction (the /b/ phoneme in later Greek often being the outcome of a phoneme /gʷ/ that still existed in Mycenaean Greek and was represented by the q-series) because sign frequencies cannot indicate the comparative frequency of different phonemes covered by a single grapheme. While the linguistic affiliation of Minoan remains unidentified, and while our evidence for it remains so limited, it is impossible to draw further conclusions about the Minoan vocalic system without wild speculation.

Case studies

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[20] See Herdan 1966, 30, quoting Ernst Förstemann.
[21] For the statistics see Whitney 1924, sections 22 and 75.

The problem considered above of reconstructing a vocalic system for Linear A, even in the case of the script alone and more so for the language underlying it, raises some interesting methodological questions concerning what look like gaps in the extant epigraphic record. We turn now to two different case studies concerning such gaps in the writing systems, though they are gaps of a different nature. The first concerns a difference between Linear A and Linear B in the attestation of individual signs, i.e. a sign that is attested in Linear B but has no predecessor in Linear A, thus constituting a gap between the two scripts. The second concerns a structural gap within Linear B itself, namely a gap within a consonant series where we might (or might not) expect the sign to have existed.

dwo

Until recently, the *communis opinio* derived from Ernst Risch's landmark 1957 article, followed by Michel Lejeune in 1958, who realised that the sign 𐀹 which had previously been read as *wo-wo*, did, in fact, render a single sign, and Risch reasoned that the two *wo* signs looking at one another, as he put it, denote a pair, and he recognised this as a symbol for the numeral two.[22] In other words, this sign which has to be read as /dwo/ was created within Linear B on the basis of the Greek language, namely the Greek word for "two". The sign *dwo* is nothing other than "duo wo", "two wo's". In other words, we would not expect this sign in Minoan Linear A unless we are faced with the extraordinary coincidence that the Minoan word for two also began with /dwo-/.

Against this *communis opinio*, Davis in his most useful and very detailed analysis of the writing system and language of Linear A argues that this is, in fact, unlikely to be so.[23] His starting point is the observation that Minoan, as opposed to Greek, systematically had labialised consonants (in Greek, only labialised velars, i.e. labiovelars occur), as shown by *nwa* that we have already mentioned. To that he adds a typological observation concerning the nature of writing systems made by Laurence Stephens and John Justeson: "Innovations that produce overrepresentations of highly-marked sounds, while ignoring underrepresentations of less-marked sounds, are almost nonexistent in the writing systems of the world."[24] From this Davis concludes: "That is: it would be extraordinary if the

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[22] Risch 1957, 32, Lejeune 1958a, 212, fn. 73.
[23] Davis 2014, 195.
[24] Stephens and Justeson 1978, 279.

Mycenaeans had created new *and unnecessary* signs for the highly marked sounds [tʷ, dʷ, tʲ], while *failing* to create new signs for the less-marked sounds [tʰ, b, pʰ, g, kʰ]", in other words, the voiced and the aspirated stops of Greek.[25] At the same time: "If a syllabary is borrowed, then borrowings of *redundant* syllabograms will be unsystematic".[26] To this he adds that no equivalent of Linear B *wo* is, as yet, attested in Linear A. The conclusion for him, then, is twofold: a) *dwo*, together with the other labialised and palatalised signs, is inherited from Linear A (a view expressed earlier by Consani 1995 [1998]), and sign AB 118 ⚕ is a good candidate for this; b) the sign *wo* was invented by the Mycenaeans "by dividing in half the LA syllabogram for <dwo> based on the same Greek visual pun."[27]

