TOWARDS A GRAMMAR OF THE INDUS TEXTS:
'INTELLIGIBLE TO THE EYE, IF NOT TO THE EARS'

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I. STRUCTURAL AND ANALYTICAL STUDIES OF THE INDUS TEXTS

It might look strange to set out to formulate a grammar for texts written in the still undeciphered Indus Script. Emil Forrer (1932) however demonstrated more than half a century ago that it is possible to acquire an objective comprehension of inscriptions written in an unknown language by observing the parallels with known inscriptions of the ancient world. Such parallels include self-evident ideograms (of deities, commodities etc.), set phrases found in royal proclamations, religious formulae or commercial documents, and also the context of occurrence (on seals, bronze weapons, pottery etc.). As Dobhlöfer (tr.Savill 1961) notes in his summary of Forrer’s work, “a simple comparison of these texts will reveal the signs employed for case-endings, pronouns, personal suffixes, demonstrative pronouns, relative and interrogative pronouns; also the adverbs, prepositions, conjunctions, particle and verb forms—in short, the basic features of a grammar, intelligible to the eye, if not to the ears”.

Formal or structural analyses of the Indus texts (as distinguished from attempts at phonetic decipherment) have been carried out by a number of scholars ever since the discovery of the Indus Civilization and its writing. The earlier studies include compilation of annotated sign-lists (Langdon in Marshall 1931; Hunter 1932 and Dani 1963), sign-manuals and concordances (Gadd and Smith in Marshall 1931, Hunter 1934, Vats 1940), studies on direction of writing (Ross 1940, Lal 1961) and notes on individual signs or groups of signs (e.g. Ross on 'numeral' signs, 1938). The most outstanding work in this period is that of G.R.Hunter who provided reliable eye-copies of the inscriptions, a sign-list, a well-arranged concordance and a detailed positional analysis of the signs.

The computer arrived on the scene in the mid-Sixties. A Soviet Group under the leadership of Y.V. Knorozov has published an important series of papers (Proto-Indica: 1965, 1968, 1970, 1972, 1973 and 1979) setting out briefly the main results of their computer-aided investigations of the proto-Indian or Indus texts. M.A.Probst wrote the computer programmes for the Soviet Group. Statistical-positional analyses of the texts were carried out by G.V.Aleksseev, and A.M.Kondratov. Structural-analysis of the texts was undertaken.
by Y.V.Knorozov. B.Y.Volchok has concentrated on the interpretation of the iconographic and ideographic motifs on the basis of parallels from the later Indian traditions.

Almost simultaneously, another independent investigation of the Indus texts by using the computer has been undertaken by a Finnish group, first at Copenhagen and later at Helsinki. Seppo Koskenniemi wrote the computer programmes to develop a method to classify characters of unknown ancient scripts and to compile a concordance to the Indus texts based on pair-wise sign-occurrences in collaboration with Asko and Simo Parpola (1970, 1973). More recently Kimmo Koskenniemi and Asko Parpola have developed the computer programmes to generate a corpus of texts (1979), analysis of duplicate texts (1980) and a revised concordance based on single-sign occurrences (1982). Kimmo Koskenniemi (1981) has also used computational linguistic techniques to study syntactical patterns of the Indus texts. Asko Parpola has dealt with structural problems like direction of writing, word-division procedures, and syntactical analysis of the texts, in addition to his papers concerned with phonetic decipherment and its further implications. (See especially A.Parpola 1970, 1971, 1975, 1976, 1979).

In India, computer analysis of the Indus Script is being carried on from 1971. K.Visvanathan (1973) developed a preliminary computer programme to generate a sign concordance at the Fundamental Engineering Research Establishment, Madras. Later the work was carried on at the Tata Institute of Fundamental Research, Bombay, where Mythili Rangarao and N.Soundararajan developed the computer programmes for generating and photo-composing of the texts, concordance and tables compiled by me and published by the Archaeological Survey of India (1977). A computerised Data Base for the Indus Script has been built up at the Tata Institute of Fundamental Research, Bombay, by Mythili Rangarao and Mahadevan (1977; also in this vol.). I have also published the results of my work on the direction of writing and word-division procedures based on the concordance (1980). In recent years another independent computer analysis of the Indus texts (based on the data from the Indian concordance) is being attempted by Gift Siromoney and Abdul Huq (1981, 1982; and in this vol.) at the Madras Christian College.

