On the Biradical Origins of the Semitic Triradical Root System [BOSTRS]

Contents

1 Introduction

1.1 The Biconsonantal Hypothesis

1.1.1 It has long been conjectured that the system of largely triradical roots characteristic of the Semitic languages originates to greater or lesser degree in an earlier system founded on roots or stems with at most two consonants. It is then argued that, in the typical case, the lexicon of the earlier system was expanded by adding to the biconsonantal stems various augments, suffixed or prefixed to their stem, and perhaps also infixed. Despite considerable efforts by a number of investigators, the morphology of these putative augments, their meaning or grammatical function, have remained largely obscure.[1]

1.1.2 The primary purposes of the present study are thus two:

1. **To provide a theoretical and methodological foundation for a systematic analysis of the triradical data;**
2. **Utilising the methodology so developed to propose sets of augment morphemes which were affixed to biconsonantal roots/stems.**

The argument is developed along quantitative lines and employs elementary statistics. The validity of any claim about the origin of the Semitic root system will therefore rest to a large extent on the quality of the theoretical argument and the statistical procedures proposed to analyse the triradical data. The major objects being theoretical and methodological, only in Sections 6 to 8 is extensive use made of examples. The study is founded on data from about 2700 verbal roots drawn from Arabic, about 1200 from Biblical Hebrew and a further 850 from Middle Egyptian.

1.1.3 Set out below are two 'propositions' which attempt to summarise previous conjectures about the non-triradical origins of the Semitic root system. The problems of method to which these give rise are outlined and then serve as an introduction to a more detailed treatment in subsequent sections.

1.1.3.1 *Proposition 1.* Many Semitic triradicals share phonological and semantic similarities that can be most satisfactorily explained by postulating that they originate in older, non-triradical stems or roots. For the most part these are taken to have been biconsonantal and to have resembled, phonologically and semantically, the biconsonantal component in what will be termed their 'triradical reflexes' - attested triradical roots that form the basis for a particular biconsonantal conjecture. This claim gives rise to two

[1] For the history of early research into the origins of the Semitic root system see G.J. Botterweck, *Der Triliterismus im Semitischen* (1952), 11-30; H. Fleisch, *Traité de philologie arabe* (1961-79), Vol.I, 252-261.

clusters of related questions.

A. What is meant by phonological and semantic similarity?. What determines whether a given triradical is taken to originate in a putative biconsonantal or conversely, by what process is a triradical to be excluded as being phonologically and/or semantically too dissimilar?

B. Assuming that the questions under A can be answered satisfactorily, why should it be assumed that the 'biconsonantal hypothesis' offers the best explanation of the observed phenomena? Are there other ways of explaining the data and if so, on what basis is one explanation to be preferred to another? For instance, how can it be shown that apparent triradical reflexes are not simply due to chance collocations of phonemes and senses?[2]

1.1.3.2 *Proposition 2*. If triradical roots do indeed originate in biconsonantals, various phonemes and/or morphemes must have been used as 'augments'. This then raises a further pair of questions:

C : What phonemes/morphemes were used as augments and can their original meaning or function be determined? What rules govern their phonological relationship to the third radical in the relevant triradicals?

1.2 Measuring Phonological and Semantic Similarity among Triradical Roots

1.2.1 To address the questions raised under A, consider hypothetical triradical roots $R_{tx} = (r_1\text{-}r_2\text{-}r_3)$ and $R_{ty} = (r_4\text{-}r_2\text{-}r_5)$, where the phonemes in position C_1 (r_1 and r_4) differ only in that the former is voiced and the latter voiceless. Assume further that the phonemes at C_3 (r_3 and r_5) have quite different points of articulation and that the sense of R_{tx} is identical to that of R_{ty}. A semitist favouring the biconsonantal hypothesis might conclude that sequences $r_1\text{-}r_2$ of R_{tx} and $r_4\text{-}r_2$ of R_{ty} reflect an original biconsonantal root/stem, R_{bx}, and that r_3 and r_5 reflect morphemes used to augment the biconsonantal. Given the identity of their senses and the near phonological identity of sequences $r_1\text{-}r_2$ and $r_4\text{-}r_2$ this would be a fairly uncontroversial conclusion.

1.2.2 Suppose now a further root, $R_{tz} = (r_6\text{-}r_7\text{-}r_3)$, where r_6 is voiceless and spirantized but otherwise has a similar point of articulation to r_1, and r_7 is voiceless and spirantized but otherwise similar to r_2. Suppose further that the sense of R_{tz} can, by the exercise of a degree of ingenuity, be related in some way

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[2] On the *a priori* assumption of a biconsonantal origin for the triradical system see the comment in Fleisch, *Traité*, Vol. I, p257.

to that of R_{tx} and R_{ty}. Should sequence r_6-r_7 be included among the reflexes of R_{bx} and if so how would the inclusion be justified? The difficulty is obvious. In the absence of a procedure which allows an objective decision as to whether R_{tz} should form part of the set of triradicals originating in R_{bx}, any phonological and semantic reconstruction of a biconsonantal root/stem and augment based on these data is ultimately subjective, coloured to a lesser or greater degree by the preferences of a particular investigator.

1.2.3 Fundamental as this problem is there is no evidence in the literature seen by the present author that it has received attention. Consider for instance the phonological and semantic relationships proposed by Botterweck.[3] The uncommitted reader may well agree that many of these conjectures are intuitively sound, but in the absence of a rigorous 'decision procedure' there is almost no limit to the number of two-phoneme sequences that can be postulated on the basis of impressionistic phonological and semantic associations. Having no basis other than intuition for evaluating these conjectures, the reader can have only limited confidence in an individual triradical as evidence for a particular biconsonantal, and hence only limited confidence in a detailed theory of biconsonantal roots/stems built on such foundations.

1.2.4 It should therefore be clear that a potentially adequate theory of biconsonantals cannot be formulated unless there is available as part of the analysis a device for *quantifying* phonological and semantic sameness and difference among triradicals. This problem is further considered in Section 2.

1.3 Validating the Biconsonantal Hypothesis

1.3.1 Placing the process of data analysis on a quantitative basis will facilitate the formulation of a fairly precise hypothesis about the general history of the Semitic root system, together with more detailed hypotheses about the history of individual roots. Question B then asks; on what basis are these hypotheses to be judged superior to others that may be developed to account for the data? For what a quantitative approach to data collection will obviously not permit is an automatic claim that the resulting hypothesis is correct, even though it has been developed objectively and is for that reason if no other superior to one developed impressionistically.

1.3.2 In science, 'induction' is the system of reasoning founded on gathering data and then proposing a theory to account for it. This approach will be recognisable to semitists since it is the one employed almost exclusively in Semitic diachronic linguistics to arrive at the history of the various languages. But, in consequence of the inevitable incompleteness of source data and the inherent ill-definedness of

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[3] *Triliterismus*, 31ff.

language systems, induction can never be an adequate form of reasoning in diachronic linguistics. For these limitations entail that, from any set of observations, several hypotheses can be proposed to explain a given body of data.

1.3.3 Consider for example the problem of the evolution of verbal aspect/tense in the Semitic languages. There are numerous hypotheses about the ways in which the systems in the various languages have come about, without exception utilising the inductive method.[4] While it is occasionally possible to detect flaws in the reasoning it is in general not possible to demonstrate conclusively that any of these hypotheses is wrong. The acceptability or otherwise of a particular proposal can only be judged intuitively.[5]

1.3.4 By contrast, Popper argues that science in essence consists of formulating hypotheses, by whatever chain of reasoning appeals to their proponents, and then using a given hypothesis to make predictions about the ways in which subsequently observed phenomena will behave.[6] Ways of testing these predictions must then be devised, and if phenomena do not behave as the hypothesis predicts the hypothesis fails the test and is therefore refuted, at least in the purest form of Popper's formulation. If the hypothesis passes the test it is not proven, but can at least be used with greater confidence as a basis for further research.[7] Given the particular limitations of the inductive method when applied to diachronic

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[4] See the discussion in S. Moscati et al, *An Introduction to the Comparative Grammar of the Semitic Languages* (1964), p131 ff. Compare E. Lipiński, *Semitic Languages – Outline of a Comparative Grammar* (2001), p343 ff, who tends to present his hypotheses as facts. See also *Aspect in Common Semitic and Egyptian*.

[5] W. von Soden argues ('Zur Methode der Semitisch – Hamitischen Sprachvergleichung', *JSS* 10 (1965), p162) that there is no alternative to the inductive method, appearing to believe that the more rigorous the examination of the data the more likely the resulting hypothesis is to be correct. While this may to some extent be so, the aspect/tense problem is sufficient evidence of the limitations of such an approach.

[6] See K.R. Popper, *Conjectures and Refutations* (1972), p33 ff and especially p53. Popper's rejection of induction has not gone unchallenged. For a summary of the problem of induction and criticism of Popper's position see T.E. Burke, *The Philosophy of Popper* (1983), p38-41, 59, 60.

