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A STATISTICAL STUDY OF THE PHAISTOS DISC

My aim here is to show that statistical tests may be brought to bear on the investigation of the script and language of the Phaistos Disc.[1] They strongly suggest that some basic questions have already been answered.

Among scores of attempts to decipher the disc, there stands out that of Benjamin Schwartz, which David Diringer thought fit to record in his monumental study, The Alphabet.[2] Schwartz, writing in 1959, was concise and trenchant – and at least partly right. He began with the assumption that, in default of any clear indication of other provenance, the disc should provisionally be accepted as Cretan. There is no need to discuss this matter in detail here: Yves Duhoux, in his judicious edition, writes of "l'origine, indubitablement crétoise, du disque"[3], and while some specialists might disagree, the evidence

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[1] The disc is too well known for background information to be necessary. Yves Duhoux, Le Disque de Phaestos: Archéologie, Épigraphie, Édition Critique, Index (Louvain 1977) summarizes and assesses previous scholarship and includes a useful bibliography. There is also a fine photographic edition, Jean-Paul Olivier, Le Disque de Phaistos: Édition Photographique, Bulletin de Correspondance Hellénique 99 (1975), pp. 5–34. Later publications are listed in the monthly bibliographies in the journal Nestor, but worth special mention is the edition by K. Artum, Die minoische Schrift: Sprache und Texte, I (Wiesbaden 1992), which includes Der Diskos von Phaistos. I have not seen Louis Godart's recently published Il Disco di Festo: L'Enigma di una Scrittura (Einaudi Editore). Kadmos 36 (1997) contains two notes by Alfred G. Kuschnereit, Der Diskos von Phaistos ist ein Unikat, and Zum Diskos von Phaistos: Beweis, daß Seite 'B' zuerst gestempelt wurde, pp. 175–76.

[2] Benjamin Schwartz, The Phaistos Disk, Journal of Near Eastern Studies 18 (1959), pp. 105–12, 222–28; see also his letter in Nestor, 1 February 1968, p. 532. Schwartz restated his arguments in: The Phaistos Disk, Again?, Bono Homini Donum: Essays in Historical Linguistics in Memory of J. Alexander Kerns, ed. Yoël L. Arbeitman and Allan R. Bombard (Amsterdam 1981), pp. 782–99. David Diringer, The Alphabet, 3rd ed. (London 1968), I, pp. 44–45, and II, pp. 60–62.

[3] Duhoux, Le Disque, p. 15, n. 4.

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has struck most as overwhelming. Schwartz went on to claim that the direction of the writing – clockwise from rim to centre of the spiral – was guaranteed by several instances of overstamping. Arnold Bradshaw's thorough and clear-headed re-examination of the evidence vindicated this conclusion, which was independently reached by Duhoux in his careful evaluation of the arguments for and against.[4] Schwartz's further assumption that the script was a Cypro-Minoan-type syllabary of vowels and open syllables and without determinatives has also been endorsed by Duhoux and other investigators.[5]

Schwartz went on to speculate upon the possibility that the Phaistos Disc might encode the same language as either the undeciphered Linear A or the then recently deciphered Linear B. The sign occurring most frequently of all, the crested warrior, is always initial. The only high-frequency and predominantly initial Linear A or B sign is the double axe (*a*), and Schwartz pointed to the resemblance between the linear and PD signs – the linear sign for *a* appeared a possible schematization of the disc's crested warrior.[6] With this clue, Schwartz noted several PD signs similar in shape to the linear signs, and found that for some the PD frequencies closely matched those of Linear B (but not of Linear A). He proceeded to ascribe values to the PD signs on one or more of the following bases: (a) similarity to a linear sign; (b) matching of the frequency curve, when graphed, with a Linear B frequency curve; and (c) context. The aim was to produce Mycenaean Greek.