The most recent structural analysis of the Indus texts is by Walter A.Fairservis Jr. (1977, 1980). He has developed a technique for analysing the texts on a 'grid' in order to bring out the syntactical order and grouping of signs in repetitive formations. His grid demonstrates once again the set order of signs already noticed by the Soviet Group and fully documented in the Finnish and Indian concordances.

Another model of decipherment based on an entirely different concept of structural analysis has been recently proposed by S.R.Rao (1982). He analyses the signs themselves rather than the texts and concludes that the Indus Script consists of only about 60 'basic' signs which possess alphabetic or syllabic phonetic values. I shall pass over in silence many other attempts based on intuition rather than on analysis. The interes-
tred readers will find all the recent attempts to decipher, interpret or otherwise analyse the Indus Script listed in the Bibliography of recent studies on the Indus Script (I. Mahadevan and Mythili Rangarao in this vol.). In the discussion which follows I have taken into account only the results of what appears to me the 'mainstream' of structural studies of the Indus Script and the texts.

It will be noticed that in this brief summary of the earlier work on the Indus Script, I have strictly confined myself only to that part which deals with formal or structural analysis of the script and the texts written in it. The very diversity of the phonetic values proposed by scholars demonstrates that we have not yet reached the stage where phonetic decipherment would logically and inevitably follow from structural analysis (as was the case with the grid analysis of the Mycenaean Linear-B Script developed by Michael Ventris). For the moment we can only go ahead with the analytical work, already fairly well advanced, but taking all linguistic speculations, even when based on sound structural analysis, with a large pinch of salt!

I propose to attempt here a preliminary synthesis of the results of structural and analytical studies of the Indus Script, confining myself only to those aspects which do not depend on the identification of the Harappan language, much less on the alleged phonetic values of individual signs. The synthesis will take into account the results achieved by a study of parallels as well as those of statistical-positional analyses of the material available in the Finnish and the Indian concordances.

The objective of the exercise is to find out the basic characteristics of the script and the texts on which any valid decipherment has to be based. To put the matter in another way, no attempted decipherment is likely to be true if it contradicts or is not in accordance with the basic findings of the structural analysis of the script and the texts. For the sake of brevity as well as clarity, I shall attempt to formulate the results in the form of an empirical and experimental set of 'rules of grammar' with brief comments on each rule pointing out to the evidence on which it rests. It is proposed at a later stage to test the validity of these 'rules' on the computer and attempt further refinement.

II. CHARACTERISTICS OF THE INDUS SCRIPT

1. The Indus Script runs normally from right to left.

This is perhaps the best established fact about the Indus Script. For detailed justification of the rule, see Marshall (1931:40), Gadd and Smith (in Marshall:410), G.R. Hunter (1934:37), A.S.C. Ross (1940), G.V. Alekseev (in Y.V. Knorozov et al. 1965), B.B. Lal (1966, 1968) and I. Mahadevan (1977, 1980). Walter A. Fairservis Jr. did experiment briefly with a left-to-right direction (1977), but later gave up the idea and has opted for the right-to-left direction (1980), now almost universally accepted.

2. When a line of text runs in the reversed direction, this fact can be usually deduced from the reversal of the 'direction-markers'.

Even a cursory inspection of
the inscriptions reveals that the same text is sometimes written in either direction. (See Vats. p.326 for examples). Hence the general rule of reading from the right cannot be applied mechanically. Failure to understand the criteria for reversal of direction has led even experienced investigators sometimes astray. For example, Heras attempted to 'read' the second lines of texts always from the left, while in fact most of them have also to be read from the right. (Heras, 1953, pp.98, 104, 106, 107). Reversal of the direction of a line of writing is indicated in almost all the cases by the reversal of the "direction-markers", viz., the disposition of the asymmetric signs, the order of the sign sequences and the distribution of the right and left end-signs. For a detailed treatment of this rule, see I.Mahadevan 1977, 1980.