As strong as these arguments may seem, they are, in fact, problematic. From a palaeographical point of view, Judson has shown that 118 is, in fact, highly unlikely to be the ancestor of Linear B *dwo*.[28] As to the rest, Davis's arguments rest on fragile supports. That *wo* is not attested in Linear A is an *argumentum ex silentio*, and, given what we said earlier, it is not unlikely that *wo* did in fact exist but is per chance not attested as yet. The point about rendering highly marked sounds while not differentiating less highly marked sounds is just a typological one, and in our view typology must be used with the same caution in the historical analysis of writing systems as it is used in historical phonology. But most importantly, the application of such a typology is not apt. For there can be no question of Linear B *dwo* representing a labialised /dʷo/. Rather, as Judson notes, it renders a *sequence* of phonemes.[29] That the Greeks inherited *nwa* from Linear A now seems clear. It is entirely possible that Minoan had a phoneme /nʷ/ or, given that labialisation tends to go hand in hand with velarisation, more likely /ŋʷ/. But in Greek, there is no such phoneme. The Greeks reinterpreted this sign and used it for the sequence of sounds /n/ + /w/. This was rare in Greek, and the fact that /nw/ was not, as far as we can see, at any time a permitted onset in Greek makes the adaptation of this sign all the more remarkable. But once the Mycenaeans had done so, the ice was broken. We now had a sign denoting sequences of consonants, i.e. a sign of the structure CCV, and this may have been supported further by another sign: Linear B *pte* which is often reasoned go back to an original palatalised /pʲe/, i.e. a palatalised consonant followed by e which due to a Greek sound change came out as a biphonemic

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[25] Davis 2014, 195.
[26] Justeson 1976, 61.
[27] Davis 2014, 195, fn. 1128.
[28] Judson (forthcoming).
[29] Judson (forthcoming).

consonant cluster *pt-*, followed by *e*.[30] In the absence of direct Linear A evidence this is quite uncertain, of course. But if correct, this is where the real difference with Linear A may well lie.

It is reasonable to assume (though is not certain) that when Linear A was first devised, all syllabic signs had a structure V or CV. But we must not forget that there are many hundreds of years between the creation of Linear A and the point when it gave rise to Linear B. It is certainly possible that due to sound changes within Minoan over time, entirely irretrievable for us, some Linear A signs denoted complex syllables of the type CCV by the time Linear B was created out of Linear A. But it is equally likely and plausible (and need not even be connected) that in the process of adaptation and due to Greek sound changes, the Greeks modified the nature of the syllabary, and more by accident than by design complex signs of the type CCV emerged. Once the ice was broken (cf. *nwa*) the Greeks could create further signs of the sort, e.g. the wholly iconic *dwo*, and on the back of this, *dwe*. That such oddities occur is shown not least by the Greek alphabet. Greek alphabetic signs are largely monophonemic as expected, and indeed all signs in the Phoenician script are. But Ξ, adapted from a *monophonemic* Phoenician *samekh*, and Ψ, created within Greek, are *biphonemic* signs. They are exceptional and unsystematic in the same way that Mycenaean *dwe* and *dwo* are. Of course, one could argue that Ξ and Ψ are more useful when writing Greek than signs indicating the sequence *-dw-* or *-tw-* would have been. But these were certainly more useful than *nwa* was, and yet this sign is used in Linear B, and at least /dw/ was a permitted onset in Greek, so one has to be careful when using "usefulness" as a criterion here.

To conclude, what we have here likely is a real difference between Linear A and Linear B, meaning *dwo* (and subsequently *dwe*, etc.) were created within Linear B and on the basis of the Greek language.

zi

The second case study concerns *zi*, one of the most obvious gaps in the writing system of Linear B as it is known so far. It has often been suspected to be among the undeciphered signs.[31] This may well be the case but at the same time it is worth pointing out that *zi* is quite different from *za*, *ze* and *zo*.

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[30] See in particular Lejeune 1976, 198f. A different position is taken by Judson (forthcoming).
[31] See first Lejeune 1958b, 325, and most recently Melena 2014a, 15f., and above all Melena 2014b. In this article, Melena even identifies *63 with *zi.* The difficulty here is, above all, that what little evidence there is

The origins of Mycenaean *z-* are similar, but not identical, to those of later Greek ζ. *z-*/ζ derive from:

a) initial PIE *(hₓ)i̯- before vowel: ζυγόν < *i̯ugom. Mycenaean shares this development, cf. *ze-so-me-no* = Gk. ζέω < PIE *(hₓ)i̯es-;

b) word-initially and -internally, ζ can result from *g/ĝi̯, *gᵘ̯i̯- and *di̯: μείζων, Myc. *me-zo-a₂*; < *meĝ-i̯os-* (with the standard remodelling of the comparative suffix in Classical Greek), Myc. *-pe-za*, πεζός < *ped-i̯o-*;

c) Mycenaean differs from all later forms of Greek inasmuch as *k/k̂+ *i̯ also results in *z*: *ka-zo-e* < *kak-i̯os-es*. Presumably this was true also for *kᵘi̯- and *ku̯i̯-[32] but the evidence is unclear. First-millennium dialects of Greek have σσ or ττ here in all of these environments.

