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THE WRITING OF ANCIENT GREEK CONSONANT CLUSTERS[1]

In what follows, it is proposed to inquire how the three systems used for writing Greek — Linear B, the Cypriote Syllabary, and the Greek Alphabet — dealt with the clusters /ks/ and /ps/.[2]

1. Linear B

Linear B is remarkable for its lop-sided representation of the Greek phonemic system.[3] The following interpretation[4] of its signs derives from our knowledge of later Greek and from comparative linguistic analysis.

In columns 1—5 are signs for which the same initial consonant is used in front of at least three different vowels; in columns 6—8 in front of less than three. It is apparent from row *1* that Greek of the earliest period had a five-vowel system, but that the script makes no distinction of length, which is phonemically significant. The consonants are more complex. They are: d — j — k — m — n — p — q — r — s — t — w — z — b/p^h — tw, which may be arrayed according to features as follows.

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[1] I would like to thank Academicians Thomas V. Gamkrelidze and A. Leslie Willson for making materials available to me. The ideas for this paper germinated during discussions with Thomas Palaima, and his extensive comments on earlier versions were invaluable. Any flaws are, of course, my own.

[2] In this paper, the following notations are used: [] = phonetic level, // = phonemic level, < > = orthographic level; # = word boundary.

[3] For the date of origin of Linear B, cf. Palaima (1988). The earliest texts from Knossos now seem to date from ca. 1400 B. C. according to the comprehensive study by Jan Driessen, The Room of the Chariot Tablets at Knossos: Interdisciplinary Approach to the Study of a Linear B Deposit (Diss. Katholieke Universiteit Leuven 1989).

[4] According to Chadwick (1987), and updated using Janda (1986) and Melena (1987).

Table 1

	1	2	3	4	5	6	7	8
1	a	e	i	o	u	a_2	a_3	au
2	da	de	di	do	du	dwe	dwo	
3	ja	je	—	jo	ju			
4	ka	ke	ki	ko	ku			
5	ma	me	mi	mo	mu			
6	na	ne	ni	no	nu	nwa		
7	pa	pe	pi	po	pu	pte	pa_3	
8	qa	qe	qi	qo	—			
9	ra	re	ri	ro	ru	ra_2	ra_3	ro_2
10	sa	se	si	so	su			
11	ta	te	ti	to	tu	ta_2		
12	wa	we	wi	wo	—			
13	za	ze	—	zo	—			
14	pa_2	—	pi_2	—	pu_2			
15	twa	—	twi	two	—			

Table 2

Labial stops	Dental stops	Velar stops
p, b/p^b	*t, d, tw*	*k, q* (= k^w)
Resonants	Semi-vowels	Continuants
m, n, r	*j, w*	*s, z*

This table does not include the assortment of sounds in columns 6—8, which will be discussed separately. The features represented are uneven. Labial, dental, and velar stops are distinguished, secondary articulations are sometimes included, sometimes not. Thus, in the dental series, voice and labialization are indicated; in the velar series, labialization; in the labial series voice or aspiration vs. undifferentiation (i. e. the characters in line *7* are undifferentiated; those in line *14* may distinguish plain stops from voiced and aspirated stops).[5] The resonants are also uneven: /m/ and /n/ are clearly distinguished (the difference

[5] Melena (1987) 227 claims that syllabic signs **56* and **22* represent respectively /ba, p^ha/ and /bi, p^hi/. Janda (1986) proposes for **22* the value /mi/. The difference does not affect the matter at hand.

being the same as between /p/ and /t, d/), but <r> represents to the best of our knowledge [r, l]. Hence, a major difference of articulation has been ignored, whatever the precise phonetic nature of Greek /r/ and /l/ may have been in this period. The system has distinguished the semi-vowels, representing two different articulations phonemically. The continuant consonants are a problem insofar as the precise articulation of <z> is disputed: it may represent [dz], [ts], [z], [d^y], [k^y] etc.[6] The main difficulty is that <z> comes from different sources (*#*y*, **gy*, **dy*, **ky*, **gi*), and we are as yet unsure what stage of development it had reached by the time of Mycenaean Greek. In later Greek, ζ = /dz/ develops to /zd/ > /z/.[7]

The main characters of the writing-system represent primary articulatory features with the exception of the liquids /r, l/. Secondary features are haphazardly represented or not. If we now consider the signs in columns 6–8, matters become more complicated:

Table 3

Labial stops	Dental stops	Velar stops
p, p^h/b	*t, d, dw, tw*	*k, q* (= k^w)
Resonants	**Semi-vowels**	**Continuants**
m, n, r, nw, ry (*ra*$_2$)	j, w	s, z, h (*a*$_2$)
Clusters		
pt, au, a$_3$(= *ai*)		

The main additions are /h/, only before /a/; labialization or clustering with labial second element for /d, n/; and palatalization of /r, p/ (assuming that *pt* < **p*^{y}).[8] Whether or not to include /dw, tw, nw/ among clusters or as labialized phonemes need not concern us here. <q> has been included among the primary velar stops from the start, because this is a commonly-recognized class of phoneme, hardly to be understood as a cluster. Finally, two diphthongs /au, ai/ are now given, albeit only in word-initial position.

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[6] Cf. Hart (1966), Ruijgh (1967), Nagy (1970), Hiller/Panagl (1976), Risch (1979), Palmer (1980), Bartoněk (1987).

[7] Allen (1987) 56–59.

[8] Lejeune (1976).

In Mycenaean Greek, the clusters /ks/ and /ps/ are represented by plene writing, using signs of the structure: $kV_1 + sV_1 = ksV_1$ and $pV_1 + sV_1 = psV_1$. Examples include: *ku-su* = *xun*, *ko-so-u-to* = *Xouthos*, *pe-se-ro* = *Psellos*(?), (*wo-no-qo-so* = *Wonoq*^{u}*s*).[9] The examples for /ks/ and /ps/ in non-final position tell us little about the phonological structure of Greek at the time of writing, because, as shown above, the writing-system was so haphazard in representing phonological distinctions. More revealing are the word-final occurrences. As a general rule, Mycenaean writing eliminates all word-final consonants, or rather, never represents them. Words with final /ks/ prove to be written in two different ways:[10] *to-ra* or *to-ra-ka* for *t*^{h}*ōraks*; *o-nu* or *o-nu-ka* for *onuks*; *wa-na-ka* for *wanaks*, *to-ro-wi* for *to-ro-wi-ka*. If /ks/ were felt to be one consonant, and the writing-system was always rigorously consistent, one would expect only forms such as: *o-nu*. Two arguments might account for the dual representations of *-ks#*: a. the dropping of the entire cluster would have made forms too ambiguous, at least in the minds of some scribes;[11] b. some scribes perceived /ks/ as a single phoneme and omitted it (e. g. *o-nu*); others saw it as two and omitted only the word-final portion of the cluster (e. g. *o-nu-ka*). With the limited data available, no clear pattern of using *ka* can be determined according to scribe.[12]

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[9] Occurring pre-consonantally on KN Ch 897 and Ch 1015. Note that *q*^{u}*s* > *ps* in later Greek and that the /s/ has been represented most unusually for this word-final position. This cluster is also represented by *-qo* three times in the name *po-ki-ro-qo* (before an ideogram on PY Jo 438.22, pre-consonantally on PY An 654.12, and prevocalically on PY Aq 64). An alternate explanation to *wo-no-qo-so* is that it represents *Woinoq*^{u}*sos* or *Woinoq*^{u}*orsos* (cf. Chadwick 1973 s. v.).

[10] A positional analysis of contexts reveals little. The four occurrences of word-final /ks/ being totally omitted are: twice before an ideogram (*to-ro-wi* on PY Cn 131.6 and PY Jn 601.2) and twice pre-consonantally (*o-nu* on KN Od(1) 681 and *to-ra* on KN Sk 8100.8b; cf. Killen 1985). However, *to-ra-ka* appears before an ideogram on TI Si 5.1 and 5.2 (cf. Naumann et al. 1977); *to-ro-wi-ka* occurs once preconsonantally (PY An 5.3). Full forms of *o-nu-ka* (and its compounds *po-ki-ro-nu-ka* and *re-u-ko-nu-ka*) occur eight times before an ideogram (KN Od 485.b, KN Ld(1) 571.b, KN Ld(1) 573.b, KN Ld 584.2, KN Ld(1) 587.1 [twice], KN Ld(1) 598.1 & 2), once before a vowel (KN Ld(1) 579.a), and twice on one tablet before breaks (KN Ld 591.1 & 2). *wa-na-ka* occurs pre-consonantally (PY Ta 711) and pre-vocalically (PY Na 334) as well as twice before breaks (KN Vc(1) 73 and PY Na 1356).