3. The Indus Script consists of word-signs (logograms).

Sidney Smith (in Marshall 1931: 415) analysed some of the seal-texts from Mohenjodaro and found that most of the signs studied by him had meanings by themselves and functioned as words. G.R.Hunter (1934:126) formulated a set of criteria for segmentation of the texts and found that almost every sign of common occurrence functioned as a single word. The Soviet Group (M.A.Probst and A.M.Kondratov in Y.V.Knorozov et al. 1965) analysed texts on the computer and concluded that the Indus Script is essentially morphemic in character, resembling the Egyptian hieroglyphic system in this respect. I have described the logical word-division procedures developed by me (I.Mahadevan 1980), which show that most of the signs of the Indus Script are word-signs.

Almost all the investigators have however also proposed on grounds of probability, taking into account the number of signs, their pictographic appearance and the general resemblance to West Asian pictographic scripts that the Indus Script is most probably a logo-syllabic system of writing comprising word-signs and phonetic syllables. This may be true, but it is necessary to emphasise that while it is possible to determine the presence of word-signs in the Indus Script (as may be seen from the foregoing summary of previous work), no one has so far been able to establish by objective analytical procedures the existence of purely phonetic syllabic signs in the Indus Script. Recognizing this difficulty Asko Parpola has recently proposed (A.Parppola 1976 quoting S.Parppola) that the Indus Script is a morphemo-graphic system using signs with inherent semantic and phonetic values and usable in either function. 'Morphemo-grams' are defined by him to be 'primarily pictograms standing for a sememe whether its semantic or phonetic meaning is intended'. He also points out that the West Asian pictographic scripts began as morphemographic systems and later developed into logo-syllabic writing.

4. Word-signs in the Indus Script are formed in three ways, namely as (i) ideograms, (ii) phonograms and (iii) conventional signs.

Ideograms are picture-signs (pictograms) which stand for not only the concrete objects shown in the pictures, but also any idea or concept associated with, or suggested by, such objects. (e.g. the picture of sun may stand for 'sun' as well as 'day'.) Ideograms cannot be phone-
ticised, but in favourable circumstances may be understood directly from pictorial depiction, parallels from other pictographic scripts or from later traditional symbolism or from the context of occurrence. Fairly obvious examples of ideograms in the Indus Script are the anthropomorphic signs (MAN, HORNS PERSON, ARCHER etc.), and the numeral signs 1 to 9 (depicted by short strokes arranged in one or two tiers). However it needs to be emphasised that there is still no unanimity of view on the recognition of individual picture-signs or their ideographic meanings.

Phonograms are also picture-signs depicting concrete objects; but these are phonetic signs whose values are derived by the rebus technique from homonyms of the words represented pictorially. (e.g. the arrow sign in the Sumerian script had the phonetic value ti with the meaning 'life' as ti stood both for 'arrow' and 'life' in the Sumerian language). Phonograms formed by the rebus principle can be recognized only if the underlying language is known or assumed as a working hypothesis. Since the identity of the Harappan language has not yet been established beyond doubt, it cannot be said that any phonogram has been recognized with certainty. Even the most commonly cited example of the FISH sign *mъm = 'fish'/*mъm = 'star, planet' first proposed by Heras and later adopted by the Soviet and the Finnish Groups and by me is still only a guess based on the Dravidian hypothesis. It is however very likely that there are rebus-based phonograms in the Indus Script as, otherwise, it is very difficult to account for the presence of such unlikely objects as the fish, birds, animals and insects in what are most probably names and titles on the seal-texts. It is likely that the Indus Script resembles in this respect the Egyptian Script in which pictographic signs serve as phonetic signs based on the rebus principle (e.g. the picture of a 'goose' stands for 'son' as the two words were homonymous in the Egyptian language).

It is not always possible in the present state of our knowledge to distinguish between ideograms and phonograms. A good example is the LOAD-BEARER sign which is treated by the Soviet Group as a phonogram with the value *kъ: to protect (derived by rebus from *kъ: 'yoke'. (N.V.Gurov in Proto-Indica: 1968, 1970). I have however interpreted this sign as an ideograph with the meaning 'office-bearer' on the basis of similar usage in later Indian traditions (I.Mahadevan 1975, 1980, 1982; also in this vol.). More recently, Asko Parpola (1981) and K.V.Ramesh (in this vol.) have also proposed ideographic interpretations for the BEARER group of signs, though the proposed solutions vary in each case.