[7] Popper's view of the structure of science not only excludes from science fields which scientists would include without hesitation, for example evolutionary theory, but does not reflect what actually happens even in those fields which can unambiguously be construed as falling within Popper's characterisation. What seems to be more generally agreed is that a scientific discipline is enriched and becomes more securely founded. to the extent that it is

linguistics, the Popperian approach would seem potentially to offer significant advantages, although the problem of devising appropriate tests is substantial and must not be underestimated ; this question is further explored in Section 3. It will of course be apparent that 'confirmation' or refutation of the general biconsonantal hypothesis would entail outline confirmation or refutation of some form of augment hypothesis, and vice versa.

1.4 The Augment Hypothesis

1.4.1 The requirement for testing applies equally to the augment hypothesis, for only in this way can an objective decision be made between this and other hypotheses which might be proposed to account for the triradical data. Once again the testing must be on two levels, a more general level which supports or weakens the hypothesis as a whole, and a more detailed level where the history proposed for a particular augment reflex is tested. Questions relating to general testing of the augment hypothesis are considered at §3.3 and §3.4 below.

1.4.2 The questions raised under A. of §1.1.3.1 rest on the assumption that the proposed biconsonantal components of relevant triradical roots (the 'biconsonantal reflex' of the original biradical) will commonly have undergone phonological change and will therefore typically not simply consist of the same phonemes as the original biconsonantals from which they are taken to derive. Similarly, and in part answer to the questions raised under C of §1.1.3.2, there is no reason to suppose that original augments would not have undergone similar phonological change when realised in actual triradicals ('augment reflexes'). Therefore, just as there are assumed to be phonological relationships among the various biconsonantals reflexes, so there would be analogous relationships among augment reflexes. Thus it is probable that the third radicals, the 'residue' of biconsonantal analysis, originate in a smaller set of augment morphemes.

1.4.3 Surprisingly, this possibility seems not to have received attention in the literature, although Fleisch makes passing reference.[8] A typical position is that of Moscati et al who merely observe, without further discussion, that all consonants can function as 'determinants', and a similar position is taken by Ehret.[9] Such a claim implies in effect that the whole stock of consonant phonemes in Semitic, without

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able to conform to Popper's structure.

[8] *Traité*, Vol. I, p259.

[9] Moscati et al, *Introduction*, p74. C. Ehret, 'The Origins of Third Consonants in Semitic Roots: An Internal

exception, occurred in morphemes which served in some grammatical or lexical capacity to modify the senses of biconsonantals in the parent language. Moreover, since for Moscati and others the set of consonant phonemes in Semitic equals almost exactly the set of consonant phonemes in Arabic, the implication is that this state of affairs is preserved almost intact in the latter language.

1.4.4 If augment reflexes do indeed originate in a smaller set of augment morphemes, the quantitative procedures proposed below for phonological analysis of biconsonantal reflexes must be paralleled by similar procedures for analysing and testing phonological relationships among augment reflexes and their proposed originals ; this question is explored in Sections 6 to 8. However, whereas the prospects for making progress in the phonological analysis of augments are quite good, it must be accepted at the outset that the task of proposing meanings or grammatical functions for augments is formidable.

2 Phonological and Semantic Networks

2.1 Measuring Phonological Sameness and Difference

2.1.1 'Distinctive feature theory' argues that phonemes consist of smaller entities termed 'features', the difference between a pair of phonemes being taken to result from differences in the sets of features of which each is composed.[10] Features are commonly expressed in binary terms such that, for example, dental phoneme *t* can be said to differ from *d* in that the former incorporates the feature [-voice] and the latter [+voice]. Similarly *t* could be said to differ from *ṯ* in that the former incorporates the feature [+stop] and the latter [-stop].[11]

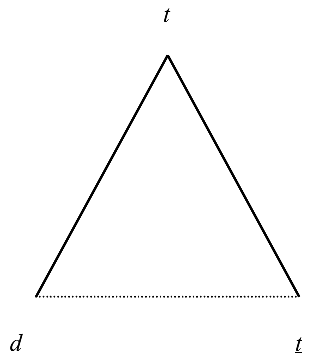
2.1.2 The relationship between these three phonemes can be represented diagrammatically as shown in Figure 1, where the left branch indicates that feature [+voice] replaces [-voice] to give phoneme *d* and the right branch similarly indicates that [-stop] replaces [+stop] to give *ṯ*. On this analysis *d* and *ṯ* differ from *t* in the assignment of one feature, while *d* differs from *ṯ* in two features. If the number of features by which one phoneme differs from another is taken as the measure of sameness and difference, then from a purely quantitative point of view phoneme *t*, which differs from *d* and *ṯ* in only one feature, occupies a more central position in this particular network than the latter two.

Reconstruction (Applied to Arabic)', *JAL 3, 2* (1989), p109-202. Ehret considers only Arabic radicals, in position C_3.

[10] For an outline of distinctive feature theory see J. Lyons, *Introduction to Theoretical Linguistics* (1971), §3.3.8/11.

[11] There is a degree of arbitrariness here, in that *ṯ* could equally be defined as [+continuant] and *t* as [-continuant].

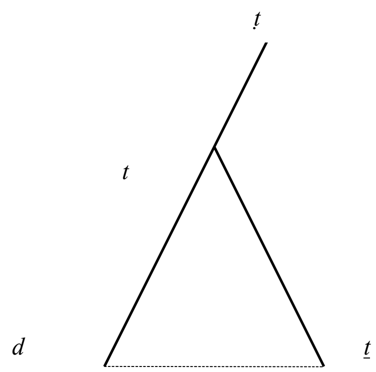
FIGURE 1



2.1.3 Suppose now that these phonemes comprise the consonantal component of three monoconsonantal morphemes that can be argued to be variant ways of expressing the same grammatical concept, with some diachronic relationship presumed to exist between them. On a purely quantitative analysis the original value of the relevant phoneme is more likely to be *t* than *d* or *ṯ*. This would not of course be sufficient to 'prove' that *t* is indeed the original phoneme; it would permit only the more restricted claim that, when investigating the original structure of the morpheme in question a hypothesis incorporating *t* as the original consonant is more likely to be firmly founded than one based on *d* or *ṯ*.

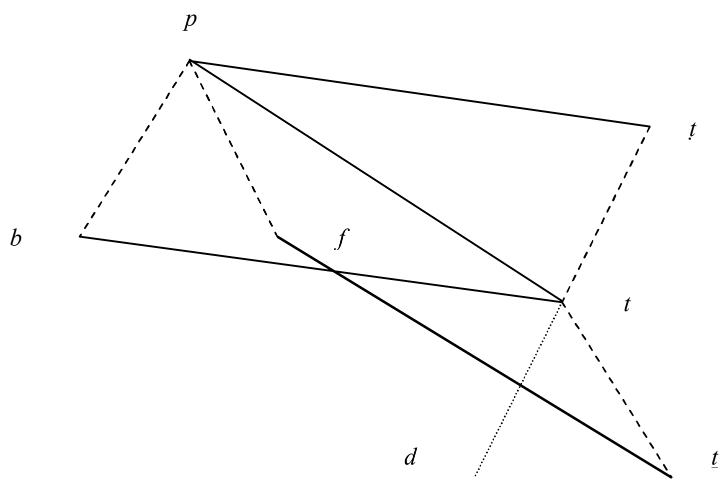
2.1.4 Suppose then that a further phoneme *ṭ* is identified, which also occurs in morphemes expressing this same grammatical concept. If *ṭ* is analysed as differing from *t* only in incorporating a feature [+velarisation] as against [-velarisation], however the actual articulation of this feature might be defined, the network diagram might now take the form shown in Figure 2. This would have the effect of reinforcing the centrality of *t* in the network and further encourage a preference for this phoneme as the original oconsonantal component of the morpheme in question.

FIGURE 2



2.1.5 **This procedure can be extended to pairs of phonemes. Suppose that, for example, in a series of triradicals the sequences *pt*, *bt*, *pṭ* and *fṯ* are postulated as originating in a common biconsonantal. Suppose further that semantic evidence supports the conjecture that the first three may originate in this biconsonantal, but that the evidence for the status of *fṯ* is less clear. Once again, the first step would be to construct a phonological network diagram. This is shown in Figure 3, and is to be interpreted as follows:**

FIGURE 3



1. **The left-hand side of the diagram comprises a network of labial phonemes representing the initial phonemes in the biconsonantal sequences. The relationships among *p*, *b* and *f* are analogous to those between *t*, *d* and *ṯ* in Figure 1.**
2. **The right-hand side of the diagram comprises a network of dental phonemes, identical to Figure 2, representing the second phonemes in the biconsonantal sequences;**
3. **Each biconsonantal pair is represented by a solid line between the relevant first and second radicals; thus the line drawn from *p* to *t* represents the sequence *pt* and the line from *f* to *ṯ* represents *fṯ*.**

2.1.6 It will be seen that two solid lines converge on *p* and two on *t*, but the remaining phonemes (excluding *d*) have only one solid line each. If those phonemes for which a biconsonantal sequence is attested, and which differ from each other in only one distinctive feature, are linked together (chain lines), it will be seen that these links also converge on *p* and *t*. The 'value' of a particular phoneme in the network might then computed as the sum of:

1. **The number of solid lines converging on a phoneme, say *p*, plus;**
2. **A number equal (say) to 50 per cent of the total number of solid lines converging on adjacent**

phonemes, i.e. lines attaching to phonemes differing by only one feature (e.g. *b* and *f*).