[11] Cf. *qo-o* on PY Cn 3.2 for *g*^{u}*ōs*, "probably due to the tendence [sic] to avoid monosyllabic words" (Vilborg 1960, 34).

[12] Pylos Hand 2 writes *wa-na-ka* pre-consonantally (Ta 711), *to-ro-wi* before an ideogram (Jn 601.2). Hand 1 writes *wa-na-ka* pre-vocalically (Ma 334) and *to-ro-wi* before an ideogram (Cn 131.6). These attestations are too few to be of much assistance. None of the Knossos hands are attested in more than one type of environment.

2. Cypriote Syllabic

This writing-system, evidently a relation of Linear B, although we are unclear as to the exact line of descent, is in general very systematic in its distinctions:[13]

Table 4

	1	2	3	4	5
1	a	e	i	o	u
2	ja	je[14]	—	jo	—
3	ka	ke	ki	ko	ku
4	la	le	li	lo	lu
5	ma	me	mi	mo	mu
6	na	ne	ni	no	nu
7	pa	pe	pi	po	pu
8	ra	re	ri	ro	ru
9	sa	se	si	so	su
10	ta	te	ti	to	tu
11	wa	we	wi	wo	—
12	xa	xe	—		—
13	za?			zo	

The vowel-system is identical to that of Linear B. If the consonants, once again, are portrayed by articulatory features, the kinds of distinctions made by the syllabary become clearer:

Table 5

Labials	Dentals	Velars
p	*t*	*k*
Resonants	Semi-vowels	Continuants
m, n, r, l	*j, w*	*s, z*
Clusters		
x (= *ks*)		

[13] Following Masson (1983) and Chadwick (1987).

[14] <je> is very rare and only found in New Paphian, Masson (1983) 54.

With the exception of two series (ʒ[15] and *x*[16]), the consonants are systematically represented by primary articulation alone, whereas features such as aspiration and voicing are *uniformly* ignored. Similarly, among the resonants and semi-vowels, the primary articulation is always distinctly represented: e. g. CS <r, l> contrasts with LB <r> (whereby the LB transcription should not be understood to imply a predominance of the *r*-like features; it is merely a transcriptional convention). Because there are no resonant or semi-vowel phonemes which are distinguished by other than primary place of articulation, we do not know whether the syllabary would have ignored the distinctions, as with the stops. *The Cypriote Syllabary indicates no secondary phonetic feature for one series in exclusion of another series.* Whereas Linear B shows aspiration only in the labial series, labialization only in the dental, velar, and once in the coronal nasal series, and voicing only in the dental series, the Cypriote Syllabary shows no aspiration, labialization, or voicing in any series.

However, the syllabic signs *xe* and *xa*, which represent the consonant-clusters /kse/ and /ksa/, violate the simplicity and regularity of the system. The Cypriote Syllabary was able to represent this cluster with plene writing: *ka-sa-*, *ki-si-*.[17] <xe> occurs most frequently at the end of words to represent /ks#/ which is never written <ke-se>. The /ps/ cluster was always written with scriptio plena: *ka-pa-sa* = Γαψᾶ(ς).[18]

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[15] Masson (1983) 55 suggests that the incompleteness of the z-series is due to scarcity of texts, i. e. coincidental, and not because of a deficit in the system. The precise value of <za> is disputed. It alternates with alphabetic <γα>, cf. Lejeune (1954), Chadwick (1988) 60, Masson (1983) 54–55.

[16] <xa> only occurs once, at Golgoi, Masson (1983) 77.

[17] Masson (1983) 56.

