# STRUCTURAL READING AND EVOLUTION OF THE INDUS SCRIPT VIEWED AS A COMPLEX SYSTEM. II: EVOLUTION AND RELATION TO THE BRAHMI SCRIPT[1]

by
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This part of the paper is a continuation of Part I (which has been published in two parts (Part IA and Part IB) in RASK) where it has been shown that the system of writing on the texts examined represents a system of metrology. Further, it was seen that each sign has individual meaning in the form of having a word value, and elements phonetization is involved in varied ways, though we were unable to obtain the phonetical readings for the texts in general. In this part, we first examine this phonetization aspect systematically, thereby deriving further evidences for the results of Part I, and show that it is involved as a part of the system in the form of a substratum. In particular it is shown that the signs that have been identified as first order numerals and a few basic forms of metrical numerals that were extensively involved in the formation compound signs, might also have been used for a different system of purely phonetical writing in general, though the mediums used for such phonetical writing have not survived. What is called Brahmi script, a script from which all the present scripts of India evolved, might actually be an evolved form of such a system. We also make some remarks regarding the possible formative stages of the Indus script and compare them with those recently proposed with respect to Sumerian by D. Schmandt-Besserat, Lieberman and others.

## *5. Elements of phonetization and the relation to the Brahmi script*

We have indicated in earlier sections (of Part I) the possibility of involvement of elements of phonetization in the Indus script in many ways, in particular in the formation of some of the sign forms. The purpose of this section is to analyze such possibilities more systematically in order to see if any possible systemization can be isolated. Such an analysis indicates that *some* of the basic signs,

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specifically the divinity signs and the ones corresponding to the first order numerals and a few basic metrical numerals that have been extensively involved in the formation of compound signs, might have the possibility of being used also for *a system* of sound values of appropriate vowels or consonantal skeletons with appropriate vowels adjoined, in addition to their use for their word or morpheme values. (Note that the two divinity signs are related respectively to a vessel and a spear, which also have the possibility of being associated with two of the basic forms of metrical numerals). This process also leads one to suspect that such sign forms and the respective skeletal sound values might actually correspond to those of an essential and basic part of later Brahmi script. Here Brahmi script refers to an alphabetic writing system that came to the 'surface' in the Indian sub-continent around third century B.C. through monumental writings. (Here we are ignoring the fact that, at the above indicated period, not all the regions of India used the same number of signs of the system though regional variations in the outer forms of the signs are only insignificant). All the present scripts in India, as well as some of the scripts of South-East Asia, are evolved from that script. Recall that in the Brahmi system the signs for vowels are used explicitly only at the beginning of the words and their values at other places are indicated by diacritical marks attached to those respective consonantal signs with which they form one unit. (There are also slight variants of this vocalization). Most of the differences between the forms of signs of the Indus indicated above and correspondingly those of the Brahmi script that will be derived below can be explained due to the evolution of that convention. For this same reason, whenever we say in what follows that a sign has the specified consonantal value, we mean appropriate vowel value is also possibly adjoined to the right of it with the nature of the vowel involved depending on the context. For instance, when we say that the sign  has the consonantal value *n*, we mean it can also stand for *na, ni, nu,* etc. The phonemes thus derived also turn out to be the basic and essential ones.

It may be noted that while the present analysis helps to identify a suitable substratum that involves the aspect of phonetization, the results are not sufficient enough to have the phonetical readings of the texts as a whole. We shall indicate in 5.1.6 below that such a broader aim may not be possible to achieve given the presently available data.





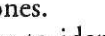
In what follows, I.i.j.k stands for the section i.j.k of Part I. Familiarity with the arguments of Part I will be assumed throughout.

As in Part I, DED stands for the work *Dravidian Etymological Dictionary*, by Burrow and Emeneau (1961). It appears that some of the lexical forms of the metrical units (such as *panai*) that will be derived below are not listed in DED. However, they are familiar units in Dravidian, used until the recent past from time immemorial (see for instance Venkatachalam (1986)). All the lexical forms we use below are however listed in *Tamil Lexicon* (1936), (see the Remark in I.3.2.1.)

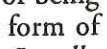
## 5.1. Further analysis and the isolation of a system of basic phonemes

As before (that is, as in Part I) we shall approach the problem step by step, basing our arguments on the results derived in the previous sections (of Part I), with the aim of isolating a systemization. In view of the constraints mentioned in I.4.2.2, our aim will be only to analyze those components indicated in Part I for which possible phonetization is supported by the results derived there. We should also emphasize the tentative character of our suggested meanings at any single isolated stage of the arguments that follow. Recall that we have derived the word values of many of the signs, but we shall first consider those which have been used for the sound values.

### 5.1.0

In the case of the first order numeral seven, we have seen in I.3.2.4 that it corresponds to the unit of work or time, and is signified through phonetical transfer, often by  , where  stands for the sound *u* and  stands for *lu*, so that  corresponds to *ulu*. Therefore, we shall give the vowel value *u* for  and the consonantal value *l* for .

5.1.1

Next, we have seen (I.3.2.1) that  is used to signify four having the approximate sound value *nal*. We shall now show that this sign has the possibility of being used for the consonantal value *n*. The sign  occurs in the form of the ligature  (with frequency 105) with the man sign. In *all* of its occurrences this ligature occurs at the beginning of a principal block, often in the form , with the divinity sign  almost always (93 times) at the left side of it. Also recall that the combination  has the possibility of standing for the numeral twenty (with the man sign inducing the multiplication operation, see I.3.2.6 and I.3.6.0), but this is not the only way twenty can be formed. Also the sign  almost always pairs with  means the combination  is likely to have a complete meaning. Since we already know that the word value of  is *aḷ* or *aḷa*, meaning amount, and that of  is *aṇ*, let us see if the word or phrase corresponding to this combination gives any meaning.

If  is given the preceding consonantal value *n*, then  has the word forms *nal* and *alan*, depending on the order in which the two signs involved are read. The first one stands for four, and the second one stands for an archaic form of a divinity, so that both make sense. Then the combination  reads *analan*, which also stands for an archaic form of a divinity, in addition to having the meaning 'divine prosperity' (see below). This possibly means the specific combination having the value twenty is used in such a position in order to have the meaning of some auspicious nature at the beginning of the reading of the texts. This does not mean the whole text will have such an additional meaning or every text will have such a possibility. It is also a possibility that this auspicious phrase was read first and then the amount specified was read with word value only 'twenty' for the combination . In the cases where  occurs other than the form of this combination, it is aligned with a metrical numeral, so that the man sign does not alter the concrete value but only helps to have the additional meaning in the reading derived above.

For these reasons let us give the consonantal value *n* for . The preceding arguments also indicate that the sign  is used for the sound value *aṇ*, similar to . Since the consonantal skeletons of these sounds are already identified, both have the possibility of





standing for the vowel *a*, if they were used also for the sound of appropriate skeleton. We shall see below that this is true for the case .