The resulting value will be termed the ‘cluster index’ (CI) of the phoneme in question.

2.1.7 Thus, since two solid lines converge on *p* and one each attaches to *b* and *f*, the cluster index for *p* is computed as 2(*p*) + 0.5(*b*) + 0.5(*f*) = 3, where the value ‘2’ is assigned by rule 1 and the values ‘0.5’ by rule 2.[12] Similarly, for *b* and *f* the cluster index in each case is 1 + 1(*p*) = 2, since one solid line is drawn to each of *b* and *f* (rule 1) and two solid lines converge on *p* (rule 2). Applying similar reasoning to the phonemes in second position it will be seen that the cluster index of *t* is also two and that of *ṭ* and *ṯ* is 1. The ‘source’ of the network is then proposed as the biconsonantal sequence consisting of the phonemes with the highest cluster indices, in this case *p* at C_1 and *t* at C_2, i.e. *pt*. Note that the ‘source’ sequence yielded by analysis may not always be attested among the biconsonantal reflexes from which the network is constructed.

2.1.8 Sequence *pt* being analysed as the source of the network it is assigned an ‘index of phonological deviation’ (Ipd) of 0. The sequences *bt* and *pṭ* then have an Ipd of 1, since both differ from *pt* in one feature, and *fṯ* an Ipd of 2. This analysis thus provides an absolute measure of the deviation of *fṯ* from the proposed source of the network. Given a means of deciding what constitutes an acceptable Ipd it can then be determined whether, on the evidence of phonology, a triradical incorporating biconsonantal sequence *fṯ* should be regarded as the reflex of a putative biconsonantal and augment. It should be emphasised that a phonological network is not a device for *deducing* the identities of original biconsonantals and their reflexes, it is rather a *hypothesis* about the diachronic relationships among a set of triradicals and the value of the biconsonantal in which they may originate. The reliability of these derivations can be established only by applying a suitable test procedure to the network.

2.1.9 Because original biconsonantals may not have consisted precisely of the phonemes proposed for them by network analysis, network sources will be enclosed in braces to indicate that their phonemes are in some sense ‘superordinate’, so for example {pt} for the network discussed above. But fitting a triradical to a phonological network in this manner presupposes some intuitively felt semantic and phonological correspondence among a group of triradicals. Thus it is possible that the ‘wrong’ pair of phonemes in a triradical is being considered as the possible reflex of a proposed biconsonantal. That is, if for some triradical $(r_1\text{-}r_2\text{-}r_3)$ sequence $r_1\text{-}r_2$ is analysed as the biconsonantal reflex, it may be that the root in fact

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[12] If two triradicals share the same biconsonantal sequence each will contribute to the total. Thus if there were two roots with the sequence *pt*, the cluster index for *p* would be 4.

originates in a biconsonantal with r_2-r_3 as its reflex, or is a completely false assignment. To limit the consequences of this kind of error a 'penalty' of one unit of Ipd is imposed on genuine (as opposed to geminate) triradicals.

2.2 Measuring Semantic Sameness and Difference

2.2.1 There will be various semantic relationships among triradicals analysed as contributing to a phonological network, initially perceived intuitively rather than objectively, which will have formed a partial justification for incorporating the roots into the network. Analysing these relationships presents two problems : selecting a hypothetical original sense for the biconsonantal stem and developing a procedure for deciding whether the sense of a particular triradical should be considered a reflex of the putative original.

2.2.2 The concept 'index of phonological deviation' proposed above suggests that setting up an analogous semantic network might permit the development of an equivalent 'index of semantic deviation' as a means of quantifying semantic sameness and difference. But in contrast to the analysis of phonological sameness and difference, where a phonological value for the original biconsonantal cannot be proposed merely by inspection, or by bringing to bear any theory of phonological evolution, the situation when measuring semantic deviation is very different. In some cases, it might seem reasonable to propose that the more general and concrete the sense of a triradical the more closely it will approximate to the original sense of the hypothetical biconsonantal.[13] Indeed, the substantial number of semantic networks on which this study is based tend to suggest that the process of adding an augment to a biconsonantal may have been one of the ways in which the pre-Semitic language developed a range of more specific or more abstract senses.

2.2.3 In some respects similar to distinctive feature theory is the theory of semantic components. Just as the former argues that phonemes are composed of features which can be expressed in terms of binary

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[13] Such an approach invites the criticism of appearing to make inferences about the supposed 'primitiveness' of the pre-Semitic language. It should not be necessary to point out that, in prehistorical terms, the Semitic group is a relatively late development in the history of the so-called 'Afrosiatic' languages and peoples, both linguistically and culturally (see *The Afroasiatic Fallacy* passim), and that the language from which Common Semitic is descended was in all probability both structurally and semantically well developed. See Section 1 of *Towards a Morphology of the pre-Semitic Vebal System*.

oppositions, so componential theory claims that the sense of a lexical item can be analysed into constituent components which, to some extent at least, can likewise be expressed as binary oppositions. For example, 'man' and 'woman' are taken to differ from 'boy' and 'girl' (partly) in that the former pair share a component [+adult] in contrast to [-adult] in the latter pair. Similarly, 'man' and 'boy' could be said to incorporate a component [-female] (or [+male]) and 'woman' and 'girl' the component [+female].[14] If the difference between the senses of a pair of words could be resolved into differing assignments of components then, just as the number of phonological features by which strings of phonemes differ can be regarded as a measure of their phonological sameness and difference, so the number of semantic components by which two senses differ could be a measure of their semantic sameness and difference. But in practice. the difficulties in applying the theory of semantic components in any non-trivial way are immense, for the theory seems appropriate only to limited areas of the lexicon, such as kinship terms, where relationships between the senses are readily stateable in binary terms.

2.2.4 Suppose for example that {cut} is postulated as the original sense of some biconsonantal and that the senses 'cut off' and 'cut up' are taken to derive from it. Intuitively, it seems reasonable to suppose that the difference between the latter two and {cut} results from the addition of one or more semantic components to the original to yield each 'derived' sense. But assigning precise values to these 'components', if not actually impossible, would be a complex procedure that would render the construction of semantic networks impossibly laborious and self-defeating.

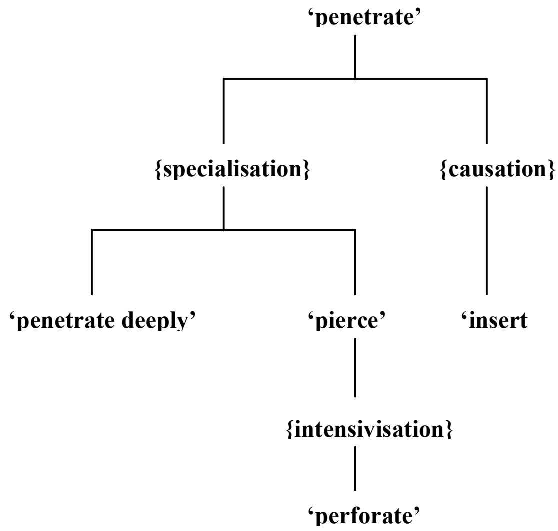
2.2.5 Alternatively however, adding or subtracting one or more components can be seen as applying some kind of semantic *process* to the original sense. For example both 'cut off' and 'cut up' are analysable as deriving from {cut} through a process of 'specialisation'. Now, although the number of 'processes' by which a derived sense is shifted from its source is unlikely to equal the number of components by which they differ, for statistical purposes the number of processes applied to an 'original' sense is in principle quantifiable and much more readily identifiable - and are also far fewer than the likely number of components. The construction of semantic networks thus becomes much simpler if the analysis is process rather than component based.

2.2.6 As an example of the use of processes to assess semantic sameness and difference consider the semantic network shown in Figure 4, associated with a network of phonologically related roots. Arabic

[14] For an outline of componential theory see Lyons, *Introduction*, p470 ff.

dk̲l has ‘penetrate’ as one of its senses. There is also geminate Arabic root ***ġll*** with sense ‘insert’. If an object is ‘inserted’ into something one may in some circumstances be ‘causing it to penetrate’ a second object, depending on context (pushing a rod into the ground would be an example). Thus the difference between the two senses could be accounted for by postulating a process {causation} acting upon the sense ‘penetrate’. Similarly, Arabic root ***wġl*** has the sense ‘penetrate deeply’ and root ***k̲ll*** the sense ‘pierce’. These are more specialised versions of ‘penetrate’, and suggest that the former two senses could have derived from the latter by the application of a process {specialisation}. There is also an Arabic quadriradical root ***k̲rbq*** with a sense ‘perforate’, which can be interpreted as {intensivisation} of the act of ‘piercing’.