[18] Masson (1983), no. 365. A count of all occurrences of /ks/ and /ps/ in Masson (1983) and Mitford (1980) reveals the following patterns of attestation: <xe> for /ks#/ 17 times; <xe> for /#kse/ or /#ksē/ 5 times; <xe> for /kse/ 3 times; <ka-sa> for /ksa/ 5 times; <xa> for /ksa#/ 1 time; <ka-so> for /ks#o/ 1 time; <ke-so> for /kso/ 1 time; <ka-si> for /ksi/ 1 time; <ki-si> for /ksi/ 2 times; <ko-zo> for /kso/ 1 time?; <pa-sa> for /psa/ 4 times; <pa-su> for /psu/ 1 time. No correlation could be determined between writing-usage and place or date of attestation, and would in any case be suspect because of the extremely limited corpus of texts. Mitford (1980, no. 117) comments that the occurrence of non-final <xe> for /kse/ at Kafizin is unique, but he overlooks Masson (1983) 77. The low number of /ps/ clusters is due to its relatively low rate of occurrence in Greek. A computer search of the Odyssey and Iliad came up with the following statistics:

/#ps/ 156 times, /#ks/ 543 times; /ps#/ 181 times, /ks#/ 615.

In Herodotus the figures are:

/#ps/ 188 times, /#ks/ 496; /ps#/ 6 times, /ks#/ 387 times.

3. Alphabetic Greek

Alphabetic Greek eventually had a superior capacity for distinguishing separate phonemes, since, in its most developed form, it indicates primary and secondary articulations as well as prosodic features. Vowel-length is only specified in the signs for /ē — ĕ — ō — ŏ/, though early Greek inscriptions generally do not distinguish between any long and short vowels.

The distribution of the group of 'supplementary'[19] signs, Φ, Χ, Ψ,[20] and the values attached to them are the basis of the typological divisions of the Greek alphabets: according to Rix,[21] as follows:[22]

Table 6

	p^h	k^h	ps	ks
Crete, Thera, Melos	π, πh	κ, κh	πσ	κσ
Eastern: Ionic	Φ	χ	ψ	ξ
Attic	Φ	χ	πσ	χσ
Western	Φ	ψ	πσ, φσ	χ

Locris and Mantinea have a special sign for Ψ, Elis and Laconia yet another.[23]

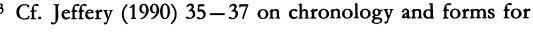
In Pausanias the figures are:
/#ps/ 141 times, /#ks/ 335 times; /ps#/ 21 times, /ks#/ 575 times.
/ps#/ occurs almost always in proper names. Its non-attestation in the Cypriote texts is probably co-incidental.

[19] Cf. Powell (1989).

[20] As well as Ξ, which does have its origin in Semitic *sāmekh*, taking this sign's numerical value and later a new denotation of /ks/. Cf. Gamkrelidze (1989) 230—231, who, however, does not explain *why* this sign and Ψ take on their later values but points out the relative frequency of these values.

[21] (1976) 26.

[22] Wachter (1989) discusses in detail the chronology and genealogy of these characters, but does not explain a motivation for the addition of monographemes for clusters. His statement p. 32 that no new ordering of the alphabet has ever occurred is incorrect. The Germanic Runes, in use for about 18 centuries, were most probably derived from a North Italic alphabet and had the standard order:

 = fuþarkgwhnijėpzstbemŋod

[23] Cf. Jeffery (1990) 35—37 on chronology and forms for the different characters.

4. Comparisons

The possible explanations of the position of /ks/ and /ps/ in the spelling-systems may be classed as **a.** phonological, **b.** perceptual, and **c.** orthographical.

a. Phonological.

The signs which are traditionally read as [ks] and [ps] may in fact have represented different sounds altogether. This idea may seem radical, yet should not be rejected out of hand without examining the evidence for their pronunciation at various points in the history of Greek. There are two ways to ascertain more closely the articulation of these clusters: i. Evidence from borrowings into other languages (both of words and of script), to be found in Armenian and Latin. Allen notes that Ψ and Ξ are transcribed in Armenian as digraphemic <p's> and <k's>, where <'> represents aspiration.[24] He states that this and other evidence point to an aspirate pronunciation of the first element of the cluster, but that Grassmann's Law does not always apply. In Latin, the Western alphabetic form <x> was adopted for the Latin cluster /ks/. Brandenstein[25] terms Ξ, Ψ, Τ "unechte Affrikaten" suggesting pronunciations of: [x̪s], [fs], [p̪s].[26] The proposal that <h> could represent [x̪] is derived from inscriptional <hσ> in the toponym Νᾱhσιος.[27] ii. Internal data, where the derivational morphology of Greek offers assistance. Schwyzer[28] shows that these consonant clusters generally result from zero grades, affixation (e. g. sigmatic future), or borrowing from other languages; i. e. the clusters derive from the respective stop and sibilant articulations.