To give an another instance similar to the preceding one, recall that (I.3.6.2) the combination  has the possibility of having the value ten, and it is only one of many forms of ten used. This combination occurs predominantly at the beginning of principal blocks with the sign  at its left side, similar to the combination . Similar to the preceding case, we now show that the combination  has the possibility of having an auspicious phonetical reading when the combination  is read in the form 'four and six'. (Incidentally, the reading 'four and six' (= *nālum cārum*) is the conventional way of expressing 'the sum of four and six', whereas the product is expressed in the form 'four-six'). Here we are not able to obtain any meaningful reading using only the skeletons of the word values involved. Using then all the word values, a possible reading is *annālumcārum*, which can be approximated to have suitable meanings, for instance by *annalam cārum* or *annalam cērum*, both mean 'let the divine prosperity accumulate', though the exact phonological shape involved here may be considered only tentative, since the phrase is somewhat long for the fact that the precise form of the language involved is unknown and no further clues are available. (In connection with this reading, recall from Section I.3.2.1 that, in Dravidian, 'four' and 'prosperity' have at an archaic stage the possibility of being treated as having the same conceptual background, at least through intermediaries, and hence having approximately the same word values also. It is possible to argue for a similar common conceptual background for 'six' (= vessel, see Section I.3.2.2) and 'accumulate'). Here, note also the basic important difference that in the earlier case  is involved as part of a compound whereas in the present it is involved in the individual form, suggesting that when a sign has the tendency to be involved as a part of compounds, then it might have the possibility of being used for the sounds of appropriate vowels or consonants. We shall have more support for this possibility. Again, here also it is possible that this reading was obtained first and then the specified amount was read, in which case only the word value of ten might have been used for the combination 

There are also other cases similar to the preceding ones with high frequencies, such as  and  with respective frequencies 150 and 24 (including their variants  and  with respective frequencies 32 and 2), both always occurring at the beginning of principal blocks and aligning exclusively with  . Both have the numeral four, as part of the additive operation, which has the form *nālum* that can be taken to mean 'prosperity' as indicated above. Specifically, the combination  involved in the first one has the reading 'four and four' which has the approximate form *nālum nalam*, which means 'let everything prosper'. Similarly the combination  involved in the second one has the reading 'four and two-five' = *nālum iru-kai* which takes the approximate form *nalam irukkai*, meaning 'let the prosperity reside'. It may also be noted that when reading the value of the amount implied by the texts is of primary interest, the above phrase forms might not have always been read explicitly, so that the compound sign as a whole might also have a phonetical reading different from the ones above that have been constructed by combining the word values of the individual signs involved. We have not investigated other similar cases. However, in situations that are not similar to the preceding ones, it is not clear if the sign  always is intended to be read phonetically. For instance, if a principal block having the phrase form evolved in the spoken language is adjoined at the left end by the sound value of  , it is not clear if the combined phrase will always make sense. However, in such cases the possibility that  by itself is read in the phrase form, such as 'possessing divinity' (see I.3.8.0), cannot be excluded. (In fact, it is still a common custom to invoke such auspicious phrases at the beginning of counting or measurement). These facts also indicate that certain well established conventions are involved in the possible phonetical construction of the texts on the seals.

The illustration discussed above also shows that the sign  has the possibility of having been used for the sound value of its word value *cāru*, but we are unable to find an instance where it is used for the sound value of its consonantal skeletons. However, we tentatively give it the consonantal value *c*, since the other value *r* will be derived below by other means.



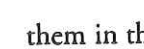


5.1.2

Next let us show that the sign  has the possibility of having the consonantal value *ṭ*. This sign stands for the first order numeral eight, having the word value *eṭṭu*, meaning 'step' (I.3.2.3). To see if any skeleton of this is used for the sound value, let us look into the sign  . If the external form of this sign is taken to have the possibility of a representation of a hoe (a suggestion which will be strengthened in what follows), it also suggests that it might stand for the combination  with possibly an additional conventional meaning implied by the concretization of the combination in the form of a hoe. We shall first derive the approximate archaic form of the etymology for hoe that will be consistent with the preceding suggestion. The one given in DED (1720, 1740), which also coincides with the current form, is *kottu* or *koṭṭu*. The sign  is clearly involved in the representation, which has the word value *kai* (=five) (see I.3.2.1), meaning hand. If one attempts to isolate this word in the preceding etymology of DED, one arrives at the form *kai-ettu* → *kottu* where the left side means 'hand-kick' or 'hand-effort', since *ettu* means kick or effort. That is, at an archaic stage, a hoe was signified by the action for which it was used. Now the etymology thus derived approximates the compound-word form of the combination  obtained using the word values of the signs involved. However, if this compound is read as a single word, which is likely, the consonantal skeleton involved is *ṭ*. This also indicates that the sign  might have been formed at a stage where the individual forms of the compound *kottu* were still intact. Furthermore, the reason for concretizing the combination  might be to force to have the reading 'five-eight' where the operation involved is then multiplication by convention, as indicated in 5.1.1, whereas without any such indication the intended operation would be addition (see I.3.6.0). It is also interesting to note that the word *kottu* also means: bunch, cluster (DED 1741), as well as a standard measure.

This example further indicates that the sign  might have the possibility of standing for the consonantal value *k*.

Let us consider another example for the preceding possibilities. We have already mentioned that the sign  has the appearance of a bull, and a deliberate attempt is made to preserve this outer form with individual details throughout the entire period. If we view this sign as a sort of a combination of the signs  ,  ,  , and put

them in the syntactic order  , one gets the reading *kai-mā-eṭṭu* → *kai-māṭu,* where the right side precisely means 'handy-bull', that is, domestic bull. Here we have used the fact that  stands for the sound value *mā,* which was already noted in I.3.3.2. Thus again the consonantal skeleton involved is *ṭ.* The word *maṭu* also stands for the meanings such as wealth, gold, large gem.

It also follows from this that the sign  has the possibility of having the consonantal value *m.* Here also it is interesting to note that the basic form  occurs only in the pre-urban phase, indicating that the sign  might have been formed at that early stage. It also follows from above that the signs  and  which stand respectively for the combinations  and  have respective the approximate word values *māna* and *mūṭai* which were indicated in I.3.3.2 to stand for volume measures.

## 5.1.3

Next, let us derive the sound value of the root  . For this purpose consider the compounds  ,  ,  . The signs involved in the first two are  ,  , the consonantal values of which are derived above. The sign involved in the third one is either  or  , both induce the same value for the compound  , as well as the word value of the first one forming a part of that of the second one (see I.3.2.1 and I.3.5.3). First, let us obtain a tentative value for the sound value of  and then use the preceding compounds to verify the value.

Recall that we have seen that  has the possibility of standing for the value ten in the form of a second order numeral, and its derivation is associated with the root  (see section I.3.5.0). Also recall (see I.2.2.2) that  cannot be considered to have the character similar to  , even though it has the appearance of a ligature of  with  . However, if one attempts to approximate the sound value of ten, *pattu,* with that of  , the root  gets the tentative sound value of the consonant *p,* since one can then tentatively argue that  is intended to be a compound of  and  in order to get the approximate sound value of ten, which is obtained since  has the consonantal value *ṭ.* The reason why the compound is turned into the form  is not completely clear, but as usual, it might be to have the external suggestion of the intended word value. In this





connection recall that the sign  has the value hundred, suggested by its outer form standing for the lay-out of a city (see I.3.5.0). Now the form  , the variant of  , is analogous to  , and might suggest a village, the sound value of the etymology, as well as the meaning, of which approximates that of ten (see section I.3.5.0).