Conventional signs are not picture-signs but arbitrary symbols or marks. The 'stroke' signs in the Indus Script (other than the numerals 1 to 9) belong to this category. It is not possible to ascertain their meanings or phonetic values directly in the absence of bilingual records. It is however possible to study the functional characteristics of the more frequent stroke-signs and determine their significance in a broad manner. For example, the super-script short stroke signs ' and " appear to be grammatical suffixes (see infra).
5. Modifiers attached to the signs modify the meanings in cases where both the basic and the modified signs have the same pattern of distribution.

This pattern of occurrence provides strong evidence for the essentially ideographic character of the Indus Script. The most outstanding examples are the FISH group of signs, where all the modified signs have virtually the same distribution pattern (that is, any modified FISH sign can be replaced by any other sign of the group in almost all contexts). Such a pattern is wholly inconsistent with phonetic modifications of syllabic signs.

There are also signs where the modifications result in change in the distributional pattern.
(e.g.) and
In such cases however there is no prima facie evidence to determine whether the modifications are ideographic or phonetic, or indeed whether the two signs are related at all. So far the existence of phonetic modifiers has not been proved by structural analysis.

6. Ligatures of word-signs modify the meanings in cases where both the basic and the ligatured signs have the same pattern of distribution.

This is again good evidence for the substantial ideographic content of the Indus Script. Such a pattern is also inconsistent with that of combinations of phonetic syllables.
(e.g.) and

There are also ligatures where the ligaturing alters the pattern of occurrence. Such ligatures may be either compound ideograms or compound phonograms or even compounds of ideograms and phonograms or even unrelated signs with different meanings.
(e.g.) and

An interesting feature of ligaturing is that it can be shown in many cases that the ligatured compound signs have to be read from right to left. The clearest examples are the anthropomorphic signs where the men hold the objects in the left hand.
(e.g.) MAN WITH STAFF, MAN WITH CUP, etc. Since it is unlikely that the Harappans were all left-handed or that the men in the pictograms turn their backs to the readers, the only reasonable explanation is that such ligatures have to be read from the right (e.g.) as STAFF MAN or STAFF-ER but not MAN-STAFF or say, SUPERVISOR, a word different from those represented by the component word-signs.

There are signs which sometimes occur ligatured, but at other times are placed side by side, clearly revealing the sequence as well as the integral character of the component words making up the compound word-sign.
(e.g.) and

Where signs are ligatured one below the other, the natural sequence appears to be from top to bottom. (I do not now agree with the Soviet and the Finnish suggestion for bottom-to-top reading of JAR-BEARER and LANCE-BEARER signs).

In one case in which two signs are ligatured one within the other the sequence is revealed by the following superscript suffix which in other cases goes only with the inner sign and not with the outer sign of the ligature.
As I shall show presently the ligature \( \ldots \) is a suffix to be read after the included sign and not before as supposed by the Soviet Group.

In other cases where none of the above rules apply it is not possible at present to split up the ligatures with certainty, or even to say whether such signs are ligatures or modified signs or integral basic signs which cannot be split up further. One cannot for example, assign without further evidence, the same value (ideographic, phonetic or conventional) to the short single vertical strokes found inside or under many of the signs. (e.g.) \( \hat{\alpha}, \hat{\eta}, \hat{\varphi} \) etc.

III. GRAMMATICAL ANALYSIS OF THE INDUS TEXTS

1. A 'word-sign' in the Indus Texts stands for a morpheme or a word or a compound-word.

As seen earlier, segmentation of the Indus Texts has shown that they consist of a succession of signs which are independent linguistic units. It is thus likely that each sign represents a morpheme. It is also possible that some of the signs may each represent a word comprising more than one morpheme. A sign with an attached modifying element or a ligatured sign may represent a morpheme or a word with more than one morpheme or a compound expression consisting of more than one word.