All the above evidence indicates that /ks, ps/ contain a velar + coronal continuant or labial + coronal continuant respectively. Even if there is an additional feature of aspiration or fricativization in the first element, it does not affect our arguments here. One explanation of the aspiration is as a co-articulation, that is the assumption of features of

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[24] Allen (1987) 60. However, the traditional pronunciation of these clusters is [k'əs-, p'əs-]. Cf. F. Schwink, On the Lexicalization of Classical Armenian Vowel Epenthesis, to appear in: Proceedings of the VIIth Conference on the Non-Slavic Languages of the USSR (1991).

[25] (1954) 82.

[26] "wird meistens -σσ-/-ττ-, -ς#"

[27] Schwyzer (1953) 211.

[28] (1953) 328—329.

the second element of a cluster by the first element.[29] This explanation is supported by the common development of /ks/ to /ss/: "La réduction de /kt/ à /tt/ et de /ks/ à /ss/, cf. ta-si-wa-na-to = Ταση(σ)ιϝάνατ(τ)ο(ς) pour Ταξιϝάνακτος, qui témoigne de la faiblesse de l'occlusive implosive, au moins dans certaines couches de la population."[30] The articulation of /ks, ps/ is only of primary relevance for the period of the alphabet's creation, for, thereafter, the symbols were passed on, even if the values might have changed. Nonetheless, the later values help us to extrapolate earlier ones.

An alternative phonological solution is that traditional definitions of affricates are too narrow and should be expanded to include sequences such as /ps, ks/. In such a case, /ps, ks/ would be single phonemes and the systematic nature of the writing-systems would not be disrupted.

An affricate is a stop + delayed release to the most closely-associated fricative articulation.[31] For example, the only feature distinction between /t/ and /s/ is one of continuancy; [ʦ] combines the features of both sounds, yet, as seen by metrics and phonological rules, it is felt to be one single phoneme. By definition, therefore, /ks, ps/ cannot be affricates because the articulation shifts from velar to coronal and from labial to coronal.

The interpretation of /ps, ks/ as affricates is only valid if we can demonstrate that /ps, ks/ behave like other accepted monophonemes and not like clusters. A primary test is in metrics. In Greek meter, the unit of rhythm is moraic, light syllables counting one mora, heavy syllables two. A light syllable contains only one mora of vocalic length (i. e. a short vowel) and does not end in a consonant. A heavy syllable contains two morae (i. e. a long vowel or terminal consonant). Tier phonology describes syllabification as a process and represents this process as a linking of items from a 'CV-tier' to units of syllabicity on an 'σ-tier' by means of solid lines (i. e. syllabification has already connected these units) and dotted lines (i. e. process of syllabification). The following rules of syllabification can be established for Greek:

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[29] Cf. Ladefoged (1975) 49; also the development σ > *h*. However, addition of inflectional /s/ after /kʰ/ blocks application of Grassmann's Law: **tʰrikʰ-s* > θρίξ, **tʰrikʰ-os* > τριχός. Bailey (1985) proposes a pronunciation [cš] and suggests that the spelling alternations reflect this. His argumentation is unclear to me. He also proposes that /s#/ was pronounced [š], but Allen neatly excludes this pronunciation because languages with separate graphemes for [s] and [š] represent Gk σ with <s>, not <š> (1987) 45.

[30] Brixhe (1988) 59.

[31] Kenstowicz & Kisseberth (1979).

1) Syllabify all Vs.
2) Syllabify Cs iteratively leftwards from Vs.
3) Syllabify any unsyllabified Cs iteratively rightwards from Vs.
4) Cs in pausa are extrametrical.[32] No lines of syllabification may cross.