These methods might have appeared less vulnerable had they resulted in a transliteration and translation that were self-evidently

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[4] The Overcuts on the Phaistos Disc, Kadmos 16 (1977), pp. 99–110. In: The Imprinting of the Phaistos Disc, Kadmos 15 (1976), pp. 1–17, Bradshaw cogently rebutted the arguments of Hans-Joachim Haecker and Erwin Scheller, Ein neues Argument für rechtsläufige Leserichtung des Diskos von Phaistos, Kadmos 10 (1971), pp. 20–27. Duhoux, Le Disque, pp. 22–23. Also, Jean Faucounau, Le sens de l'écriture du Disque de Phaistos, Kretologia 12–13 (1981), pp. 245–50. In: Neue Überlegungen zu Schriftrichtung und Textstruktur des Diskos von Phaistos, Kadmos 25 (1986), pp. 89–96, Haecker continues to read the text from centre to rim.

[5] Yves Duhoux, L'écriture et le texte du Disque de Phaestos, Acts of the Fourth International Cretological Congress (Athens 1980), pp. 112–36. See also Alan Mackay, On the Type-Fount of the Phaistos Disc, Statistical Methods in Linguistics 4 (1965), pp. 15–25.

[6] Of course the linear sign has usually been thought to derive from the double axe. See, for example, John Chadwick, Documents in Mycenaean Greek, 2nd ed. (Cambridge 1973), p. 33, Fig. 6.

right, or at least carried conviction. But although the text Schwartz obtained is by no means nonsensical and even features some plausible Mycenaean Greek grammar, his "list of places, presumably sacred, which may have served as a sort of routier for pilgrims" seems all too likely to be a product of the scholar's own creative imagination and the chance bias of the surviving Mycenaean vocabulary.[7] Other decipherments have followed.[8]

The weaknesses in Schwartz's procedure are that (1) many of the PD signs, including some of the most frequently occurring, could conceivably be "continued" (Schwartz's term) in any one of a dozen or more linear signs – there is scope for much self-deception in attempts to detect the requisite likenesses – and that (2) for many of the PD signs, again including some of the most common, the frequencies fit quite well those for a large number of Linear B values.[9] However, Schwartz's basic argument for a relationship between the language and script of the Phaistos Disc and the Mycenaean Greek of Linear B rests on the convergence of factors "a" (sign shape) and "b" (sign frequency): his claim is that, in relation to one another, PD signs resembling linear signs have initial, medial, final, and overall frequencies closely matching those of the Linear B corpus, once the latter has been reduced proportionally to the same size. This is a claim of some importance, and it can be assessed independently of the supposed "decipherment".

Schwartz's belief that the pictographic printing of the Phaistos Disc belongs within a continuous, if complex, development from the Cretan hieroglyphs to the linear scripts has gained ground in recent years, but the tendency has been to link the disc's language with that of Linear A, rather than with that of Linear B.[10] Conceivably, it might bear some relation to both, and they to each other. In any case, Schwartz's claims that certain PD signs are continued into the linear

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7 Journal of Near Eastern Studies 18, p. 112.

8 Two of the more serious recent proposals, utterly different, are those of Steven Roger Fischer, Evidence for Hellenic Dialect in the Phaistos Disk (Berne 1988), and of Jan Best and Fred Woudhuizen, Ancient Scripts from Crete and Cyprus (Leiden 1988).

9 For the danger of illusory resemblances, see Steven Roger Fischer, Rongorongo: The Easter Island Script: History, Traditions, Texts (Oxford 1997), pp. 147–54.

10 See Werner Nahm, Vergleich von Zeichen des Diskos von Phaistos mit Linear A, Kadmos 14 (1975), pp. 97–101; Jacques Raison and Maurice Pope, Index du Linéaire A (Rome 1971); Diether Schürr, Der Diskos von Phaistos und Linear A, Kadmos 12 (1973), pp. 6–19; Yves Duhoux, Les langues du Linéaire A et du Disque de Phaestos, Minos 18 (1983), pp. 33–68.