FIGURE 4



2.2.7 Thus, proposing ‘penetrate’ as the source of the network, it is assigned an index of semantic deviation (Isd) of 0. Then, if ‘pierce’, ‘penetrate deeply’ and ‘insert’ are taken to differ from ‘penetrate’ in the application of one process, they are each assigned an Isd of 1. Sense ‘perforate’, taken to result from intensification of ‘pierce’, will then have an Isd of 2. The structure of such semantic networks can to some extent be tested by examining logical relationships between their constituents. Thus for example – albeit simplistially - when ‘penetrate’ is compared to the two senses deriving from it by the process {specialisation} it will be seen that whereas ‘penetrate deeply’ implies ‘penetrate’ the latter does not imply ‘penetrate deeply’.

2.3 Index of Overall Deviation

2.3.1 The 'index of overall deviation' (Iod) of a given root is the sum of its indices of phonological and semantic deviation, and is therefore a measure of the degree of confidence with which a particular triradical can be considered to be a phonological and semantic reflex of a hypothetical biconsonantal - and its augment. The lowest possible value of Iod for a non-geminating triradical is 1, comprising an Ipd of 1 (see §2.1) and an Isd of 0 (§2.2) ; such a root can be argued to originate in its proposed biconsonantal and augment with some degree of confidence. But what if the Iod is 10 say; is this acceptable or not, and how is it to be decided?.

2.3.2 As remarked above, phonological and semantic networks have been constructed for roots drawn from Arabic, Biblical Hebrew and Middle Egyptian and, of these, about 2000 triradicals have been identified which appear to originate in an augmented biconsonantal. The distribution of Iod among these triradicals is shown in Table 2.1.

TABLE 2.1 DISTRIBUTION OF IOD

	Number of Roots		
Iod	**Arabic**	**Hebrew**	**Egyptian**
0	12	5	5
1	84	42	18
2	226	103	42
3	275	148	83
4	273	168	78
5	163	113	57
6	70	37	21
7	14	8	4
8	3	0	2
Total	**1120**	**489**	**306**

Histograms based on these values approximate fairly closely to a normal disrtribution with mean *(x)* ranging from 3.4 (Arabic) to 3.6 (Egyptian) and standard deviation *(s)* between 1.4 (Hebrew) and 1.6 (Arabic*).*[15] These give values for *(x + 2s)* ranging between 6.33 (Hebrew) and 6.59 (Arabic), which means

[15] A normal distribution is a theoretical distribution which is more or less bell-shaped and dies out at the tails. The standard deviation of such a distribution indicates the extent to which a set of measurements deviate from their mean. The area under a normal curve between *(x - s)* and *(x + s)* is approximately 68 per cent of the total, which means that some 68 per cent of all roots will have an Iod between these two values. The area of the curve between *(x - 2s)* and *(x + 2s)* comprises approximately 95 per cent of the total. Thus there are only 2.5 chances in a hundred that an Iod greater than

***(x + 2s)* is not exceptional in some way, within what is termed the 0.05 level of significance. Statisticians commonly use**

that an Iod of greater than 7 can generally be neglected. Thus, to answer the question posed above, a root with an Iod of 10 should be excluded from the analysis, certainly initially and probably thereafter.

2.3.3 Despite the obvious limitations of this procedure yields what other workers in this field have lacked - a quantitative method of deciding whether a root should or should not be regarded as originating in an augmented biconsonantal. To repeat what has already been said, the procedure cannot *prove* that a postulated biconsonantal existed in pre-Semitic or that any particular triradical derives from it. What it does do is provide a reasonably rigorous means of identifying possible biconsonantals, which then permits a judgement to be made as to which triradicals may derive from them. Confirming that a particular pair of phonological and semantic networks is or is not an accurate characterisation of the history of the relevant roots is more problematic and must also take into account the history of the associated augment reflexes.

2.4 An Illustrative Example

2.4.1 This section concludes with an example of complementary phonological and semantic networks. Table 2.2 lists a selection of roots (all Arabic) together with their senses, Ipd, Isd and Iod.. Figure 5 shows the phonological network constructed on the basis of these roots and Figure 6 the equivalent semantic network ; of course in its full form this network also incorporates Biblical Hebrew and Middle Egyptian roots.

TABLE 2.2 SELECTED ROOTS ASSIGNED TO NETWORK {ġm : cover}

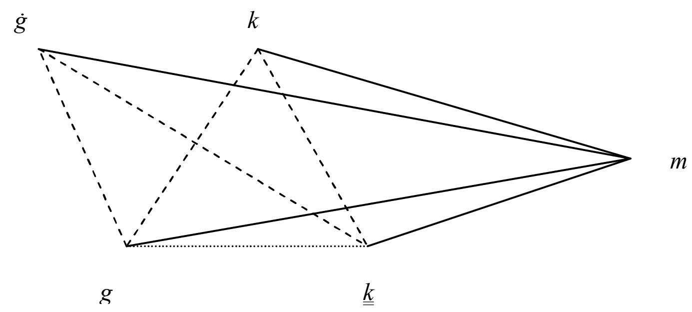
Root	Sense	Ipd	Isd	Iod
kmm	cover	2	0	2
ġmm	cover	0	0	0
kmn	be concealed	3	3	6
kmt	suppress anger	3	2	5
ġmr	cover	1	0	1
ġmd	cover	1	0	1
ġmḏ	conceal	1	1	2
ġmy	roof	1	1	2
k̲mr	conceal	2	1	3
ktm	conceal	4	1	5
ġms	immerse	1	1	2
ġym	be overcast	2	2	4

2.4.2 Proposing sequence *ġm* as the phonological source of the network results from applying to Figure 5 the decision procedure outlined in §2.1, in that cluster indices are calculated for the phonemes comprising the various biconsonantal sequences and it turns out that *ġ* has the highest value in position C_1

three levels of significance, 0.05, 0.01 and 0.001, of which 0.05 is the least rigorous.

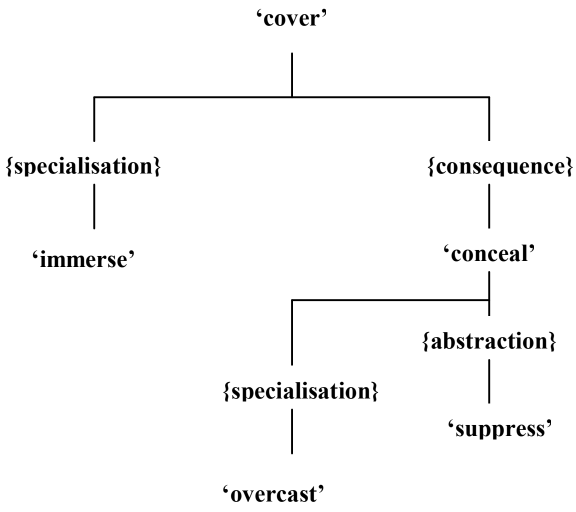
; in position C_2 the only phoneme identified is *m*. Thus the source of the phonological network is calculated to be {ġm} and the values of Ipd listed in Table 2.2 are developed on this basis.[16] Note that the values of Iod for these triradicals all fall within the range calculated in §2.3.

FIGURE 5 PHONOLOGICAL NETWORK {ġm}



[16] When the analysis is extended to Biblical Hebrew and Egyptian the source becomes {km}, not least because no equivalent to Arabic *ġ* occurs in these languages. This serves to emphasise the provisional nature of both phonological and semantic networks - and also begs the question of whether *ġ* was a phoneme in the language from which these roots are descended.

FIGURE 6 SEMANTIC NETWORK {cover}



3 Testing the General Hypotheses

3.1 Introduction

3.1.1 In §1.3 a distinction is drawn between testing the general hypothesis that many Semitic triradicals originate in biconsonantals, and testing specific hypotheses about individual roots. In §1.4 a similar distinction is drawn between testing the general augment hypothesis and particular hypotheses about the history of individual augments. This section addresses the question of testing the two general hypotheses, and it must be emphasised at the outset that there would appear to be no test that, in Popper’s terms, could entirely refute either hypothesis. Such a test would have to allow as a possible outcome that the Semitic triradical root system could not originate, either entirely or in part, in a biconsonantal system. Apart from being intrinsically unlikely this would be impossible to demonstrate, as testing must rely on statistical techniques which, being probabilistic by definition, cannot yield as an outcome the total refutation of the hypothesis.

3.1.2 With this reservation there are two obvious ways of testing the general biconsonantal hypothesis:

1. **Directly, by taking a well-defined sample of roots from one of the languages under study and calculating whether the proportion of the sample that can be fitted to phonological and semantic networks is statistically significant;**
2. **Indirectly, by determining whether the distribution of putative augment phonemes in a particular root**

position differs significantly from the overall distribution of the same phonemes in the language under consideration.

3.2 Testing for Biconsonantal Sequences in Triradical Roots

3.2.1 When testing for a significant incidence of biconsonantal sequences any set of roots may be used - geminate, second weak, third weak, or some subset of the 'strong' roots - provided that the sample is reasonably representative both phonologically and semantically. For example Wehr's dictionary of modern Arabic lists about 255 geminate verbal roots, the precise total depending on a judgement on the number of denominatives. The networks on which this study is based currently incorporate 147 Arabic geminate roots whose Iod falls within the range calculated in section §2.3. Is this a statistically significant proportion of the total? Two steps are involved in finding this out:

1. **Calculating the probability that 147 out of 255 roots would be fitted to networks;**
2. **Deciding whether this probability is statistically significant.**

A significantly high probability would constitute a failure to refute the biconsonantal hypothesis. If the probability is not significant the hypothesis would not be supported, although every additional geminate root fitted to a network would decrease the probability that the result is due to chance.