By these rules, in a sequence $C_1V_1C_2V_2C_3$, after all vowels have been syllabified (rule 1), consonants to the left of vowels will be syllabified first (rule 2), then those to the right (rule 3). Thus, C_2 is syllabified to V_2 and not V_1. If both vowels are short, then the first syllable will be short metrically. If C_3 is word-final and pre-vocalic, then sentence sandhi will syllabify it to the next vowel, and V_2 will be metrically short. If C_3 is word-final and pre-consonantal, then it will be syllabified to V_2, and V_2 will be metrically long. If C_3 occurs in pausa, it is extrametrical, and V_2 will be short. If a sequence has the form: $C_1V_1C_2C_3V_2C_4$, then the syllabification will depend on the relative sonorities of C_2 and C_3 and the manner of speech. In a sequence such as /VklV/ both syllabifications /Vk-lV/ and /V-klV/ are possible; if it is the former, then the preceding syllable will be metrically heavy.[33]

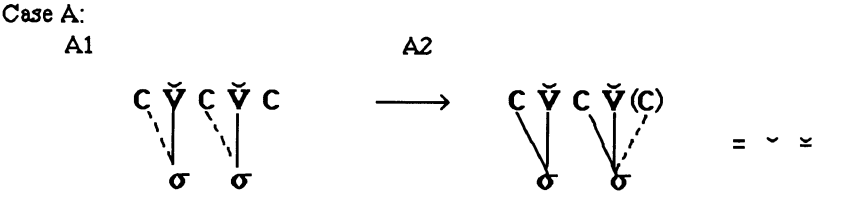

Figure 1

In Figure 1 the process of syllabification of a theoretical sequence of consonants and vowels is shown. In A1 the vowels have already been assigned syllabicity (rule 1), and each consonant is being assigned to the following vowel's syllable if possible (rule 2). In A2, the final consonant is syllabified with the previous vowel (rule 3) if the consonant is pre-consonantal; if it is pre-vocalic, then it is syllabified to the

[32] 'Extrametricality' in metrical phonology means that before the assignment of prosodic features, some element, generally at a word boundary, is automatically excluded. If a consonant is in pausa and hence extrametrical, it is ignored by the process defining syllables as light or heavy.

[33] As a rule, consonant clusters may only be syllabified with the following vowel if they can occur word-initially.

following vowel; in pausa it is extrametrical and ignored (rule 4). Both metrical possibilities are shown. The result is: short—long or short.

Case B:

B1 **B2**

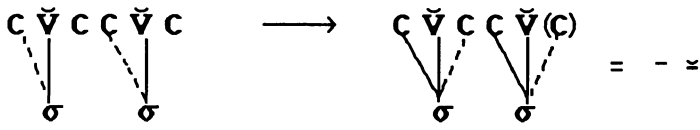

Figure 2

In Figure 2 a sequence with an internal consonant cluster is given. B1 shows a stage identical to that in A1. Note that the first consonant in the medial cluster has not been syllabified. In B2 the non-syllabified consonants are assigned to the vowels preceding them. Thus, the first syllable in B2 is heavy, i.e. metrically long. The second syllable's metrical length depends again on whether the last consonant is word-final and in pausa or not. The syllable assignment in Case B depends also on the relative sonority of the medial consonants; e.g. if they are /-lk-/, then /-l-/ must be assigned to the previous syllable. In the case of /-kl-/, the /-k-/ may be assigned to either syllable, depending on derivation, author, and metrical requirements. Homer, for example, usually syllabifies /-Vk-lV-/ unless the meter forces him to syllabify /-V-klV-/, perhaps as a reflection of the careful spoken form of presentation.[34]

If /ks, ps/ behave like the medial consonant in Case A and not like the medial consonants in Case B, this is evidence for a single consonantal phoneme. If /ks, ps/ behave, on the other hand, as in Case B, then they are clusters. Our knowledge of Greek metrics shows that indeed the latter is the case, for /ks, ps/ 'make position' and are divisible in such a way as to make a preceding syllable with a short vowel metrically heavy. Interestingly enough, <ζ> also makes position, an indication that the transformation to the value /zd/ or /dz/ as two separate phonemes may already have occurred by the time of our earliest poetry.

[34] Snell (1982) 66. Snell gives greater detail about which clusters are divided by which authors in what manner. The metrical analysis of a word final long vowel as short before a word initial vowel may be due to sandhi.

The use of a single grapheme suggests that the monophonemic value may have fluctuated with the biphonemic value, just as IE *k^w may have occasionally alternated with *kw.[35]

b. Perceptual.