scripts and that the disc's language is akin to the Mycenaean Greek of the Linear B inventories can be put to the statistical test. I doubt that a measure of graphic similarity between PD and linear signs can be devised, but a measure of the degree to which frequencies match is available in the chi-square "goodness of fit" test, so long as we stay aware of the restrictions that inhibit a valid interpretation of the results.[11]

Schwartz based his frequency counts of the Linear B signs on Bennett's index of 1953 and of Linear A on tables by Pope and Goold, but I have used, for both A and B, the figures compiled by David W. Packard.[12] For Linear B, I have based my calculations on his table for all complete sign groups, 11,726 altogether, in which he gives initial, medial, final, and overall frequencies for each of the eighty-eight Linear B signs. The chi-square statistic can compare the actual frequencies for the Phaistos Disc signs with "expected" frequencies calculated proportionally to the size of each corpus: 242 PD signs, if we include the erasure, read by Bradshaw as the dotted triangle,[13] and 11,726 Linear B signs. In each case, the differences between the actual and expected frequencies are in turn squared and divided by the expected frequencies: the sum of the answers obtained provides a measure of the degree to which the frequencies match – the smaller the sum the better the match. Chi-square is not being used as a test of statistical significance, but simply as a way of generating rankings according to how closely Phaistos Disc frequencies for each sign correspond to a those for a hypothetical 242-sign Linear B text derived from the figures listed by Packard.[14]

To test Schwartz's claim that graphic similarity between PD and Linear B signs tends to be accompanied by similarity of frequencies,

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[11] Statistical tests used for this article are described in standard textbooks, such as Anthony Kenny, The Computation of Style: An Introduction to Statistics for Students of Literature and Humanities (Oxford 1982).

[12] Minoan Linear A (Berkeley 1974). Packard's book remains a convenient source of data on both Linear A and Linear B, even though more material, particularly on Linear A, has accumulated since it was published. Reliance on newer figures would not affect my arguments.

[13] The Missing Sign of the Phaistos Disk, Kadmos 15 (1976), p. 177.

[14] Many expected frequencies are below 2. Chi-square is preferred to linear correlations because it takes into account not only the shape of Schwartz's graphs but the size of the various totals. The results with random 242-sign Linear B samples (as described below) vindicate the procedure. But the true tests of statistical significance are the non-parametric ones applied to the rankings thus generated and to the raw data for the signs tested.

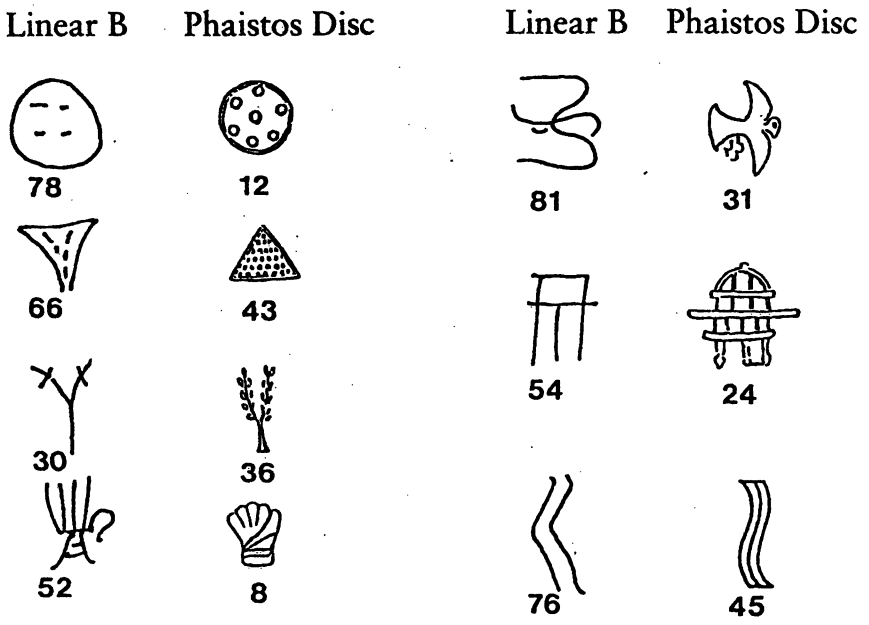

Fig. 1: Phonetic signs cited by Schwartz to indicate a relationship between the Phaistos Disc and Linear B scripts

we may turn to the nine signs that he cites towards the beginning of his article in order to establish that a definite relationship of shape exists. Two of the nine have no phonetic value in Linear B. The other equations are:[15]