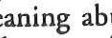
Now let us see if the preceding tentative sound value for the root  is consistent with the possible word values for the remaining compounds. For this purpose let us collect the word values of the ancient metrological units that start with the sound *p.* These are *pana* → *panai* and *panam, pala* → *palam, paṟa(i), paṭi* and *poṭi.* First,  matches with that of *pala,* since this is a compound of  and  respectively having the values *p* and *l.* Similarly,  matches that of *pana.* Also, both *paṭi* and *poṭi* match that of the value of  derived above, again indicating that the inspiration in the formation of  might be a volume measure, as indicated in section I.3.5.0. This leaves *paṟai* and the compound  . To see a possible match, note that the sign  has the possibility of having the word value *vari-kai* (see I.3.5.3), which might have been often used in the abbreviated form *vari* (DED, 4304). If we take the consonantal value of this to be *r,* and taking  to be a compound of  and  , one then sees that  matches with that of the unit *paṟai,* the lexical form of which also stands for drum (DED, 3319) (which appears to have been suggested by the outer form  ). Thus one gets a certain consistency in assigning the consonantal value *p* to the root  . It is again important to note that the root  is extensively involved in the formation of compound signs, a possible reason for acquiring the consonantal skeleton, as indicated in 5.1.1.

The above arguments also show that the sign  has the possibility of having the consonantal value *r.*

## 5.1.4

Now let us look at the root  . As mentioned earlier in 2.6.0, the outer form of this as well as the divinity sign  are derived from the spear-head. It has the etymology *vēl.* The sign  ligns with the fish sign and its variants with very high frequency. This indicates, similar to the reasonings given with respect to the sign  , such combinations might also have had suitable auspicious phonetical readings. In fact it is possible to give several such readings for the

combinations such as  if  is given the sound value of *vēl* and the sign  is given the consonantal value *m* derived above. For instance *vaḷam*, meaning abundance, riches, etc. This indicates that the word corresponding to  or  is used for its sound value. As for the ancient metrological unit that matches this sound, one has *vēli* which generally refers to a land measure. In this connection it may be noted, as already indicated in I.3.3.0, that essentially the same sound stands for the meaning labour as well as time. Thus it is possible that this metrical unit initially stood for a unit of labour, expressed either for instance in terms of a volume measure of a grain in the form of the amount paid for a specific labour, or in terms of a land measure meaning the area of the field that can be covered with respect to a specific labour such as ploughing in a specific amount of time. However, the fact that the sign  is used to signify such a unit of measure cannot be viewed merely in terms of phonetical transfer, similar to the remark made with respect to the fish sign in I.3.3.2, but we shall return to this point in Section 6.

As to the possibility that  is used for the sound value of its appropriate skeleton, in addition to the possibility for the sound of its word, note that in I.3.7.1, we have seen that  has the possibility of standing for the combination  , which has the compound word value *vēl-kai* → *vīcai* or *vīcam*, (DED, 4478), where the right hand side stands for an important metrical unit employed during the historical period. (Note that we have discussed a similar transformation in I.2.8.3 in the form *vari-kai* → *varicai*. Thus we give the consonantal value *v*, as the remaining consonant has already been identified.

Unfortunately we have been unable to identify clearly further signs that might have been used for the appropriate sound values. However, there are a few signs whose word values have the apparent possibility of being represented by phonetical transfer. In such cases, appropriate phonetization is already implicit. One such case is  having the appearance of a leaf and the value of a metrical numeral. It further occurs in the modified forms such as  ,  ,  . The etymology for leaf has the forms such as *ilai*, *elai*, or *ele*. Also, *irai* or *erā* in general means food, in particular that of birds or domesticated animals. (Also in colloquial of some Dravidian languages, *orē* means a load). An ancient metrical unit that approximates this sound is *eṭai* or *iṭai*; it generally stands for a weight measure, possibly might have





stood for a typical load a man can carry. Here the consonantal skeleton involved has already been identified. The remaining vowel skeleton could have been either *i* or *e*.

5.1.5

(The results of this subsection are not used in further analysis).

It is interesting to note that the approximate word values of all the metrological numerals derived above match those of certain ancient metrical units. It should however be noted that during the historical period, the same lexical forms of the units discussed above stood for several types of units such as volume, area, weight, as well as for the value of numerals or fractions. This is possibly the case since the initial stages, as is natural in a barter system. Note also that the exact values of such units did not remain constant with respect to temporal and geographical differences during the historical period, so that nothing reliable can be obtained regarding the specific numeral values of the metrical numerals.

This then encourages one to look into similar possibilities for other basic metrical numerals also. In fact such a possibility, as well as the preceding facts were indicated in I.3.3.0 and I.3.4.1.

The possibility that  might stand for the metrical unit *kāṇi*, meaning land, was already indicated in I.3.3.0, where it was also indicated the possibility that the root  might stand for the metrical unit *manai*, which generally refers to a ground or land measure (associated with a dwelling place.)

Now consider . An ancient metrical unit that appears to stand for this is *tōl-ala* → *tolā* or *tulā* where the left side stands for the meaning 'shoulder amount', which appears to have been suggested by the outer form of the sign, and the right side stands for a standard metrical unit. Here, the sign has the appearance of a compound, but we have been unable to obtain this word from those of the individual signs that can be possibly isolated from the sign.

Next, we give tentative suggestions for two more cases. First consider  . As is clear from many variants of this sign given in Mahadevan (1977: 785), it stands for a quadruped. An ancient metrical unit that can be possibly identified with this is *maṇaṅku*, since this also stands for lamb, or young cow or buffalo (DED, 3887). This possibly means at an archaic stage such a quadruped was

exchanged, as its flesh was possibly edible, for a suitable amount of grain, eventually evolving into a grain measure. In this connection it is also important to note that it is not unusual to derive the lexical form of an object that was frequently traded from that of its 'price'. This sign appears to have been derived from a basic metrical numeral in the form of a ligature initially, but we are unable to make a satisfactory identification. We have already indicated that similar difficulties arise in many other cases.

Now recall that (section I.3.2.2) the unit  stands for a concrete form of  which has the word value *cāru*, and the metrical unit having this approximate word value is *cēr*.

## 5.1.6

It is important to note that in the preceding derivations (*except* 5.1.5), the signs involved are, apart from the divinity sign  , the first order numerals and the basic forms of metrical ones. These are precisely the ones involved extensively in the formation of compounds. Thus a definitive *systematization* is involved in the preceding derivations. It would be convenient to collect together the vowel or consonantal values derived above : *a, i* or *e, u, k, c, ṭ, p, n, m,* r, *v, l.*

It would also be convenient to list the word values of the metrical numerals derived above: *mā, mana, mūṭai, pala(m), vēli, vīcai* or *vīcam, panai, pana(m), paṭi, poti, paṟa(i), kaṇi, eṭai, tulā, maṇaṅku, cēr, kottu, maṭu.*

It may further be noted that many of these word values have also entered into expressing the concept of magnitude in general in various forms; to give just one example, the approximate form *para* can be isolated to mean 'greatness' in many names of divinity, employed throughout India.