3.2.1 The statistical significance of these two quantities is calculated directly, using the formula:

$$z = \frac{x - np}{\sqrt{npq}}$$

where z is the number of standard deviations by which the calculated probability differs from the mean probability that 147 roots (x) from a sample of 255 (n) would be fitted to networks by chance (p = 0.5 and q = 1 – p). The resulting value for z is +2.44, and since a value of +2.0 or greater represents a significant incidence, this result can be interpreted as supporting the biconsonantal hypothesis.[17] It is assumed (but has not been demonstrated) that other subsets of roots would yield similar results.

3.2.3 The same calculation can be applied to the geminate roots of Biblical Hebrew. Making similar judgements about roots probably originating in nouns, *BDB*[18] lists 116 geminates, of which 69 are currently assigned to networks. The value of z for these data works out at 2.04, which again supports the

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[17] For a definition of 'standard deviation' see §2.3 above. The result is reasonably consistent with the comment made by Fleisch (*Traité*, Vol. I, p257) regarding the number of Arabic roots showing evidence of biconsonantal origin.

[18] F. Brown, F.S.R. Driver and C.A. Briggs, *A Hebrew and English Lexicon of the Old Testament* (1972).

biconsonantal hypothesis. Given that Arabic and Biblical Hebrew share a number of geminate roots the similarity between the two values for *z* is to some extent predictable.

3.2.4 The situation in Egyptian is somewhat different, in that the language displays a substantial number of biconsonantal roots but a very much smaller number of geminates. Faulkner's dictionary and the lexicon in Gardiner's grammar between them list 128 of the former and 23 of the latter.[19] Taking the two together, 69 roots are currently fitted to networks, which gives value for *z* of -1.06, a result which is obviously not significant. Moreover 12 of the 23 geminates are assigned to networks, so that the value of *z* for biconsonantals alone would be even lower. The difference between the results for Egyptian and the Semitic languages is perhaps rather surprising, for given the much greater age of the data in the former it might be expected to reflect the (common) pre-Semitic language more than do the Semitic languages. On the other hand the Egyptian biconsonantals probably includes a number which are African in origin rather than Asiatic and these, depending on their number, would obviously tend to skew the calculation. The limitations of Egyptian orthography also make it possible that some biconsonantal roots may in fact be II-weak, a possible example being *mt* 'die'.[20]

3.3 Testing the Distribution of Suffixed Augment Reflexes

3.3.1 This study is founded on data drawn from over 100 phonological and semantic networks and as will be seen from Table 3.1, the majority of triradicals fitted to the networks display a pattern where phonemes in position C_1-C_2 appear to reflect an original biconsonantal and the phoneme in position C_3 appears to reflect an augment.

TABLE 3.1 ANALYSIS OF ROOTS FITTED TO NETWORKS

	Total Roots	Geminate	Prefixed	Infixed	Suffixed	Quadri-radical	Biconso-nantal
Arabic	1103	147	161	188	607	48	-
Hebrew	619	69	116	104	334	3	-
Egyptian	361	12	69	43	153	29	57

In a relatively small number of cases the same root may be analysed as displaying either a prefixed or a suffixed augment reflex. In some instances this occurs because the root has apparently quite distinct senses which are best accounted for by proposing that two originally different roots have coalesced. In

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[19] R.O. Faulkner, *A Concise Dictionary of Middle Egyptian* (1962); A.. Gardiner, *Egyptian Grammar*[3] (1988).

[20] See for example T.W. Thacker, *The Relationship of the Semitic and Egyptian Verbal Systems* (Oxford 1954), p61 ff. Apparent Egyptian biconsonantals are accepted as such unless there is compelling evidence to the contrary.

other cases the Iod of a root may not allow its origin to be determined unambiguously. [21]

3.3.2 Table 3.2 shows the distribution of Arabic phonemes (total 607) currently assigned as suffixed augment reflexes (SARs).

TABLE 3.2 ARABIC AUGMENT PHONEMES IN POSITION C_3

Phoneme	Number of Roots	Phoneme	Number of Roots	Phoneme	Number of Roots
’	23	z	11	f	34
b	35	s	27	q	37
t	8	š	13	k	16
t̠	6	ṣ	8	l	42
j	13	ḍ	11	m	43
ḥ	27	ṭ	17	n	16
k̠	11	ẓ	1	h	4
d	26	‘	34	w	48
d̠	1	ġ	1	y	34
r	60				

There are two possible relationships between these totals and the numbers of each phoneme occurring in position C_3 in Arabic as a whole:

1. Each total is approximately proportionate to the overall incidence of the phoneme, which would suggest that the postulated SARs occur randomly;
2. The totals are not proportionate to the overall incidence, in that some phonemes occur more often that might be expected and others less often.

3.3.3 The actual incidence of phonemes in each root position is therefore compared with the numbers which might be expected if they were occurring randomly. If the overall distribution differs significantly (in statistical terms) from that which might have been expected, and is therefore probably non-random, this particular set of data would constitute further formal support for the hypothesis that many triradicals originate in biradical plus suffixed augment. The statistical significance of the data is determined by calculating the value of χ^2 in the formula:

$$\chi^2 = \sum_{i=1}^{28} \frac{(o_i - e_i)^2}{e_i}$$

where *o* is the actual number of examples of a particular phoneme (as in Table 3.2) and *e* the number

[21] Note the variation in the percentages of quadriradicals fitted to networks, 6 per cent in Arabic but only 1 per cent in Hebrew. Egyptian quadriradicals, by contrast, comprise almost 12 per cent of the total. Except insofar as they contribute to the construction of phonological and semantic networks, no consideration has been given to the ways in which quadriradicals, other than reduplicates, may have been created. See Fleisch, *Traité,* Vol. II, p427 ff.

which might be expected if the incidence were random.

3.3.4 Observed and expected values for Arabic phonemes in position C_3 are compared in Table 3.3.[22] These yield a value for χ^2 of 49.20, which (for 28 phonemes) is significant at the 5 per cent level. In statistical terms this is a quite satisfactory result and supports the general augment hypothesis, at least insofar as it concerns Arabic phonemes in position C_3.

TABLE 3.3 ARABIC SARS – OBSERVED VS EXPECTED VALUES

Phoneme	o_i	e_i	Phoneme	o_i	e_i	Phoneme	o_i	e_i
’	23	22.99	z	11	11.26	f	34	29.75
b	35	38.59	s	27	20.42	q	37	25.24
t	8	16.08	š	13	13.83	k	16	12.54
ṯ	6	13.83	ṣ	8	10.45	l	42	40.04
j̲	13	17.37	ḍ	11	9.17	m	43	39.07
ḥ	27	23.48	ṭ	17	14.63	n	16	30.23
k̲	11	11.74	ẓ	1	4.02	h	4	8.68
d	25	31.52	‘	34	25.24	w	48	35.37
ḏ	1	5.31	ġ	1	4.98	y	34	37.03
r	60	53.87						

3.3.5 Similar calculations have been carried out for putative SARs in Hebrew and Egyptian, which yield χ^2 values of 37.85 and 16.92 respectively. The Hebrew value is also significant at the 5 per cent level (for 23 phonemes), but the value of 16.92 suggests that at least some Egyptian phonemes postulated as augment reflexes at position C_3 have a different history.[23] Thus although there are three Egyptian phonemes whose incidence at position C_3 is individually statistically significant (§7.1 below), at the period of the documents from which the data is drawn, triradicalisation through suffixed augments in Egyptian would appear either not to have been so prominent as in the Semitic languages, or phonological changes in Egyptian had been rather more far reaching than the methodology employed in this study can currently detect.

3.3.6 It will be seen from Table 3.3 that the difference between the observed and expected values for certain Arabic phonemes in position C_3, for example *s*, *q* and *w*, is particularly striking. If the incidences of these and other phonemes can be shown to be individually statistically significant then it might be possible to begin to understand the history of these augments, at least as regards their phonology if not

[22] Data for the expected totals are derived from the tables in J.H. Greenberg, ‘The Patterning of Root Morphemes in Semitic’, *Word 6* (1950), p162-81.

[23] Calculations for Hebrew and Egyptian based on verbal roots only. Hebrew roots are those listed in *BDB* ; Egyptian roots are from Gardiner’s grammar and Faulkner’s *Dictionary of Middle Egyptian*.

their original meaning or grammatical function. These questions are explored in Sections 6 to 8.

3.4 Prefixed and Infixed Augment Reflexes

3.4.1 The distributions for prefixed and infixed augment reflexes (PARs and IARs) are calculated in the same way, and yield the values for χ^2 shown in Table 3.4.[24]

TABLE 3.4 VALUES OF χ^2 FOR PARS AND IARS

	PAR	IAR
Arabic	109.05	92.48
Hebrew	43.84	46.13
Egyptian	43.18	22.26

All three values of χ^2 for PARs are significant at the 5 per cent level, as are the values for Arabic and Hebrew IARs. As with the SARs, the value of χ^2 for Egyptian IARs overall is not significant, although there are two phonemes whose incidence is significant individually (Section 8 below). But note that only 43 Egyptian roots are currently identified as displaying IARs.