PD 12	B 78	*qe*
PD 43	B 66	ta_2
PD 45	B 76	ra_2
PD 36	B 30	*ni*
PD 8	B 52	*no*
PD 31	B 81	*ku*
PD 24	B 54	*wa*

The first three of these should perhaps be omitted from our test. PD 12, which occurs seventeen times on the disc, thirteen times follows initial PD 2, the crested warrior, and is final in the other four in-

[15] Schwartz numbers PD signs in his own way. My numbering is that first established by Arthur J. Evans, Scripta Minoa (Oxford 1909), I, p. 276, and now widely accepted. See also Duhoux, Disque, pp. 56–61. Linear B numbering and values are in accordance with the international system.

stances. It obviously constitutes some sort of quasi-detachable prefix when linked with PD 2 – inspection of the sign groups in which it appears makes this abundantly clear – and seems to be an enclitic in the other cases: the enormous disparity between its occurrences on Side B of the disc (two) and its occurrences on Side A (fifteen) suggests that its use on the Phaistos Disc is quite abnormal. With PD 43 and 45 the difficulty is that the visually matching Linear B signs are the alternative and much less common *ta* and *ra* symbols respectively, and it may be that in each case a single PD sign covers the values split into two signs in Linear B, so that the PD frequencies would better match those for the main *ta* and *ra* signs.

This leaves us with four signs, in which the graphic relationship between the PD and the linear form is undeniably strong. Of all the connections proposed on purely graphic grounds those between PD 8 and B 52 and PD 31 and B 81 are the most striking. Both are quite complex symbols in the linear series, and B 52 has always been recognized as a stylization of a hand with thumb on the right, and B 81 as a stylization of a flying bird. How well do the PD and linear frequencies match? Using the method outlined above, we find that PD 8 is better fitted to B 52 (*no*) than to any other of the eighty-eight Linear B signs. This fact in itself would seem almost enough to verify Schwartz's basic contentions. The Linear B signs to which PD 8 is next best fitted are (in order) *we*, *wo*, *to*, *ja*, *u*, *ro*, *ta*, *o*, *so*, *jo*, and *ko*: the prevalence of other syllables in *o* is noteworthy. Linear B *no* is a predominantly final syllable, so if the extraordinarily close matching of the PD and Linear B frequencies be not a misleading coincidence, it confirms the direction of writing on the disc.

But perhaps this one positive result is fortuitous? For PD 31 the findings are less impressive. It is a fairly good fit to B 81 (*ku*), but is even better matched to twenty-nine other of the eighty-eight Linear B signs. The best fits are (again in order) to *ka*, *ke*, *pi*, *wa*, *pa*, *ki*, *i*, *da*, *pe*, *ma*, *ko*, and *wi*: the prevalence of syllables in *k* is interesting. The matching of PD 31 to B 81 would be improved if PD frequencies and "expected" frequencies derived from Packard's data were calculated on a slightly different basis. PD 31 occurs three times in the same word – the combination 2-12-31-26. If we were to count identical complete sign groups only once, some PD frequencies, including those for PD 31, would be reduced, as of course would all the "expected" frequencies, and PD 31 would be a better fit to B 81 than to all but three of the Linear B signs (*po*, *pe*, and *pa*).

By frequency distribution PD 36 appears to fit only two Linear B signs better than B 30 (*ni*). The best fits (in order) are to *ti*, *ri*, *ni*, *si*, *wi*, *re*, *ki*, *me*, *ke*, *wa*, *pi*, and *te*: the prevalence of syllables in *i* is noteworthy and supports the identification of PD 36 with *ni*. PD 24 fits B 54 (*wa*) better than all but six of the eighty-eight Linear B signs. The best fits (in order) are to *re*, *ke*, *te*, *ra*, *u*, *ka*, *wa*, *ko*, *si*, *pi*, *ti*, and *we*.