Thus a systematization that can be isolated regarding the writing on the seals is as follows: The signs that do not appear to be compounds have word values, some of them are *apparently* formed through phonetical transfer, but many others can be made sense both ideographically as well as phonetically. Some of the signs have word values derived apparently through semantic (ideographic) suggestions, such as  or  . In general, the derivation of word



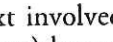


values appears to involve a complex process, see for instance I.3.2.5 and the preceding derivations for the roots such as  and  . We shall attempt to clarify the complexities in the formation of word values later, in section 6. Some of the compounds, such as  and  , have word values formed, or can be viewed as such, by appropriate skeletons of those of the individual signs involved. It is possible that these words evolved from compound-words formed by the words of the individual signs involved, but we meet the script at a stage where the individual signs appear to have taken also the form of appropriate skeletons of the word involved. Also such skeletal values appear to occur only within the compounds. Some of the compounds might have compound-word values, such as  which has high frequency, but most of these probably have low frequency of occurrences. Some of the compounds, mostly used at the beginning of a principal block and whose components can be clearly identified (for instance  ), have been used to form auspicious phrases induced by the word values of the component signs (see 5.1.1.) However, it is possible that such compounds might also have word values that correspond to the (numeral) values associated with the appropriate combinations of the component signs. The first order numerals and some of the basic metrical numerals, especially the ones involved in the formation of compounds, as well as the divinity signs, have taken the character of phonetical signs, either for the sounds of their words or appropriate skeletons. Generally, there are some established conventions for reading the texts, as explained above in 5.1.1.

The preceding derivations unfortunately do not give any clear indications as to the possible nature of phonetical writing that might have been employed for purposes other than that on the seals. It is possibly in a more evolved form than the one on the seals, in view of the preceding possibility of a fairly clear knowledge of the phonetical construction, but the exact form cannot unfortunately be identified based on the present texts only, since they represent essentially a different system. In fact, the writing in the seals can be classified as a form of monumental type in the sense of employing standard words and phrases subject to established conventionalizations, so that such simplifications will not be available in general. However, we have seen in 5.1.1 the possibility of phonetical construction at the beginning of texts in a general system other than the one derived in Part I, the nature of which can be classified as word-syllabic, in the

sense of Gelb (1963). One can attempt to further identify such readings, in particular those cases for which complete texts might have such a possibility, but, as indicated earlier, they are unlikely, though not impossible, since that would mean that a single construction needs to have two different meanings in two different systems. There are also dangers in attempting to identify those possible exceptional cases. That is, it may not be impossible to 'derive' some form of phonetical readings in both the systems for a few texts conveniently chosen with this aim, in view of the brevity of the texts, but they cannot be relied upon unless they can be verified through several interlocking clues, which are unfortunately not available generally, except for the results derived so far.

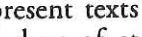
In order to have reliable phonetical readings of the present texts themselves, it is essential to obtain approximate word values of at least the frequently used signs. For an indication of the difficulty with regard to the signs other than the first order ones and the compound ones involved in 5.1.0 - 5.1.4, see some of the tentative derivations in 5.1.5, which we are unable to use in the further analysis with confidence. Even if one has such reliable approximate word values, the phonetical reconstruction of the texts confined to a *restricted system* is still largely a different matter, since the readings by those who actually used them might have involved several conventionalizations, including phonetical ones, which can change from time to time in some details, while the subsystem in question itself has unfortunately not survived completely in the form it was used by the Indus.

For this reason we have avoided the phonetical reading of individual texts, except in one case that appeared to incorporate some recognizable clues. The text involved is  . The associated seal (partly broken) has attracted many scholars, in view of the very unusual iconography in the form of an anthropomorphic figure surrounded by many animals (elephant, rhinoceros, buffalo or bull, lamb?, tiger, and man (also the horns of one more appear to be partly visible from the broken part)), see the Figure (negative.)





Note that any iconography other than a bull is not usual or typical. Apart from this, we have a fairly clear understanding of the phonetical values of all the signs involved. In addition, even though the writing fits very well into the system we have examined, it also exhibits some unusual features, leading to the suspicion that it might have been so constructed as to fit into another system also. For instance, the man sign is placed at the right end, whereas its usual place is to the left of the divinity sign  , when this divinity sign occurs. This same divinity sign is also repeated in the middle of the text, precisely aligning with the head of the anthropomorphic figure.

Recall that the numeral value of  is || . Also, the man sign does not have any concrete value. Thus the amount specified by the system derived is simply  , which involves two construction units,  and , where  is a ligature of  and  . Now viewing the signs phonetically, we have the following values:  = *aṇ*,  = *mā*,  = *āḷ*,  = *l-*,  = *vēl*. (The numeral word value of  is *ulu*). Regarding  , it was already noted that it might stand for a length measuring device, and is related to  which has the consonantal value *ṭ*. An archaic length measure having this value is *aṭi* (which also means foot, among many other related meanings). With these values one gets the straightforward reading:

*aṇ-mā-aṇ-vēl-aṭi-l-āḷ* → *aṇmān vēlaṭiulāḷ*,

which means 'glorious deity (and ) those under (His) divine feet', or interpreted simply 'glorious deity and His subjects'. This also fits into the external suggestion obtained from the figurative representation on the seal. Also note that archaeologically this seal appears to belong to a lower level of the site Mohenjo-daro, according to its excavator Mackay (1938).

## 5.2. Analysis of fitting the Brahmi system as a subsystem

### 5.2.0

The preceding derivations indicate that the phonetical system used for the general, possibly limited, purpose of communication might have been at least in the form of word-syllabic, possibly at the stage of

type 3 objects itself, since most of the signs involved in the preceding analysis occur in type 3 objects themselves, and the construction in a single phonetical system would have been simpler than the one that will fit into two different systems. Note that the phonetical constructions derived earlier cannot be taken as prototypical since they fit two different systems. While the exact form of such a system is impossible to derive, one can attempt to see if it could have gradually evolved, eventually taking the form of the later Brahmi system. The reason for suspecting such a possibility is that in the course of the process of derivation of the vowel and consonantal values given above, we happened to notice striking similarities, both with respect to the outer structural forms of the signs as well as their sound values. Thus our next step will be to see if the phonemes and the corresponding sign forms derived above were continued to be used, through a study of possible connections with the later Brahmi script. Such a study will also provide further support to the validity of the preceding derivations.