4 Testing Biconsonantal and Augment Networks

4.1 Phonological Evolution in Triradical Roots

4.1.1 In §1.3 above it is emphasised that a quantitatively-based analysis of a set of triradicals is not in itself sufficient to ensure that a given pair of phonological and semantic networks, however carefully constructed, constitute a correct account of the history of their biconsonantal component and of the associated triradical roots. Both types of network are hypotheses about relationships among the putative biconsonantal reflexes from which they are constructed. Adapting Popper's formulation (see again §1.3), in order to begin to validate a given pair of networks it must be possible to make at least general predictions about the relationships between the roots on which they are based, and then to devise a method for testing these predictions. This section considers how this might be done for phonological networks.

4.1.2 If a triradical is assigned to a network by applying the procedures developed in Section 2, and does indeed appear to originate in an augmented biconsonantal, consideration should be given to the ways in which the triradical could have evolved. The principle that an augment becomes so closely identified with a biconsonantal as to be more or less inseparable from it presents no theoretical difficulty ; but what are the likely phonological consequences of such a development? Consider a hypothetical biconsonantal

[24] Actual values of observed and expected PARs and IARs can be found in Tables §6.1 and §8.1 below.

**pr* which enters into permanent association with a suffixed augment having as its consonantal component phoneme **s*. Ignoring modifications to the vocalisation of the resulting three-consonant cluster there would seem to be four principal ways in which the phonemes of augmented biconsonantals could have interacted.

1. Each phoneme retains its original value, so that the resulting triradical is *p-r-s*;
2. Sequence *p-r-s* may have been phonologically unacceptable or only peripherally admissible, in which case there would have been pressure to modify one or more of the three phonemes;[25]
3. As the range of senses associated with a triradical expanded, phonological and semantic changes may have occurred more or less simultaneously, so that 'new' senses acquired their own triradical pattern. There is obviously considerable potential for this kind of process and it must be assumed that its results are reflected in the networks;
4. Language-specific sound laws are at some stage likely to have operated on triradicals formed in the ways outlined above, and it must also be assumed that there would have been other phonological developments specific to certain dialects of a particular language.

The foregoing does not exhaust the ways in which changes could have occurred but should be sufficient to demonstrate that roots identified through network analysis have very likely been subject to a complex series of phonological processes.

4.1.3 If the data yielded by networks is generally valid, and the relevant triradicals have developed phonologically along the lines proposed above, it can be asked why a particular triradical consists of the precise phoneme string it does, rather than some other. For example, suppose that biconsonantal **pr* and augment **s* yield the triradical $p\text{-}r\text{-}s_1$, where s_1 differs from *s* only in one distinctive feature. Suppose also that there exists a further phoneme, s_2 which also differs from *s* by only one feature, but that $p\text{-}r\text{-}s_2$ is not attested, why should the triradical take the former value rather than the latter? Of course, natural language being an ill-defined system the absence of a particular root may in many cases simply be due to chance, quite aside from the fact that such a root may simply not be attested in the corpus of a dead language.

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[25] A variant on this process could have involved modifications to *r* and *s* while the latter was still perceived as being distinct from its biconsonantal.

4.2 Statistical Patterning of Triradical Root Morphemes

4.2.1 Certain phonological patterns are statistically more probable in Semitic triradicals than others. For instance, Table 4.1 shows the patterning of Arabic triradical roots fitted to networks along dimension [+voice] vs [-voice], together with calculations of the probability that such sequences will occur. Table 4.2, by comparison, shows the patterning and probability of the same roots analysed along dimension [+stop] vs [-stop]. Both distributions are statistically significant and at an anecdotal level there are a number of points of interest. In Table 4.1 for instance, there are relatively few roots with three voiceless radicals, whereas in Table 4.2 there is a near total absence of roots with three stops, and a marked preference for roots with only one stop or none at all.[26]

TABLE 4.1 DISTRIBUTION OF ARABIC ROOT PATTERNS: [+VOICE] VS [-VOICE]

Sequence	Number of Roots	Probability
nnn	24	0.043
vvn	49	0.090
vnn	55	0.101
nnv	61	0.112
vvv	72	0.132
nvn	88	0.150
vnv	82	0.150
nvv	121	0.222

TABLE 4.2 DISTRIBUTION OF ARABIC ROOT PATTERNS: [+STOP] VS [-STOP]

Sequence	Number of Roots	Probability
sss	8	0.015
ssn	38	0.071
sns	39	0.071
nss	41	0.075
snn	85	0.156
nsn	103	0.189
nnn	114	0.209
nns	118	0.216

4.2.2 The potential for utilising this kind of evidence in addressing the question raised in §4.1 will be obvious. If it can be shown that, in articulatory terms, sequence *p-r-*s_1 is more probable than *p-r-*s_2 then a start has been made in explaining why the one string is attested but not the other. Thus, if *p-r-*s_1 originates in **pr-s* the prediction being made is that the former sequence is at least not less probable than the latter, and that on some phonological measure s_1 is closer to the original augment consonant than is s_2. Similarly,

[26] In Table 4.1, v = [+voice] and n = [-voice], and in Table 4.2, s = [+stop] and n = [-stop].

if it is proposed that a further triradical, say p_1-r-s_3, has derived from p-r-s_1, this in effect is to predict that sequence p_1-r-s_3 is not less probable than p-r-s_1.

4.2.3 The power of this technique could obviously be enhanced by developing probability tables embracing a more comprehensive range of phonological patterns. For example the probability that a triradical will occur with some combination of the features [+voice] vs [-voice] and [+stop] vs [-stop] can be calculated, although of course this would not of itself be sufficient. For example, save where accompanied by voicing or spirantization, nothing is being said about the probability of weakening in pharyngals, or emphatics generally, or the occurrence of different sibilants. Both are well-attested phenomena in the Semitic languages - albeit not in Arabic.

4.2.4 However, there is no reason in principle why probabilities for the variant occurrence of sibilants or weakening in pharyngals could not be incorporated into a more powerful table. Nonetheless, even an expanded table would still represent only an approximate statement of the phonological principles governing the creation of individual triradicals and their subsequent modification. For example, if a sequence of three voiceless stops is improbable but nevertheless occurs, there must be environments in which such a sequence is acceptable. Thus if, as would seem inevitable, probability tables can be concerned only with phoneme classes, they would need to be supplemented by rules governing co-locational restrictions among individual phonemes. Some of these restrictions are already well known. For instance the rule that phonemes in positions r_1 and r_2, or r_1 and r_3 in a Semitic triradical generally cannot be identical, or even homorganic, can obviously be utilised when testing networks. However, in the limit, there will always be a small number of triradicals which will resist verification.

4.2.5 A further difficulty with a probabalistic approach is that although in synchronic terms the probability of one type of root rather than another in a given language can be computed, there is no assurance that the same probabilities were operating in the pre-history of the Semitic languages, when triradicals were first being created. On the other hand it is not impossible that the historically-attested patterning of root sequences in Semitic is to some extent fossilised evidence for these older phonological processes.

4.2.6 In contrast to the reasonably encouraging prospects for testing phonological and augment networks there are possibly insuperable problems in testing semantic networks. Clearly there is no probability-based test that could be applied since, beyond the completely trivial, it is impossible to predict

that some particular sense would be assigned to a triradical rather than some other. It could be suggested that if one root can be phonologically derived from another, then the sense of the former might equally originate in that of the latter. While this would be a useful check on phonological networks, semantic change being in the final analysis socio-environmentally conditioned, it is unlikely to be susceptible of logical or quantitative analysis beyond the very general level proposed in Section 2.

4.2.7 To summarise, it may be that the compilation of probability tables, supplemented by rules governing co-locational restrictions, will offer a potentially adequate device for testing phonological networks. Given the differing patterns of phonological development in the various languages, slightly different tables will be required for each group of languages; thus for example a table for Arabic would value more highly triradicals with pharyngals than would say an equivalent table for later variants of Aramaic.

5 Analysis of Augments

5.1 Standardised Significant Incidence (SSI) of Augment Reflexes

5.1.1 That the overall distributions of prefixed, infixed and suffixed augment phonemes in the data are in many cases statistically significant (§3.3 and §3.4) does not mean that every individual phoneme is of equal importance as a potential augment reflex. Table 3.3 shows that several of the observed incidences of Arabic suffixed augment reflexes (SARs), for example those for *b* and *r*, are more or less equal to those expected. The purposes of the discussion which follows are therefore:

1. **To develop a procedure for determining whether any individual augment reflex identified by network analysis occurs in statistically significant numbers ;**
2. **To consider how, on the basis of results yielded by the procedure, the various augment reflexes might be related to each other and what their original phonological values may have been.**

5.1.2 The importance of an individual phoneme as a potential augment reflex cannot of course be assessed independently of the overall incidence of that phoneme at the relevant position in the root. Suppose for example that the observed incidences of two phonemes p_1 and p_2 at position C_3 both exceed their expected values by five. If p_1 occurs 100 times overall (i.e. in all roots) and p_2 occurs only 50 times, then the deviation of p_2 from its expected value is in some sense more striking than that of p_1 and should be reflected in the way the data is analysed. A further problem arises where the number of observed examples of a particular phoneme yielded by network analysis is substantial, as Arabic *b* and *r*, but

because of the high overall incidence of the phoneme in question the expected total is also substantial. This could suggest that the examples observed are due to chance, which some indeed may be. But if many of the relevant roots display good values of 'index of overall deviation' (§2.3), it may be that the high overall total is a *consequence* of the original function of the phoneme in question as an augment reflex, rather than the *cause* of the high observed value.