2. A morphemic sign represents either a root morpheme or a suffix.

Morphemic signs can be grouped on the basis of their positional and functional characteristics into two classes, viz., root morphemes and suffixes. Root morphemes comprise the bulk of the signary (406 signs), but have a much lower average frequency (25 times) when compared with the suffixes which are fewer in number (10 basic signs, 3 ligatures and one modifying element) but with a much higher average frequency (250 times). A list of suffixes along with their distributional statistics is given in the Chart.

3. A root sign represents either a substantive or an attribute. The same sign can serve either function in different positions.

In the Indus Texts there seems to be only one class of root morphemes which function either as substantives (nouns) or as attributes (adjectives) depending on their position. However, it is possible to classify the root morphemes into those which occur more often as substantives and others which occur more often as attributes. (e.g.) \( \hat{\alpha} \) occurs more often as an attribute while \( \hat{\beta} \) occurs more often as a substantive.

4. Attributes precede the substantives they qualify.

Textual analysis shows the attributive character of the root morphemes which optionally precede the substantives within a phrase. Numerals which are attributive in function precede the enumerated objects. (e.g.) \( \psi \overline{\overline{I}} \), \( \hat{\alpha} \overline{\overline{I}} \) etc.

5. The three super-script short stroke signs are grammatical suffixes functioning as case-markers. (Signs \( \overline{I}, \overline{\overline{I}}, \overline{\overline{I}} \)).

Signs functioning as case-endings
are recognized by the following characteristics (See Chart):

(i) They are suffixes occurring only in final or quasi-final positions in texts or phrases (which are minimal meaningful word sequences within a text).

(ii) They occur more often medially (generally at the end of the 'introductory' phrase) than finally in a text as their function is to relate the preceding substantive to the remainder of the text.

(iii) Their super-script position, their physical placement much closer to the preceding than the succeeding sign and the rare instances where they are ligatured with the preceding sign (e.g. texts 1332, 1424 and 5067) confirm that a suffix of this class and the preceding sign constitute one word.

It can be shown that the employment of a super-script suffix is governed by the preceding substantive. The substantives can be classified into three groups on the basis of the types of super-script suffixes which can be added to them:

(i) Substantives which are followed by any one of the three suffixes.

(ii) Substantives which are followed by either of two suffixes only, or .

(iii) Substantives which are followed invariably by the suffix only.

It seems possible to infer broadly the meaning or function of the super-script short stroke suffixes as a class on the basis of the following considerations:

(i) They occur most often after single initial signs at the end of an 'introductory' phrase within the text.

(ii) The 'introductory' phrase is optional and serves as an attribute of the succeeding substantive phrase in the text.

(iii) In ancient Indian inscriptions place-names preceded personal names. This is also likely to be the pattern in the Indus seal-texts most probably containing the owners' names.

(iv) At least three of the initial signs preceding the super-script suffixes in the frequent introductory phrases can be identified as place-names from the context as well as on the basis of closely analogous forms in other contemporary pictographic scripts:

\[\text{: PALACE, TEMPLE} \]
\[\text{: CITY} \]
\[\text{: CROSS-ROADS, QUARTERS} \]

(cf. I. Mahadevan 1981, for details).

If these parallels are accepted as valid, the three superscript suffixes which follow them are likely to be locative case-endings. However it is seen from the texts that these suffixes also follow anthropomorphic signs (most probably representing personal names, titles, professions etc.) in similar contexts. In these
cases the super-script suffixes seem to have genitive, possessive or oblique case significations. Other possible case-endings are found to be unlikely for the following reasons:

(i) Introductory phrases consisting of a place-name and a super-script suffix are often followed by anthropomorphic signs representing personal names and titles. In these cases, dative or ablative cases seem unlikely.

(ii) The occurrence of accusative or instrumental cases on the brief seal-texts containing only place-names and personal names also seems unlikely.

It needs to be emphasised that the super-script short stroke suffixes are conventional signs and hence their phonetic values cannot be determined by ideographic parallels or by the rebus method or by treating them as 'numeral' signs (which they are not). At present I am not also able to find the precise distinction in the meanings of the three suffixes which are functionally very similar but not identical. Tentatively all the three suffixes may be interpreted to mean broadly 'OF, IN, AMONG, BELONGING TO' (or as the oblique case markers). Thus we may provisionally interpret the frequent opening phrases as follows:

Ⅰ: OF the Palace/ Temple.
Ⅱ: IN the City.
Ⅲ: AMONG the archers etc.