There would appear to be no reason why, if the script and language of the Phaistos Disc be not related to the Mycenaean Greek of Linear B, the PD signs should show the slightest tendency to match in their frequencies the Linear B signs that they most resemble, rather than any others among the eighty-eight in Packard's list. In other words, by chance alone their average ranking should be 44.5 out of 88: but the four signs which we have just considered are ranked 1, 3, 7 and 30, an average of 10.25.

The appropriate statistical test of the significance of these rankings is the Mann–Whitney modification of Wilcoxon's Sum of Ranks test. In this all 352 (4 x 88) of the calculated frequency matchings are ranked, and the computation assesses the likelihood that the rankings, among the 352, of the four hypothetically correct matchings (PD 36 with B 30 or *ni*, and so on) could together be so high by chance. The result is $z = 2.832$, $p < 0.01$, which means that the probability is less than one in a hundred that the high rankings could have occurred by chance. Such a result can be deemed significant, and confirmatory of Schwartz's claims.

Turning to the three signs that we rejected for this test, we find that PD 43 is a fairly close fit to B 66 (ta_2), and a less good but still fair fit to *ta*; that PD 45 does not fit B 76 (ra_2), but is an excellent fit to *ra* (in fact it fits only four Linear B signs more closely); and that PD 12, as we foresaw, is a poor fit to B 68, and indeed to every Linear B sign.

I have not carried out similarly elaborate calculations for Linear A frequencies, as it is obvious from Packard's tables for Linear A that there is no tendency for graphically alike PD and Linear A signs to afford matching frequencies. Indeed the complete contrast between Linear A and Linear B in this respect supports Schwartz's case (Linear A serves as control).

Other tests of significance may be used to show the relationship between PD and Linear B signs. For instance, for each of the four key signs dealt with above we have three independent frequencies – those for initial, medial, and final usage. All twelve PD figures (that

is, 4 signs x 3 positions) may be ranked according to size, and the raw figures for the supposedly corresponding Linear B items similarly ranked. Spearman's rank-order correlation test shows that the correspondence between the two rankings is very highly significant (*rho* = 0.898, *df* = 10, $p < 0.001$). This means that there is a less than one in a thousand probability of such a result being due to chance. A correlation of 1.0 would signify exact agreement between the two orderings, the first item in one list being the first in the other, and so on, while a correlation of -1.0 would signify that the two orderings ran in opposite directions, the highest total in one list being the lowest in the other, and so on; a correlation of 0.0 would signify a purely random relationship. The correlation of 0.898 reflects a very substantial measure of agreement. Even when we add PD 12 and B 78 (*qe*), and the signs in which Linear B offers alternatives, PD 43 and B 66 (ta_2) and PD 45 and B 76 (ra_2), the correlation remains significant (*rho* = 0.54, *df* = 18, $p < 0.02$).

When the same computation is worked out for PD and Linear A signs (PD 36 – A 60, PD 31 – A 98, PD 24 – A 75) results accord exactly with chance expectation (*rho* = 0.025).[16]

Of course, when the average word length is more than three syllables, medial frequencies for complete sign groups will be higher than initial and final frequencies, and the high correlation between PD and Linear B figures is partly due to this factor.[17] Average Linear A word length is much closer to three syllables.

Here we have, however, yet another feature linking the script of the Phaistos Disc with Linear B. The mean length of PD sign groups is 3.967 signs, and the standard deviation, a measure of dispersion either side of the mean, is 1.211. The standard error of the mean is thus 0.155, which implies that the mean length of sign groups of the language and script, of which the Phaistos Disc affords a sample, is most unlikely to be outside the range 3.502–4.432. Average Linear B word length may be calculated from Packard's table for all complete sign groups in Appendix F (pp. 209–210), where the total number of signs is given, while initial (or final) frequencies for each

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[16] PD 8 – A 100 has been dropped, because, following Raison and Pope, Packard links A 100 with B 28 (*i*) only, not with B 52 (*no*). Including A 100 in our computations would not improve the correlation between PD and Linear A.