There are several excellent sources regarding the Brahmi script, for example Bühler (1904), Dani (1963), Mahalingam (1974) and Mahadevan (1968), of which the last two, especially the last one, give a detailed treatment of early Brahmi inscriptions written in Tamil, one of the major Dravidian languages. There are several conflicting theories regarding the origin of the Brahmi script. The one that appears to have been generally accepted by most of the Western scholars takes the view of West Semitic origin, a theory put forward around the turn of this century by its chief architect Bühler (1898), one of the pioneers in Indian palaeography. Unfortunately, the theory is based mainly on formal comparisons of the external forms of the signs, a standard method of the older school of authors of the early period, often forcing the comparison in order to have an arbitrarily limited phonetical match also. Often, several *a priori* speculative statements or arguments are also brought in to support the theory. Since the book by Gelb (1963) contains a detailed discussion of the dangers involved in such formal speculative and subjective methods, we shall not go into further details of that theory. While Gelb (1963) rejects the methodology, he is also inclined to accept a Semitic origin for different reasons. Since his reasonings will be of relevance to us, we shall indicate them. The main reasoning is that the inner structural characteristics, that is, the methods of vocalization involved in both the systems, are similar.





Another is that the material evidence regarding writing in the Indian subcontinent is available only starting from the third century B.C., whereas that for the Semitic system starts from around the middle of the second millennium B.C. These facts, together with the possibility of cultural contacts between different cultures, might have led to his conclusion.

On the other hand the data we have derived so far is much more extensive and is of a different nature :

1. We have seen a fairly clear evidence for the possibility of the use of a purely phonetical system for the purpose of general communication, at least in a restricted way.

2. We have seen the possibility that the system of measures, as well as the numerology associated with them or in the construction of them, involved under the restricted system derived in Part II, was continued to be used in some form during historical periods, leading to the same possibility for other systems employed by the Indus.

3. If one takes into account the principle of economy (Gelb 1963: 251) in the sense that in many of the earlier phonetical systems (or many of even the current ones), the differences between, for example, voiced, voiceless and emphatic consonants, or between some of the vowels, were not incorporated into the signary, that is, the differences would be either entailed or understood by the contexts, the phonemes systematically derived above constitute the basic and essential phonemes, as will become clear below.

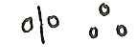
4. The fact that the seals did not continue to be used cannot be taken alone to suggest the possible disappearance of the writing system itself. For instance if the material, steatite, of the seal was replaced, for instance by some of the more efficient and reusable metals, then it may not be surprising that they have not survived since they would have been recycled. In addition the seals were only one of the many mediums on which the system was represented, and the possibility that some of the functions or purposes of some such mediums were replaced by alternative ones, for reasons of simplicity or efficiency, cannot be excluded.

Thus we shall also follow Gelb's method of analyzing the inner structural characteristics, but based on the details of the preceding data, whereas no data was available to Gelb.

The first important point to note regarding the inner characteristics is that each of the consonantal skeletons derived earlier stands either for the consonant itself or for the consonant plus an appropriate vowel, which is also the case for both the Semitic and Brahmi systems. (Here and in what follows we are ignoring the fact that the vowel differences were indicated, either precisely or approximately, in both the systems). On the other hand we have also seen the possibility of a separate signary for some of the vowels, which is also true for Brahmi (which used the signs for vowels explicitly only at the beginning of the words), but not for the Semitic system, which, according to Gelb (1963), is possibly in analogy with the Egyptian consonantal phonetic system. With these preliminaries, let us present a comparison table, where the first column gives the basic phonemes, the second column gives the corresponding *system* of Indus graphemes derived earlier and the third one that of the Brahmi. There were some regional differences in the external forms of Brahmi graphemes. Though they are only minor structurally, we have included representatives of these variants in order to facilitate the comparisons. We have also included some from southern part of India, especially the ones in Bhattiprolu inscriptions where the differences are visible.





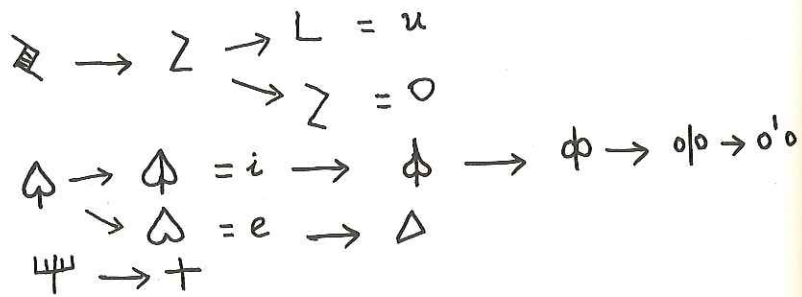
| | Phonemes | Indus graphemes | Brahmi graphemes |
|---|---|---|---|
| 1 | *a* |  |  |
| 2 | *i* |  |  |
| 3 | *e* |  |  |
| 4 | *y* |  |  |
| 5 | *u* |  |  |
| 6 | *o* |  |  |
| 7 | *k* |  |  |
| 8 | *c* |  |  |
| 9 | *ṭ* |  |  |
| 10 | *t* |  |  |
| 11 | *p* |  |  |
| 12 | *r* |  |  |
| 13 | *m* |  |  |
| 14 | *n* |  |  |
| 15 | *v* |  |  |
| 16 | *l* |  |  |

In making the comparisons, we shall again try to isolate possible gradual systemization. First let us look at the signs which involve essentially no change or only a change in angle. These are 8, 9 and 13, corresponding respectively to *c*, *ṭ*, *m*. In the case of 8, essentially no change is involved, in 9 it is turned 90 degrees and in 13 it is turned upside down.

In order to understand the changes involved, note that, as indicated earlier, the vowel changes in Brahmi are indicated by diacritical marks attached to the consonantal signs, usually at the top. As a result the verticals of the Brahmi consonants are in general drawn with tapering thickness, giving the general apparent impression that vertical lines are suitably extended or attached at the top of many consonants in order to accommodate such diacritical marks. Thus the changes in angles in the signs 9 and 13 appear to be made in order to have the convenient accommodation of diacritical marks at the top. No such change is required in the case of 8. (Here and in what follows, we mean that the changes in angles and in other respects took place gradually over a long period of time).

The sign 1, which also accommodated diacritical marks extensively in the process of lengthening its sound value, involves also essentially a change in angle initially, in the form

Next, let us consider the cases where the changes involved may be considered due to the process of simplification or linearization. These are 2, 3, 5, 6, 7, with the changing process *approximately* given by

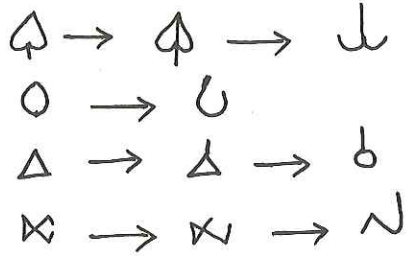


Note that this also indicates that the distinction in the sign forms between *u* and *o* or *i* and *e* emerged only gradually.





Next let us consider the signs where a vertical line is created, either by deletion or addition of appropriate sections. These are 4, 11, 15, 16 with the approximate changing process given by



Here the situation with respect to the consonant *y* is rather interesting. The same sign is possibly used initially for *i*, *e* and *y*, that is, these were differentiated depending only on the context. Later, when these phonemes and the vowel changes were differentiated more precisely, a separate sign for the consonant *y* evolved in the form of a gradual modification of  in order to accommodate the diacritical marks.