The signs for /ks/ and /ps/ may represent clusters and their place in the syllabary or alphabets may be the result of the adaptor's phonemic perception. All too often, researchers in dead forms of language treat the writing-systems as if the inventors had been keen phonologists, capable of identifying precise phonological structures. While there certainly were ancient phonologists (like the Indian grammarians), most inventors of writing-systems had an imperfect perception of the language.[36] Hence, it is possible that the inventor or adaptor of the Greek alphabet noted how unusual /ks/ and /ps/ were as the only clusters (with /nks, rks/) which can occur as word-endings and therefore decided to group them together with other phonemes as having distinct graphemes.

In an analogous instance, the Indic Brāhmī script has a 'ligature' क्ष (devanāgarī, Bombay form[37]) for the combination *kṣ*. Whitney[38] discusses this cluster under consonant combinations, but points out that "no trace of the constituent letters is recognizable" (the graphemes for *k* and *kṣ* are क and ष). Bengali also uses a separate sign for *kṣa*.[39] In the earliest period of the Brāhmī script, this 'ligature' was often included in the alphabet as a separate letter, arrayed at the end of the series "aus unklaren Gründen".[40] There is no such sign for *ps*, but there is one for *jña*. Finally, it is interesting that the sign for /ks/ was borrowed into Latin by way of Etruscan, maintained as <x>[41], and passed on to other European languages. This did not happen to the sign for /ps/ except in the Coptic alphabet, perhaps because the cluster was not

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[35] Cf. IE *$ek\acute{w}os$ > Skt. *aśvaḥ* vs. Lat. *equus* and Go. *aiha-*; KN V 280.15 *i-ku-wo-i-pi.* vs. KN Ca 895.1 *i-qo.*

[36] As Coulmas (1989) puts it, "few people understand the systematic make-up of alphabetic orthographies" (p. 43); faithful mapping is not the user's primary concern (p. 47).

[37] Lambert (1953) 34.

[38] (1889) 14.

[39] Alphabete und Schriftzeichen des Morgen- und des Abendlandes (1969) 59.

[40] von Hinüber (1989) 17.

[41] Here, too, early inscriptions show a confusion about this letter. Cf. *vixsit* vs. *vixit* in Warmington (1940) nos. 68 & 69.

prominent in the borrowing languages. Eteo-Cypriote makes no use of the <xa, xe> of the Cypriote Syllabary.[42]

c. Orthographic.

Jeffery[43] suggests that Ψ could be from one of the syllabaries, although none of the deciphered syllabaries has such a sign with the value /ps/. She does not explain the Cypriote Syllabic <xe, xa>.

A reverse explanation could trace the origin of the Cypriote sign)(= /xa/ to the influence of the Greek alphabet, because of its formal similarity to Ψ = /ks/.[44] However, the base)(exists in a number of variations with 'diacritic' modifications. The use of <X> instead of <Ξ> might be due to early Euboean contacts with Cyprus;[45] but we still cannot explain the modification of a script which is otherwise extremely conservative. Either of these explanations would only illuminate the state of affairs for one stage, not for the origin. Similarly, the borrowing of <x> into the Latin alphabet with the value /ks/ can be explained within the system of Latin or Etruscan by its origin, but still not within the system of Greek.

Powell[46] has proposed that the creation of the 'supplementary' signs Φ Χ Ψ was an attempt to represent phonemic distinctions that were not needed by Semitic speakers; for Φ and Χ this suggestion is plausible, but it does not explain Ψ. Powell proposes that /ks, ps/ were added on the model of /ts/ or /dz/. However, such an excplanation neglects the fact that /t̪s̪/ and /d̪z̪/ are single phonemic units, each characterized by the features: [+ coronal, + delayed release]; they are, in other words, affricates. /ks, ps/ do not fit this definition unless it be expanded (see above, **4a**).

5. Conclusions

Although not conclusive, the evidence favors the perceptual solution **4b**. The /ks, ps/ clusters are unusual, and the degree of co-articulation may have been so extreme that the untrained adaptor of the alphabet

[42] Masson (1983) 78.

[43] (1990) 36.

[44] Masson (1983) 56 follows this view and cites older literature. He further suggests that writing <ke-se> word-finally would have been awkward. Why this should be more awkward than elsewhere is unclear.

[45] Cf. Coldstream (1989).

[46] (1987).

as well as the shaper of the Cypriote syllabary, both of whom show a generally keen perception of Greek phonological structure, decided that one or both clusters should be represented like other monophonemes; the inventor(s)/adaptor(s) of Linear B, who created a less regular system, ignored these clusters.

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