5.1.3 To take these factors into account the observed (raw) value of each potential augment reflex is weighted to reflect the total number of the particular phoneme occurring at the root position in question; this will be termed the 'standardised incidence' of the augment.[27] When these values have been calculated for each potential augment reflex the mean and standard deviation of the data are calculated. Applying the criteria for statistical significance introduced in §2.3, it then becomes possible to identify which phonemes have a 'significant standardised incidence' (SSI) and are thus more likely to merit further analysis. In the following sections this analysis is carried out for each triradical root position.

5.2 Constructing Augment Networks – Cluster Indices

5.2.1 A complementary technique for analysing augments, which can be deployed in parallel with the purely statistical technique outlined above, is to construct augment networks, fitting augments into the kind of phonological template utilised when constructing biconsonantal networks, and then to calculate a 'cluster index' (§2.1.6) for each augment phoneme (data in Appendix A). For example, for SARs in the velar/laryngal/pharyngal ('velaph') series (§7.3), it turns out that *q* has the highest cluster index in both Arabic and Hebrew (Appendix A Table A10).

5.2.2 For a given articulatory series (velaph, dental, labial, etc.) the phoneme with the highest cluster index is proposed as the closest match to the consonantal component of the original augment, and associated phonemes with lower values of cluster index are taken to result from phonological changes applied to the original. In the ideal case, augment phonemes pinpointed by statistical analysis as having 'significant standardised incidence' would also display the highest cluster index, and this is not infrequently the case. However it also becomes apparent that some groups of augments exhibit neither a

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[27] **The formula for this calculation (developed by trial and error and doubtless capable of improvement) is $SI = o.\left(\frac{o}{e}\right)^2$, where *o* and *e* are respectively the observed and expected numbers of the particular augment phoneme at the relevant root position.**

phoneme which is statistically significant nor one with a particularly interesting cluster index. These groups are a problem in that they suggest that the process of triradicalisation was more complex, or at times more random, than has so far been envisaged. Certain roots will of course have been incorrectly assigned to networks despite displaying an index of overall deviation within acceptable limits.

5.3 Augment Functions

5.3.1 Given the great length of time that has elapsed since triradicalisation took place, and the consequent potential for roots to have undergone substantial phonological and semantic modification, there must be a considerable element of conjecture when proposing augment functions. The process is simplified by grouping augment reflexes into clusters, which avoids the necessity for futile speculation on the original functions of twenty-odd phonemes. But as will be seen from what follows, without extensive exercise of the imagination it is very difficult to make more than the most general statement about the original function of any group of augment reflexes.

5.3.2 Other studies that have attempted to address this question reach widely differing conclusions (§6.1, §7.1 and §8.1 below). Ehret for example proposes a comprehensive if ultimately implausible set of suffixed augments and associated functions, but has nothing to say about prefixed and infixed augments. Kuryłowicz[28] takes a quite contrary position, concluding that most apparent suffixed augments result from phonological modifications to geminate roots, and that there can thus be no demonstrable relationship between form and function. Botterweck takes an intermediate position, viewing both PARs and SARs as resulting from the incorporation of deictic elements into original biconsonantal roots. Botterweck and Kuryłowicz both interpret PARs as originating in deriving morphemes, but neither devotes much attention to IARs. All three tend to assume that where not originating in a noun (favoured in particular by Kuryłowicz), the original roots/stems were biconsonantals of form CvC (with short vowel). However, a consideration of non-Semitic languages founded to a lesser or greater extent on biconsonantal stems suggest that, although a convenient working hypothesis, this is simplistic, especially with regard to triradicals incorporating a weak consonant.

5.3.3 The roots cited in the following sections are generally confined to those with an index of overall deviation (Iod) of 3 or less. None has an Iod greater than 4, although roots with putative IARs frequently

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[28] Ehret, 'Origins' *passim*. J. Kuryłowicz, 'The Verbal Root in Semitic' in his *Studies in Semitic Grammar and Metrics* (London 1973).

have the latter value. The roots cited are thus among the most secure of those analysed for this study.

6 Prefixed Augment Analysis and Functions

6.1 Significant Standardised Incidence

6.1.1 Table 6.1 sets out the raw (unstandardised) observed and expected values for putative prefixed augment reflexes (PARs) in the three languages under consideration ; observed values exceeding the corresponding expected values are shaded.[29]

TABLE 6.1 PREFIXED AUGMENT REFLEXES (RAW DATA)

	Arabic		Hebrew		Egyptian	
	o	e	o	e	o	e
ʾ	8	5.59	8	5.14	3	2.20
b	9	6.48	10	5.14	0	2.20
t	3	2.13	1	2.2	2	2.43
ṯ	0	2.13	-	-	-	-
j/g	4	6.06	3	4.46	0	1.62
ḥ	3	8.36	-	-	0	4.63
ḵ	3	6.14	4	9.31	1	4.28
ẖ	-	-	-	-	0	1.27
d	4	5.25	5	4.27	2	2.43
ḏ	1	2.30	-	-	-	-
r	7	9.72	8	8.24	1	1.62
z	9	3.58	5	3.59	-	-
s	5	8.02	2	3.98	12	9.03
š	11	6.95	10	8.83	2	3.47
ś	-	-	2	3.39	-	-
ṣ	2	5.12	5	4.46	0	1.97
ḍ	1	3.20	-	-	-	-
ṭ	1	3.84	1	2.72	-	-
č	-	-	-	-	1	0.93
ẓ	1	0.64	-	-	-	-
ʿ	6	8.79	5	7.37	0	3.13
ġ	1	5.20	-	-	-	-
f/p	4	7.72	3	6.40	7	3.48
q	1	7.68	0	5.33	0	1.85
k	2	6.01	2	4.85	1	1.16
l	3	6.82	3	2.72	-	-
m	11	7.29	2	5.33	3	3.70
n	34	12.07	22	10.28	13	5.33
h	5	5.20	4	2.15	1	1.04
w	21	8.02	0	0	11	6.48
y/i	1	0.68	11	6.30	9	4.75

6.1.2 Applying the procedure outlined in §5.1, the following phonemes are identified as having statistically significant standardised incidence (SSI) as a prefixed augment:[30]

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[29] **The Egyptian character transcribed as [ḏ] is taken here to have had something of the value *ṣ*, although no roots with this phoneme as PAR have so far been identified. The observed/expected totals for Egyptian *3* are given under *ʾ*, but see also §6.3.**

[30] **The value for Egyptian *w* is in fact slightly less than signficant.**

Arabic	***n***	***w***	
Hebrew	***n***	***y***	***b***
Egyptian	***n***	***w/i***	***p/f***

6.1.3 As noted above, a common conjecture about prefixed augments is that they derive from the conjectured 'Afroasiatic' deriving morphemes. It will be seen from what follows that in many cases this is probably the correct explanation. Kurylowicz assumes that all such roots originate in 'deverbative nouns',[31] but whereas it would be surprising if no root incorporating a PAR originated in this way, and indeed he offers relatively recent examples from Arabic, it is not clear why this should be true of a majority let alone all of the relevant roots, unless by appeal to his 'general theory of the derived verbal classes', on which he does not elaborate.

6.2 Sibilant Group

6.2.1 The sibilant phonemes considered in this study are taken to comprise the unordered set:[32]

S = [s, š, ṣ, ś, z]

where *ś* is attested only in Hebrew and Egyptian *z* is attested only in the oldest period. Arabic *ṯ* must also be considered an intermittent member of this set; likewise Arabic *j*, which on occasion clearly originates in *ž* (voiced *š*), and also Semitic *h*, occasionally originating in *s*. It will be seen from Table 6.1 that the individual totals in this group are not large - and moreover no phoneme has SSI. Nonetheless it is likely that at least some of the relevant roots incorporate the consonantal component of the 'Afroasiatic' causative/factitive deriving morpheme *š(a) / s(a)*, among which are the following, all Arabic:

TABLE 6.2 SIBILANT PARS IN CAUSATIVE/FACTITIVE ROOTS

Root	Source	Root	Source
sjn 'imprison'	{kn : protect}	skb 'pour out'	{kb : pour}
sdl 'lower'	{dl : be low}	šml 'fill'	{ml : be complete}
šḵb 'pour out'	{kb : pour}	šhr 'make known'	{hl : become apparent}

6.2.2 The Arabic and Hebrew cluster indices point to *š* as the original value of this augment and the Egyptian data to *s*. But *š* as the consonantal component of the causative/factitive morpheme seems almost

[31] 'Verbal Root', p7.