The change in the case of 14 could have occurred, for instance, in the process of lengthening the vertical line at the top without changing the total vertical length of the sign.

Thus all the changes can be explained in a straightforward manner either in terms of the process of simplification (linearization) and/or in terms of simple changes or modifications for the purpose of accommodating the diacritical marks. Now let us see how the preceding derivation stands with respect to the writing system of a Dravidian language, Tamil. The reason for choosing this language is that it is believed to have preserved more archaic nature than other Dravidian languages, at least in the extant records dating back to the beginning of this Christian Era. In addition the basic phonemes of the writing system of this language that are not covered by the above discussion are not many and it also appears that all of the missing ones can be approximated by the ones in the above list. The basic ones that are missing are *t*, *l*, *l̲*, *ṉ*, *ṅ*, *ñ*, *r̲*. At an early stage it is unlikely that the difference between *l* and *l̲* would have been differentiated graphically even if one assumes that the difference between their sounds was serious enough in the context, possibly limited, in which the writing was employed. Actually the Brahmi sign form of *l̲* appears to have been derived from that of *l*.

The same appears to be the case with respect to *r* and *ṟ* and with respect to *n* and *ṉ*. Further, in Dravidian, the sounds *n* and *ñ* would normally be entailed by the contexts. For instance *ṅka* is an approximation to *nka*. For this reason it is unlikely they would have been signified separately. Similarly when forming the Brahmi sign for *ḷ*, it appears to have been considered as a (consonantal cluster) compound sound (*ḷ* = *ṭl*, approx.?). Thus the only phoneme that is left is *t*, the difference between the sound of which from that of *ṭ* appears to be significant. Its Brahmi, sign form suggests many possibilities; it could have been derived as a modification of that of ṭ (  ) or from the sign of one of the variants of the numerals nine (  ) or ten (  ), the etymologies of both of them contain the skeleton *t*, and they have also been used in forming ligatures.

Thus the preceding discussion appears to be satisfactory with respect to the logical rigor of the derivation and with respect to the writing system of at least one of the languages of India. It should also be emphasized that the Brahmi writing system surfaced as a full writing system in the sense that it precisely differentiated the vowels through diacritical marks in addition to having separate signs for all the basic phonemes necessary to express the various Indo-Aryan languages of India in a rather extreme minute detail. (See I.3.1.0 for some caution that needs to be exercised in the classification of Indo-Aryan). One gets the vague impression that in forming the signs for, for instance, soft consonants, these were treated as variants of, or approximations to, the corresponding hard ones, but unfor-tunately we have been unable to see or isolate any systematization in such possible modifications, possibly because they occurred at various stages in which the signs were treated as mere identification marks. Also note that any such process must involve a slow and gradual emergence of certain conventionalizations in the form of assimilation and acceptance by the wider public, and hence would have taken a long period of time.

### *6. Possible formative stages*

Having seen the possibility that the writing systems as well as the systems of metrology and numerology employed in later historical periods of India are continuations of those employed during the Indus period, we shall take up briefly some of issues regarding the





formative stages of the Indus script that were not completely clear to us. Unfortunately the nature of this sub-section, the last part of the paper, is different from that of the previous sections in the sense that, unlike the previous sections, it does not involve any concrete data pertaining to the issues discussed, since by nature no concrete data appears to be obtainable. In spite of this and the fact that none of the previous sections depend on such issues, we would like to discuss them since they cannot be left entirely unattended either.

It was indicated in earlier sections that in the formation of the word values of many of the Indus signs, phonetical transfer is apparently involved in some form; but the actual process involved might be more deeper than the one implied by the easy answer of phonetical transfer. We shall clarify this point a little more. For convenience, we start our discussion with one such sign, the fish sign, which stands for a root, that is, a metrical numeral. It has the word value *mā*. As discussed in I.3.3.2, the idea of phonetical transfer is apparently involved in using the fish sign to signify the measure having the same word value. Note that the fish sign is one of the frequently occurring signs in a highly conventionalized and simplified form, in type 3 objects. Also note that it is one of the Indus signs that occur as 'potter's marks' at the stage prior to the mature urban phases, in the same conventionalized form, possibly at least as early as 3000 B.C., as is the case for instance as potter's marks at the early Harappan site Rehman-Dheri (see I.2.3.4), where other roots such as  ,  and  also occur in highly conventionalized and linearized forms. Such an early occurrence means it is not clear as to when the sign, in some form, came to be conventionalized to signify the unit of volume measure. In addition, questions such as, as to why phonetical transfer was needed to represent as concrete an object as a unit of volume measure, and even if phonetical transfer was necessary, why the fish sign was chosen and how such a conventionalization process came to be realized uniformly in such a vast river valley at such an early stage, do not have satisfactory answers. Further, it is also not clear if such an abstract conventio-nalization process can in any sense be considered as an 'invention' or a conscious creation at all, since we have already seen that even the basic abstract numerals were arrived at from concrete metrical measure-ments only through a long process of evolution.

Even though answers to these questions are not essential for the present purpose, one can give the following plausible reasonings

which however are only in the nature of '*a priori* scheme of things' (Lieberman (1980)), since they cannot be supported by data, although they are grounded on the results of the preceding sections. Recall, again restricting our discussion to the fish sign, that earlier in I.3.3.2 we have given arguments for the possibility that the unit of grain measure signified by the fish sign might have evolved from a suitable unit of edible flesh. Assuming this, one plausible answer to the preceding questions is that the beginning of such a process might have occurred at a stage when the edible flesh of different animals were referred to by the same word *mā*, being the word that stood for animals in general (see I.3.3.2), so that only one form of signification was needed to designate the spoken word-sign of the unit of edible flesh. Also, at such an archaic stage it is natural to define the unit involved in terms of rough size of the amount, in particular in terms of the whole amount of flesh of a suitable animal that has a convenient interpretation in terms of size and other factors. Assuming that the animal fish is gradually conventionalized, as is possibly natural in a river valley with one of the major rivers of the world, as a convenient form of signifying such a unit of measure of flesh, in the next stage the same spoken word-sign might have been used to signify the equivalent unit of volume measure of grain, as is natural in a barter system. At that stage, note that there is a break-up, though not completely, of the intimate relationship that existed between the spoken word-sign of fish and the unit of flesh. It appears that the graphic representation, in some form, of fish to signify the associated spoken word-sign of the volume measure might have occurred at least at this stage, otherwise we do not know how to explain satisfactorily the involvement of the fish sign. At this or the next stage, note that definitive relationships between this volume measure and other units of volumes, as well as the units of various measures associated with other goods and services, might have evolved, and the fish sign then signifies all such 'relationships'. Exactly the same reasonings hold with respect to other root signs. In the next stage, more elaborate units of measures, constructed from basic units of measures might have evolved in the spoken language. If the language involved is agglutinative, as is the case for Dravidian (and Sumerian ?), or any language that employed the agglutinative process for the restrictive subsystem involved, then the words and phrases associated with such measures will be evolved by simply putting (accumulating) together the words of basic units in a suitable





syntactic order (see I.3.4.1), so that such words and phrases of the spoken language might have been represented graphically simply by replacing the word-signs of the basic units involved by their corresponding graphic signs. Here the order of occurrence of the signs need not coincide with the corresponding order in the spoken language, since in view of the brevity and limited nature of the writing such factors could be understood by convention and contexts, and other factors such as the need to introduce further semantic (ideographic) suggestions might also have been involved.