d) ζ also results from a sequence /s/ + /d/, cf. ὄζος < *o-zd-o- < *o-sd-o-, Ἀθήναζε < -ασ+δε. It is likely that this was, in origin, different from the outcome of a-c) but no Greek dialect of the first millennium shows any difference. In Mycenaean, no *z* resulting from /s/ + /d/ is attested as far as we can see.

e) Mycenaean also shows an alternation between *-k-* and *-z-* in the term *a-ke-ti-ri-ja* (PY, TH, MY) : *a-ze-ti-ri-ja* (KN), and a few personal names like *a-no-ke-we* : *a-no-ze-we* (both PY). The personal names are difficult to evaluate; *a-no-ke-we* : *a-no-ze-we* has been interpreted as /anor-skewēs/[33] but this is impossible to verify or falsify. The term *a-ke/ze-ti-ri-ja*, on the other hand, clearly denotes female workers and is plausibly interpreted as ἀσκήτριαι "finishers" *vel sim*. So, *-sk-* *may* also sometimes give *z*, but much is unclear here, all the more so given that ἀσκέω has no Indo-European etymology, and we may be dealing with different renderings of a non-Greek sound rather than with a sound change within Mycenaean Greek.

f) We mention only in passing that in a few dialects, notably Elean, we find a secondary affrication of /d/ before front vowels, thus Elean ζικαιος for standard Greek δίκαιος. But this is a very limited phenomenon, and nothing like this has been found in Mycenaean.

What does this mean for *zi* and ζι? Clearly, contexts a), b) and c) can be ruled out as sources since they presuppose a non-existent phonological sequence *k/g/d + -i̯i-. A survey of words beginning with ζι- in historical Greek shows that a) these are vanishingly rare and b) the few

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consists mostly of personal names, making a verification, as well as a falsification, all but impossible; his interpretation of *63-te-ra-de*, the only term that *may* be part of the appellative vocabulary, as from a noun *skʰistēr*, which, as he himself points out, is not attested in Greek, is merely speculative.

[32] See Melena 2014a, 47.

[33] Thus Melena 2014a, 47.

that are there are either loanwords such as ζιζάνιον "a weed that grows in wheat" < ultimately Sum. *zizān* "wheat", onomatopoeic formations like ζίγγος "ὁ τῶν μελισσῶν ἦχος" (Hsch.) or products of dissimilation, e.g. ζίζυφον may be dissimilated from *ζύζυφον "jujube"). None of these groups stands any likelihood of being attested in Mycenaean.

This leaves d) and e) as potential sources for *zi*. d) would presuppose a group *-*sdi*- which would not just be very rare in itself; we know of no example for it in Greek at all (and examples for $z <$ *-*sd*- seem to be lacking in Mycenaean in general).[34] This would leave the very unclear option e) as the only plausible source, and this must be highly questionable. All of this means that a *zi* is hardly to be expected in ordinary words in Mycenaean. However, it could still exist in place names and personal names of foreign origin. It is thus certainly possible that *zi* is among the undeciphered signs. As far as Linear A is concerned not only do we not know whether a sign *zi* exists here, we also have only very limited means to ascertain this. Put differently: if a sign *zi* exists in Linear A only, we would need considerable additional information to identify it. If it exists in Linear B as well, the situation is not much better, and we would probably need a spelling doublet like *a-ke-ti-ri-ja* : *a-ze-ti-ri-ja* (which would *demonstrably* have to be one and the same lexeme) to recognise it. For the time being, this remains a gap, and we cannot say whether it is a real gap in Linear A, Linear B or both, or simply a gap in our knowledge.

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[34] Note that the toponym *pa-ki-ja-ne*, dat./loc. *pa-ki-ja-si*, has as its allative form only *pa-ki-ja-de*. But a rarer sg. form nom. (or loc.?) *pa-ki-ja-na* is also found, and *pa-ki-ja-de* may thus reflect an acc. sg. in /-ān-de/, rather than an acc. pl. in /-ās-de/.

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