Text No.

4237: Ⅰ
2039: Ⅰ
4017: Ⅰ
2600: Ⅰ
4297: Ⅰ
1348: Ⅰ
1373: Ⅰ

The single and double short stroke signs of the middle register (signs Ⅰand Ⅱ) seem to be functionally different from similar strokes placed in the upper register (signs Ⅰand Ⅱ). When the single and double strokes in the middle register occur in non-initial positions, they do not appear to function as case-endings, but rather as conjunctions joining two independent linguistic formations (phrases or whole texts). Compare the texts in 4237 and 2039 which are joined together by the sign Ⅰin 4017. Similarly 2600 and 2039 are joined together by sign Ⅰin 4297. Compare also 1348 and 1373 for a similar use of sign Ⅱ:

6. The single and double short stroke signs of the middle register (signs Ⅰand Ⅱ) occurring in the non-initial (medial or final) positions function differently from the same (?) signs placed in the initial positions where they appear to be numerals (1 and 2) or alternate forms for the single and double long strokes (signs Ⅰand Ⅱ).
In general, the Indus Script seems to distinguish semantically and functionally between long and short vertical strokes and also between the short vertical strokes of upper and middle registers.

7. A set of five frequent terminal signs (and their ligatures and combinations) function as nominal suffixes:

\[
\begin{align*}
&\text{U} &\text{A} &\text{E} \\
&\text{E} &\text{F} &\text{G}
\end{align*}
\]

A significant finding of the present study is that these signs are not grammatical morphs (indicating number, gender, person or case) as proposed by most of the investigators (though none of the models are in agreement), but function as nominal suffixes in name-formation as originally suggested by G.R. Hunter (1934). It can also be shown that these signs are substantives with ideographic signification. The evidence on these points is briefly summarised below:

(i) There are rare but well-attested cases of solus occurrences of the signs. \(\text{U}\) occurs as a single-sign text on a recently found button-seal from Daimabad. \(\text{E}\) and \(\text{F}\) occur as large single signs on pottery. \(\text{G}\) also occurs as a single ideogram in a scene on a sealing (2841) from Mohenjodaro. These solus occurrences indicate the ideographic character of the signs.

(ii) The signs are occasionally doubled, behaving in this respect as some other substantive word-signs in the script. \(\text{A}\) is doubled 14 times, \(\text{E}\) 9 times and \(\text{U}\) once; but the signs do not function as suffixes in these cases.

(iii) There are a number of instances where these signs are immediately preceded, not by substantives, but by the super-script stroke suffixes and thus stand initially or by themselves separated from the preceding texts. This pattern is compatible only with the substantive character of the signs (cf. I. Mahadevan 1977: Table II).

(iv) There are even more instances where these signs are immediately followed by the superscript stroke suffixes confirming their substantive character (ibid).

(v) \(\text{U}\) occurs also modified with 1 to 4 short strokes placed on the top. The modified signs share some extent the environment of the basic sign (cf. concordances). This pattern is not compatible with the theory which treats this sign as the oblique case suffix. The pattern of distribution of the modified signs indicate an ideographic relationship to one another.

(vi) Two of the signs (\(\text{U}\) and \(\text{A}\)) occur as the upper parts of ligatures in signs \(\text{E}\), \(\text{F}\), \(\text{G}\) and \(\text{H}\). In these cases the Egyptian parallels as well as general probabilities indicate that the ligatured signs have to be read from top to bottom. There are no convincing arguments for reading the ligatures from bottom to top as proposed by, the Soviet and the Finnish Groups. As both the Groups regard the lower parts of these ligatured signs as substantives, it follows that \(\text{U}\) and \(\text{A}\) which precede the substantives cannot be case-endings. Recently Asko
Parpola (1979) has veered round to the view that these signs could be substantives but used with genitive and dative signification. This is of course possible. For another view see my paper Terminal ideograms in the Indus Script (I. Mahadevan 1982). Another implication of this analysis is that the nominal suffixes, being elements in name formation, are added only to personal nouns and not to other types of nouns. If this result is found valid on further investigation, it would help us to classify the substantives (nouns) accordingly. Nominal suffixes can be classified as primary or secondary depending on their position after the root morphemes (see Chart).