[17] However, even when only initial and final frequencies are taken into account, the correlation between PD and Linear B for all seven signs is *rho* = 0.53. Although for 12 *df* this is not significant, the correlation remains of the same order as when initial, medial, and final frequencies were used for all seven signs.

sign may be added together to yield the number of sign groups. The average Linear B word length is about 3.7 signs, close to the mean for the Phaistos Disc. Computation based on Packard's Appendix E (pp. 193–196) reveals that the average Linear A word length is about 3.2 signs, which is well outside the limits for the script and language represented on the disc.[18]

The similarity in word length between the Phaistos Disc and Linear B, and the dissimilarity of both from Linear A, can be seen in Table 1, where the PD distribution of sign groups of 2, 3, 4, and 5–7 signs is compared with the distribution in random Linear A and Linear B samples of the same length.[19] The PD and Linear B distributions are nearly identical and might easily be samplings from the same population. The PD and Linear A distributions are so different that they are most unlikely to be samplings from the same population (chi-square = 16.37, 3 *df*, $p < 0.001$). Admittedly, a particular text is not just a random sample from a language's total vocabulary; but it remains true that PD word length conforms to a Linear B, but not to a Linear A, pattern.[20]

Table 1

Signs per word	Phaistos Disc	Linear B	Linear A
2	6	5	21
3	16	17	32
4	21	26	12
5–7	18	15	11
Words:	61	63	76

Comparison of Phaistos Disc, Linear A, and Linear B word length in samples totalling 242 signs.

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[18] The addition of more recent data would reduce the Linear A average word length to 3.00 signs. See Duhoux, Une analyse linguistique du Linéaire A, p. 68. Calculations ignore the 19-syllabogram "word", which, as Duhoux notes, is clearly the result of the writing of several different words in scriptio continua.

[19] The samples, consisting of complete sign-groups, were constructed, with the help of random number tables, from Packard, Minoan Linear A, Appendix H (pp. 255–72), for Linear A and the Glossary (pp. 527–94) of Chadwick, Documents in Mycenaean Greek, for Linear B.

[20] Calculations based on the table of Linear A word length in Duhoux, Linéaire A, p. 68, would yield a distribution even less like that of the Phaistos Disc: 2 signs per word = 30, 3 signs per word = 30, 4 signs per word = 14, 5–8 signs per word = 7, total words = 81.

A possible objection to the findings of this article may be anticipated and answered. Does not the disc afford too small a sample of its script and language to sustain the kind of statistical treatment to which I have subjected it? Given my testing procedure, the small size of, or bias in, the sample might have led to negative results, even though the hypothesis tested was in fact sound, but it can hardly account for the positive results in fact obtained. Moreover, the method works perfectly well with sixty-one word samples of real Mycenaean Greek, taken at random from the Ventris–Chadwick glossary.[21] Also, when initial, medial, and final rates of occurrence are counted for every Linear B syllabogram in such a random sample, the figures obtained provide a highly satisfactory fit to the "expected" figures calculated from Packard's table for the whole Linear B corpus.

So the Phaistos Disc contains a sample of its language and script that is large enough for the purposes of the present study, though it may well be too small for a convincing decipherment ever to be possible.