In this connection one must also take into account the archaic nature of the language in the sense that the words would have been of simple forms, individual word forms within the compound words would have been basically intact, and the lexical similarities between different words having seemingly different meanings would have been very close. The arguments involved in the etymological studies of the preceding sections give sufficient evidence of this fact. As a specific example, we may mention the case presented in 5.1.2 in detail in which the compound word 'five-eight' (= *kai-eṭṭu* = hand-step) is represented by combining the signs of five and eight, but the combination is transformed graphically into the form of a hoe (= *kai-ettu* = hand-kick) exploiting the fact that the compound word that stands for a hoe almost coincides with that of 'five-eight'. In this way, signs such as the fish sign will gradually evolve into further signifying the sound value of *mā* in general. In addition, we have seen the possibility that when the compound word formed by the combination of two signs evolves into a single word, the individual component signs involved will naturally evolve into signifying the respective skeletons suggested by that single word. In this way some of the signs which initially stood for words will evolve into signifying the sound values of appropriate skeletons. This can lead to a complete system of phonetical writing, though such a system might have been used in limited way. As is demonstrated in 5.1.0 - 5.2.0, it is possible that we meet the Indus script at least at this stage in type 3 objects.

Unfortunately, we have been unable to see anything that can be called 'revolutionary' in the preceding evolutionary process that possibly led to what we now call writing in the case of Indus. Indeed, it appears that such an evolutionary process is not basically different from that associated from any other technologies, such as pottery, where each stage of the evolution depends on, and proceeds from, the previous stage, and no stage can be called revolutionary, including for

instance the stage of wheel-turned potteries. In addition the evolution of any one system needs to be considered only as a component of a system of interrelated systems. In this sense it is possible 'writing' could have evolved independently among many different ancient cultures, though the exact course of evolution might depend on the nature of the information or message the particular culture needed to communicate and record through graphical and related significations, and the form of the conventionalization process employed for that purpose.

One can also similarly argue that one of the purposes of the tokens (type 3 objects) might have been iconic in the sense that they give iconic values to the meanings associated with the writings on them or with their outer shapes, when such iconic values are necessary, as is the case for instance when one obtains a service and the service is paid by the currency whose function is iconic. Here we are not suggesting that the tokens served as coins, but as an icon with an inherent promise governed by the custom and convention of the society. In this sense the possible functions of type 3 objects suggested by Shendge (1984) that they are calculi or accounting devices, might be secondary.

In this connection it may be mentioned that a recent evolutionary model by D. Schmandt-Besserat in her book (1992) (to be referred to hereafter as DSB) with respect to Sumerian, proposes that the immediate precursor of writing is a system of clay tokens that represented various goods and services and were used as calculi and accounting devices. The proposal that a certain restricted class of clay tokens in question might have been related to the origin of Sumerian writing is due to P. Amiet, according to the above book and many others. However, the proposal, put forward since (1977), that the clay tokens in general, which the above book shows to have started to exist since the beginning of the neolithic stage, formed the immediate and only precursor of writing in the sense that Sumerian script directly derived from them, is due to Schmandt-Besserat. Several scholars have expressed reservations regarding the proposed model; the most notable one is due to Lieberman (1980). Since we are not schooled in archaeology, we do not feel at home, unfortunately, in subjecting the archaeological data of clay objects in question, or the detailed analysis of such a data done by the preceding authors, to a proper critical view.





The reason for our interest in the opinions of the above authors is that in the case of Indus also, the shapes of type 3 objects (miniature tablets), as well as some of those of type 2, are clearly related to some of the sign forms, specifically the ones that represent some of what we have called basic forms of metrical numerals, which by themselves can form a restricted system, as we have seen previously. Our purpose here will be merely to make certain remarks based on the results of the present paper in connection with those opinions. For convenience we shall restrict our attention to opinions of the above two authors, though related opinions have been expressed by others, see the references in the above works. First, it is generally an accepted fact, in particular by Lieberman, that a certain restricted class of clay tokens, in shapes such as solid clay spheres and cones, called 'calculi' by Lieberman and 'plain tokens' by DSB, of the third and fourth millennium B.C. is *related* to the system of numerals of the Sumerian script that existed in parallel at around the same period; for the details, we refer to the above mentioned works. Therefore, the question of concern here is as to whether the Sumerian script as a whole, at least at the 'initial stage', directly *derived* from the three-dimensional clay objects, as proposed by DSB.

It would be convenient to briefly recall the basic points of the proposal. In the case of the impressed signs that represented the system of 'numerals' of the archaic solid clay tablets, their shapes can be clearly identified with those of a class of plain tokens mentioned above, through successive intermediate stages. We refer to the book by DSB, chapter 6, for a detailed and thorough analysis. Initially these tablets consisted of only such signs, meaning that the things counted were either left implicit or incorporated into the signs themselves, that is, in our terminology, they were possibly used in the form of metrical numerals. This is natural if the tablets had only a restricted function initially. The identification has also a logical basis since it is clear, as noted by Lieberman, that these signs formed a system among themselves. Here it may be noted that this need not mean that the society that used this system did not know earlier how to represent even a restricted class of numerals, and the objects counted graphically in concrete situations, at least in the form of repeated strokes. What is involved here appears to be a deeper aspect, that is, a gradual attempt to conventionalize a certain system, possibly incorporating several meanings to be understood by convention, with clay as a medium, as is implicitly recognized in

Lieberman (1980). The function of these tablets were also probably more profound than the one associated with mere calculi or recording.

Now, the difficulty arises with the next stage of the development, where the clay tablets incorporate also incised or scratched pictographic signs, but with the signs of earlier system, as well as the system itself, always distinguished by representing them in impressed forms. The book proposes that the bulk of the pictographic signs are also representations of what the author calls complex tokens, that is, clay objects of various shapes with extensive markings on them, which according to DSB signified various commodities (for example 'a jar of oil' , but with no other meanings such as the ones associated with our metrical numerals). These complex tokens were coexisting with the preceding clay tablets bearing only impressed signs. Lieberman objects to this part of the proposal on several grounds. In particular, he argues that the comparison is done based on purely formal comparison of the token forms with the outer forms of certain signs, that is, no systematization, analogous to the one associated with plain tokens, appears to have been isolated. What is meant here is probably analogous to the following. In the case of Indus the shapes of type 3 objects can be identified with certain basic forms of what we have called metrical numerals, which are frequently modified to form new metrical units. In other words, these type 3 objects could form a system by themselves, for instance analogous to a system of coins. In view of our limitations, unfortunately, with respect to the archaic Sumerian clay tablets, we have no idea as to the possibility of the derivation of any analogous systematization with respect to the complex tokens of Sumerians. We do not even know the extent to which the archaic pictographic clay tablets are currently understood. However, even if such a suitable systematization can be isolated, it is unfortunately not clear to us if the three dimensional token forms preceded pictographic forms, at least in the case of Indus, for the following reasons.