8. The ligatured element '⋯' is the plural marker.

The Soviet Group (Proto-Indica 1979:8) has treated all circumgraphs alike describing the ligaturing "as a norm of orthography and not a norm of the language". According to them the circumgraph should be read first and then the inserted sign, as numerals precede the substantives in the texts. However this analogy does not hold good in this case as textual analysis clearly indicates that the ligatured circumgraph (of four short vertical strokes) functions like a suffix and not as an attribute and thus has to be read after the included sign and not before. The evidence for this view can be briefly summarised as follows:

(i) The pattern of numeral circumgraphs relied upon by the Soviet Group is illustrated below:

\[4134: \text{U} \text{I} \text{I} \text{I} \text{I} \text{I} \text{I} \text{I} \text{O}\]
\[1074: \text{U} \text{.} \text{.} \text{.} \text{.} \text{.} \text{.} \text{.} \text{.} \text{.} \text{O}\]

We notice in this case that the basic sign preceded by the numeral 5 in 4134 and the ligatured sign circumscribed by the numeral 7 in 1074 share the same environment. This is thus a case of mere alternative modes of writing. Hence this circumgraph is an attribute to be read before the included sign like a preceding numeral.

(ii) The pattern is however wholly different in the case of the 4-stroke circumgraph found attached to 20 signs (cf. sign-list in I. Mahadevan 1977). Here the ligaturing alters the basic character of the included sign in two major respects:

(a) A basic sign which is mostly initial or medial becomes mostly final when ligatured with the 4-stroke circumgraph:

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<tr>
<td>0</td>
<td>36</td>
<td>309</td>
<td>18</td>
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<td>0'</td>
<td>2</td>
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<td>0'</td>
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<td>137</td>
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<td>0'</td>
<td>3</td>
<td>5</td>
<td>10</td>
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<td>0</td>
<td>68</td>
<td>209</td>
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<td>0'</td>
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<td>7</td>
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<td>30</td>
<td>72</td>
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<td>0'</td>
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<td>4</td>
<td>4</td>
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</tbody>
</table>
(b) A basic sign which is normally followed by a primary nominal suffix ( \( \text{U} \), \( \text{U}^\prime \), \( \text{U}^\prime\prime \)-group) loses it when ligatured with the 4-stroke circumgraph:
(e.g.)

Text No.
3103 : \( \text{U} \)
1177 : \( \text{U} \)
1625 : \( \text{U} \)
1316 : \( \text{U} \)
4285 : \( \text{U} \)
3070 : \( \text{U} \)
4659 : \( \text{U} \)
4465 : \( \text{U} \)
9001 : \( \text{U} \)
4117 : \( \text{U} \)

The only major exception to this pattern is the sign \( \text{U} \), which is always followed by the suffix \( \text{U} \). It is noteworthy that this is also the only sign which has no corresponding 'basic' sign without the circumgraph. The sign \( \text{U} \) is followed once by the suffix \( \text{U} \). The sign \( \text{U} \) is followed thrice by the suffix \( \text{U} \). The exceptions require further study.

(iii) There is however overwhelming evidence of the two special features of the 4-stroke circumgraph, not shared by any other circumgraph. I would interpret the evidence as follows:

(a) A basic sign becomes substantivised by the addition of the 4-stroke circumgraph and then ceases to function as an attribute.

(b) The 4-stroke circumgraph is a suffix which in the ligatured signs generally replaces the nominal suffix of the corresponding basic sign. In other words, the circumgraphed sign functionally corresponds to the sign-pair formed by the basic sign and its nominal suffix.

(c) This analysis also shows that the 4-stroke suffix is functionally analogous to the nominal suffixes and not to the case-marker stroke-suffixes.

(d) In Egyptian hieroglyphic script the addition of a very similar sign (consisting in this case of 3 short strokes placed side by side or one below the other) is a sign of the plural. Taking all these factors into account I suggest on this analogy that the 4-stroke suffix is the plural marker in the Indus Script as originally proposed by Heras (1953:83).