In attempting a decipherment, Schwartz made several identifications (besides those already mentioned) of PD with Linear B signs on the basis of a fair measure of graphic resemblance bolstered by his graphs of rates of distribution.[22] Those that receive most support from the chi-square matchings are PD 26 as B 75 (*we*), PD 35 as B 4 (*te*), PD 27 as B 77 (*ka*), PD 20 as B 67 (*ki*), and PD 29 as B 38 (*e*).[23] A plausible identification contrary to those made by Schwartz is PD 25 with B 10 (*u*): among Linear B signs, B 10 is visually the best candidate, with the possible exception of the extremely rare B 86, to which no value has been assigned, and checking the chi-square matchings one finds that PD 25 is fitted to only one other sign better than to B 10; the convergence of the two independent types of evidence is suggestive. But for too many PD signs several of the best

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[21] In fact I worked with samples in which the number of signs totalled 242, as on the disc. The number of words selected at random from the Glossary – again with the help of random number tables – was always close to sixty-one, but selection of the last two words in the sample was limited by the specific requirement that signs total 242.

[22] In some cases the relationship is more apparent when the Linear B sign is connected with its counterparts in Linear A and the hieroglyphs.

[23] One's natural inclination might be to connect PD 29 with B 80 (*ma*), the probable development of the hieroglyphic and Linear A feline sign; the cat has the syllabic value *måu* in Egyptian. However, *ma* provides only the eighteenth best fit for PD 29; *e* provides easily the best and could be a stylization of the cat's pointed ears.

frequency matchings might credibly be supposed to coincide with a graphic resemblance between the PD and the linear sign, so that – even supposing we grant Schwartz's main contentions – the two kinds of testimony, even in combination, are ineffectual in establishing PD values.

Nevertheless, Schwartz's twin conclusions that the language of the Phaistos Disc is akin to Mycenaean Greek and that the disc's sign-repertory is related to those of the linear scripts appear to be confirmed by the present study.

Finally, it might be urged that considerations of chronology render implausible any attempt to link the Phaistos Disc printing with the Mycenaean Greek of the Linear B writing – the object having been discovered close to a Linear A tablet in an archaeological milieu that dates it 1850–1600 BC, probably nearer the latter limit.[24] This is, of course, not so much an objection to my argument as presented, as an a priori reason for suspecting that there must be something wrong with it. But the difficulties may not be overwhelming. It has become clear that for much of the Middle Minoan period several systems of writing were in simultaneous use in Crete and that this was never a simple case of one script replacing another.[25] More problematic is the postulation that a form of Greek, or of a language related to Mycenaean Greek, should be found on an object originating in Phaistos before 1600 BC. However, there are so many gaps in our present knowledge of the movements of Bronze Age peoples and languages in the Aegean that to dismiss Schwartz's claims on purely chronological grounds would be imprudent. There is no independent evidence of the use in Crete around 1700–1600 BC of any of the other languages that the disc has been conjectured to preserve. Besides, "akin to" may, if necessary, be quite broadly interpreted. There have been persistent claims, by reputable scholars, that the Minoan

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[24] Evidence of dating is fully discussed by Duhoux, Disque, pp. 6–14.

[25] Maurice Pope and Jacques Raison, Linear A: Changing Perspectives, in Études Minoennes I: Le Linéaire A, ed. Yves Duhoux (Louvain 1978), pp. 5–64; J. T. Hooker, The Origin of the Linear B Script (Salamanca 1979). Hooker asserts, in relation to Bronze Age Crete, that we should think "not of the supersession of writing-systems by new ones but of the gradual evolution of related scripts during a period of several centuries" (p. 19). Gareth A. Owens states in: The Common Origin of Cretan Hieroglyphs and Linear A, Kadmos 35 (1996), pp. 105–10, that "during the last two years discoveries and studies have highlighted still further the epigraphic relation between Creatan Hieroglyphs, Linear A, the Phaistos Disk, and related inscriptions" (p. 110).

language recorded in Linear A has a significant Greek component.[26] The idea that the Phaistos Disc encodes some form of proto-Greek, or a language with elements of proto-Greek, remains worth entertaining.

[26] Some of these are discussed by Pope and Raison in: Linear A: Changing Perspectives, pp. 41–50; and see Peter G. van Soesbergen, Parallels in Minoan Linear A and Mycenaean Linear B, in Atti e Memorie del Secondo Congresso Internazionale di Micenologia, ed. Ernesto De Miro, Louis Godart, and Anna Sacconi (Rome 1996).