First, as to the possibility that the shapes of type 3 objects of the Indus represent those of three dimensional counterparts, if they can be defined or identified, note that according to the excavator Vats (1940), they measure in length from 0.36in to 0.7, in width 0.25in to 0.6in, and in *thickness* only 0.05in to 0.13in. In addition, it is rather unclear if some of the signs related to the shapes of the tokens could have evolved in three dimensions. For instance one of the tablets has





the shape  which corresponds to the the sign  that has the possibility of representing a metrical numeral through an apparent phonetical transfer. This is unlikely to have occurred first only in three dimensions. Similarly the tablet, of type 2, of cube shape (see I.3.3.1), one or two of its sides completely occupying the sign  , appears to be an appropriate carrier of the two-dimensional sign form  and the meanings or the value associated with it. Indeed, it is not clear as to how one can represent this sign in a token form without some form of graphical aid. Features such as these appear to be present also in some of the Sumerian clay objects described as complex tokens by DSB, as has been pointed out by Lieberman, raising the question as to whether they have the possibility of appropriate carriers of the meanings related to the two-dimensional signs involved. Note that these reservations by themselves cannot entirely invalidate the proposal in question. However, many of the tablets, such as the one of fish shape, which have the apparent possibility of having represented at some stage their three-dimensional counterparts, correspond to the signs that have deep and complex meanings far removed from the corresponding three-dimensional shapes, as we have seen. According to the proposal in question, such meanings were then carried by the token forms before they were transformed into the graphical forms. What is a little puzzling for us here in this proposal, in view our own limitations in the subject under discussion, is that if it can be assumed that a society which can gradually conventionalize deep and complex meanings in the form of clay tokens modeled on three dimensional objects, then how can it entirely fail to conventionalize the corresponding graphical forms, at least in isolated forms analogous to tokens, since there is no reason to doubt the ability of that society to evolve abstract graphical representations of real objects?

In this connection it is to be noted, however, that the tokens of the Sumerians under discussion belong to the stage where the script was at an earlier stage of evolution than the stage of Indus writing on type 3 objects. The analogous earlier stage of the Indus has survived, unfortunately, only in the form of 'potter's marks' of the pre-urban phases. Even at that stage, many of the signs occur in a highly conventionalized as well as linearized form, in contrast to the conventionalized monumental form on type 3 objects, including some that correspond to the shapes of type 3 objects, see I.3.3.1. There appears to be no reason to doubt the fact that the signs constituting

such potter's marks have meanings the same as those of the stage of type 3 objects, including numeral meanings. But, unfortunately, we have not checked if the corresponding token forms also coexisted at that stage. For this reason, let us pass on to another point of the proposal in question.

The point in question is that DSB attributes the evolution of abstract numerals also to clay tokens. Unfortunately, we are unable to see a clear evidence to this possibility, at least in the case of Indus. First, if we look at the sequence of numerals given in I.4.1.0, the class that took the abstract form first appears to be what we have called first order numerals, which include four to nine. These are represented by signs of linear forms also, unlike the Sumerians who represented them (within a system) only in a concrete form analogous to what we have called straight numerals. These sign forms do not give any clear indication of their association with token forms, though they evolved through concrete metrical measurements. For instance four is represented by a grain,  or , and five by a hand,  . The etymology of six is vessel (that served as a mortar), but its sign form is represented by pestle, . Indeed these signs are perfect abstract depictions of real objects. The same is possibly true for eight. Seven is represented through an apparent phonetical transfer since its etymology does not correspond to any concrete object or action. Nine is represented as the sum of eight and one. Note that representations of these in the form of straight numerals are also common (subject to certain conventionalities), which in fact are likely to have been the 'initial' forms and can be represented only graphically.

As to the abstract forms of the meanings of these numerals, they could have very well evolved in the form of word-signs in the spoken language in the process of actual complex dealings with various metrical units themselves. The same remark can be made with respect to deep and complex meanings associated with other types of numerals such as metrical numerals. Indeed, assuming that clay tokens, analogous to type 3 tokens but without signs on them, representing some of these metrical numerals were existing in the pre-urban phase, the circumstances under which such tokens were used would have been far fewer than those that involved the actual metrical units in the medium of the spoken language, such as for instance in the barter system of trade and business, as far as we can imagine. Even the suggestion of Lieberman, which at first thought





appears to be quite plausible, that a certain class of what was earlier called plain tokens, in view of their possible use as counters at an archaic stage, were responsible for the size value notation of Sumerians, which later evolved into a place value notation, appears to be not entirely unquestionable on further thought. For instance when a farmer, literate or illiterate, describes the amount of the yield of his cultivated grain, he would instinctively count first by cart-loads, then by sack-loads, and then, if any amount is further left, by the approximate fraction of the sack-load or by the number of a still lower unit. In other words, a form of size value notation appears to be inherent in the very nature of the gradual stage by stage evolution of the metrical measurements. Thus it is not clear to us if the fact that the two-dimensional representation of the system of Sumerian numerals is clearly related to certain clay tokens can be taken to mean that the tokens were entirely responsible for the evolution of the associated abstract meanings. Neither can the degree of abstraction of the numeral meanings in the system of the medium of the spoken language be related to the concrete nature of objects, either tokens or graphemes, used to represent such meanings, since transforming the meanings of one medium into another medium is a complex process. Indeed the results of the present paper appear to clearly demonstrate the decisive role the structure and the form of the spoken language have played in the stage by stage evolution of numerals at various levels, and it is a possibility that the same process that induced such a development also induced parallel attempts to represent such structures through graphical and other related forms, at least in a restricted way, influencing, and influenced by, the successive stages of the development.

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**Additional References**

Bühler, J.G. 1904. Indian Palaeography. (English translation by J.F. Fleet). Appendix in Indian Antiquary, 33.

Bühler, J.G. 1898. On the Origin of the Indian Brahma Alphabet. Strassburg.

Dani, A.H. 1963. Indian Palaeography. Oxford University Press.
Lieberman, S.J. 1980. Of clay pebbles, hollow clay balls and writing: A Sumerian view. American Journal of Archaeology, 184, p. 339.
Mahadevan, I. 1968. Tamil-Brahmi inscriptions of the Sangam age. Second International Conference-Seminar of Tamil Studies. Madras.
Mahalingam, T.V. 1974. Early South Indian Palaeography. Madras.
Schmandt-Besserat, D. 1977. An archaic recording system and the origin of writing. Syro-Mesopotamian Studies, 1, p. 31.
Schmandt-Besserat, D. 1992. Before Writing, Vol.1: From Counting to Cuneiform. University of Texas Press, Austin.
Shendge, M. 1985. The inscribed calculi and the invention of writing: the Indus view. Journal of the Economic and Social History of the Orient, 28, p. 50.