(e) A further implication of this result is that the nominal suffixes are added to singular nouns. This result is in conformity with our earlier finding that the nominal suffixes are added to personal nouns (probably to names and titles).
9. An Indus Text generally consists of a substantive phrase preceded (optionally) by an introductory phrase.

The core of a text is the root morpheme or substantive. It may be preceded (optionally) by one or more root morphemes functioning as attribute(s) qualifying the substantive. The substantive may be followed by one to three nominal suffix(es). The whole sequence namely, the attribute(s) (if any), the substantive and the nominal suffix(es) (if any), constitutes the substantive phrase of the text. A 'phrase' is a minimal linguistically meaningful word-sequence within a text.

The substantive phrase may be preceded optionally by one (or rarely more) 'introductory' phrase(s) which serve(s) as the attribute(s) qualifying the substantive phrase. The introductory phrase has at its core a root morpheme as the substantive, preceded (rarely) by one (or more) root morpheme(s) acting as attribute(s) qualifying the substantive. The substantive is followed by a case marker in the introductory phrase(s).

The following diagram illustrates the syntax of an Indus Text:

```
<table>
<thead>
<tr>
<th>Introductory Phrase(s)</th>
<th>Substantive Phrase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attribute(s)</td>
<td>Substantive (root)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

A provisional analysis of two specimen texts is given below to illustrate the syntactical pattern of the Indus Texts:

1078:  

![Diagram](image)

A: Substantive root morpheme (of the substantive phrase).

B: Case-marker suffix (attached to the substantive A).

CDE: Substantive (main phrase of the text).

G: Attribute to the substantive D.

D: Substantive root morpheme (of the main phrase).

E: Nominal suffix (attached to the substantive D).

**NOTE**

Sign and Text numbers and the statistical data in this paper are taken from *The Indus Script: Texts, Concordance and Tables*, I. Mahadevan (1977).
<table>
<thead>
<tr>
<th>SIGN NO.</th>
<th>SOL.</th>
<th>INIT.</th>
<th>MED.</th>
<th>FIN.</th>
<th>TOT.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class A: Super-Script Suffixes/Case-Markers:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>97</td>
<td>0</td>
<td>*1</td>
<td>87</td>
<td>3</td>
<td>91</td>
</tr>
<tr>
<td>II</td>
<td>99</td>
<td>0</td>
<td>*2</td>
<td>625</td>
<td>22</td>
<td>649</td>
</tr>
<tr>
<td>J</td>
<td>123</td>
<td>0</td>
<td>0</td>
<td>186</td>
<td>7</td>
<td>193</td>
</tr>
<tr>
<td><strong>Class B: Conjunctions:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>I</td>
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<td>0</td>
<td>*4</td>
<td>72</td>
<td>12</td>
<td>88</td>
</tr>
<tr>
<td>II</td>
<td>100</td>
<td>*1</td>
<td>@12</td>
<td>16</td>
<td>0</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>@These are numerals (unconnected in function with s.100) or var. of s.87.</td>
</tr>
<tr>
<td><strong>Class C: Primary Nominal Suffixes:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>342</td>
<td>*3</td>
<td>@1</td>
<td>420</td>
<td>971</td>
<td>1395</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>@in a second line.</td>
</tr>
<tr>
<td>A</td>
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<td>*1</td>
<td>0</td>
<td>42</td>
<td>184</td>
<td>227</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>*1</td>
<td>@1</td>
<td>9</td>
<td>69</td>
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<td></td>
<td>13</td>
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<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>14</td>
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<td>0</td>
<td>2</td>
<td>11</td>
<td>13</td>
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<tr>
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<td>15</td>
<td>*3</td>
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<td>30</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>@in a second line.</td>
</tr>
<tr>
<td><strong>Class D: Secondary Nominal Suffixes:</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>1</td>
<td>*3</td>
<td>@12</td>
<td>33</td>
<td>86</td>
<td>134</td>
</tr>
<tr>
<td>E</td>
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<td>*1</td>
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<td>316</td>
<td>355</td>
</tr>
<tr>
<td><strong>Class E: Plural Marker:</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
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<td>7</td>
<td>22</td>
<td>29</td>
<td>62</td>
<td>120</td>
<td></td>
</tr>
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</table>
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