[32] The notation *S*, etc. denotes a superordinate morpheme which may or may not have had the value of one of its members. The braces *[ ]* indicate that this and the following sets are taken to be formally ill-defined.

to be confined to the Semitic languages, with *s* almost universal in the relevant African languages.[33] Thus, although Semitic roots with PAR = *s* may originate in PAR = *š*, it may also be the case that *s* (and *z*) reflect a (pre-Semitic?) stage before *š* became the predominant phoneme. The foregoing aside, it is not obvious why some have PAR = *s* and others *š*, other than dialectal difference ; note in particular the two clearly equivalent Arabic roots *skb* and *šḵb*.

6.2.3 The list can be expanded to include roots that are fientive but not obviously causative or factitive (Table 6.3 - grouped according to the value of their initial consonant). Note the number of roots expressing a sense of making some kind of noise, which could well be denominative in origin.

TABLE 6.3 SIBILANT PARS IN FIENTIVE ROOTS

Root	Source	Root	Source
Ar (sḥj : scrape off)	{ḥq : scrape}	Eg (snq : suckle)	{nq : suck}
Hb (srḥ : go)	{ḥr : move away}	Eg (ssḥ : destroy)	{šḥ : crush}
Eg (sbḥ : cry aloud)	{bḥ : make noise}		
Ar (šdḵ : smash)	{dḥ : crush}	Hb (šṭp : overflow)	{ṭb : overflow}
Ar (šhq : bray}	{‘q : cry out}	Hb (šs‘ : divide)	{š‘ : cut}
Hb (š’g : roar)	{‘q : cry out}		
Ar + Hb (záq : scream)	{‘q : cry out}	Hb (ṣhl : neigh)	{hn : make noise}
Ar (ṣḵb : shout)	{bḥ : make noise}	Hb (ś‘r : perceive)	{‘l : be evident}

6.2.4 A few roots have intransitive or stative sense,[34] among which are:

Ar (sḵn : be hot) source {ḥr : be hot}   Eg (sṣr : lie down) source {ḍn : be low}

Hb (šbt : cease) source {bt : be weak}   Eg (š’m : be hot) source {ḥm : be hot}

Ar (zḵm : stink)[35] source {ḵm : decay}

6.2.5 Among Arabic roots with possible *j* ← *ž* ← *š* are *jbr* ‘repair’, source {rb : mend}, and *jr‘* ‘swallow’, source {l‘ : eat}. Among Hebrew roots with possible *h* ← *š* (or *s*) are *hdk* ‘tread down’, source {dk : crush} and *hpk* ‘overturn’, source {qp : overturn}.

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[33] See Lipiński, *Outline*, §41.7. There appears to be evidence that the Egyptian phoneme represented by the sign [š] was not originally a sibilant, but rather velar, perhaps corresponding to ḵ or ẖ. See K. Rowan, ‘Meroitic-an Afroasiatic language’, *SOAS Working Papers in Linguistics 14* (2006), §3.2.7.

[34] See Moscati et al, *Introduction*, §16.10.

[35] Also Hb (zhm : be foul). Certain of these roots could have originated in a dental PAR, i.e. *t* → *d* → *z*. See below at §6.5.

6.3 NLR Dental Group

6.3.1 The set of nasal, lateral and rolled dental phonemes examined in this study can be summarised as;

N = [l, r, n, R]

where *l* is (graphically) absent from middle and earlier Egyptian and *R* is taken commonly (but not always) to be the value of Egyptian *3*.[36] Intermittent members of this set are labial *m* and semi-vowel *w*.

6.3.2 As noted at §6.1.2, significant incidences of *n* are attested in all three languages under review, and the standardised incidences are supported by the cluster indices, in which *n* predominates in all three languages. As with the sibilants it is likely that at least some of the relevant triradicals incorporate Semitic deriving morpheme *n(a)*, commonly occurring with passive or middle function.[37] However, rather fewer than 50 per cent of roots identified with PAR = *n* in fact have passive or middle implication. In Berber and Cushitic the consonantal component of the morpheme equivalent to Semitic *n(a)* is generally *m,* and as the Arabic cluster index for the lattter phoneme is reasonably high it may just possibly reflect an alternative to the *n*-based morpheme, although the nearer phonological association of *m* with the labial group tends to weaken such a conjecture.

6.3.3 Among roots supporting the conjecture that PAR = *n* may reflect the Semitic deriving morpheme are;

Ar (nd̲l : be low)[38] source {dl : be low} Ar (nšb : be fixed) source {sb : join}

Ar (nwt : stagger) [39] source {wd : wander about} Hb (ngr : flow) source {rq : move [vt]}

Note also the following roots expressing the sense of making a noise of some kind, parallel to those in Table 6.3;

Ar (nbḥ : bark) source {bḥ : make noise} Ar (nšj : sob) source {šk : b unhappy}

Hb (n'q : groan) source {'q : cry out}

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36 Thacker, *Relationship*, 2. A. Loprieno, *Ancient Egyptian – A Linguistic Introduction*, 1995, p31. For Egyptian *3* as a glottal stop see §6.6.1.

37 Note that *n* as a deriving morpheme has very restricted distribution in Egyptian, Aramaic, N. Ethiosemitic and Epigraphic South Semitic. See Gardiner, *Egyptian Grammar*, p276; Lipiński, *Outline*, §41.17.

38 Cf. also Ar (rd̲l : b low).

39 Also Hb (nwd : wander), Eg (nwd : turn aside) and Ar (rwd : move about).

Among possible examples of PAR = *r*, *l* or *m* with passive/reflexive sense are;

Ar (mḥḏ : be pure) source {ṣḥ : be pure} **Hb (rbd : be spread) source {bt : spread}**

6.3.4 But many roots with PAR = *NLR dental* are transitive and are thus less likely to derive from original N-forms. Examples are given in the following table;

TABLE 6.4 NLR DENTAL PARS WITH TRANSITIVE SENSE

Root	Source	Root	Source
Ar (nṯr : scatter)	{zr : scatter}	Ar (nkb : pour out)[40]	{kb : pour}
Ar (nḥt : cut out)	{qṭ : cut}	Hb (npṣ : shatter)	{pḍ : force apart}
Ar (nk̲z : bore into)	{k̲z : pierce}	Eg (ndb : cover)	{ḏm : cover}
Ar (rkz : plant)	{k̲z : pierce}	Hb (rṣḥ : slay)	{ḥṣ : cut}
Hb (rkš : gather)	{qš : gather}	Eg (rk̲s : slaughter)	(ḥṣ : cut}
Ar (lqm : gobble)	{qm : eat}	Hb (lḥṣ : press)	{qs : crush}

These roots thus suggest that NLR dental PARs may in fact embrace two different morphemes, one corresponding to the Semitic N-form but the other, actually slightly more common in the data, appearing to derive from a pre-Semitic original with transitive sense and having no obvious correlate in Semitic.

6.3.5 Otherwise, with regard to phonemes *r* and *l* it should be noted that the former is the most common infixed augment reflex (Section 8 below), and it is thus possible that some instances of these phonemes in position C_1 result from metathesis from position C_2.

6.4 Labial Group

6.4.1 The set of labial phonemes considered in this study can be expressed as;

$$B = [b, p, m]$$

where *p* is also realised as *f* in Egyptian and is always *f* in Arabic. Intermittent members of this set are *n* and semi-vowel *w*, the latter an occasional variant of *b* and *p*, as for example Arabic *bjm* 'be dumb' vs *wjm* 'be silent' and Egyptian *pḥṣ* 'sever' vs *wḥs* 'cut off'. Hebrew *b* and Egyptian *f/p* both have SSI, an analysis supported by their cluster indices. Thus, even though the weighted values for Arabic *b* and *f* fall short of significance, it remains likely that there was indeed an original prefixed augment with a labial component. In support of this there are several roots with convincing Iod, a number of which have intransitive or passive sense, as for example;

Ar (b's : be strong) source {'ṣ : strong} **Hb (b'r : burn) source {ḥr : be hot}**

Hb (brḥ : flee) source {ḥr : move away} **Hb (bšl : boil) source{sr : burn [vt]}**

However, Arabic *b* not uncommonly has *w* as a variant, and stems with weak prefixed augment appear

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[40] Compare Ar (skb) in §6.2.

originally to have had primarily intransitive or passive sense (§6.7). Thus it may be that some roots with labial PAR originate in this way. Applying this argument to Hebrew would of course require that at least some of the attested I-*y* roots in that language were originally I-*w*.[41]

6.4.2 But there are also several good examples of a labial PAR with unambiguously transitive sense, for example;

Ar + Hb (bzr : sow) source {zr : scatter} Ar + Hb (bl' : swallow) source {l' : eat}

Ar (fqš : crush) source {qṣ : crush} Eg (pḥṣ : sever) source {ḥṣ : cut}

Eg (mn' : suckle) source {nq : suckle}

Roots with apparent PAR = *f* < *p* could also be explained as originating in a sibilant but this is of course less likely for roots with PAR = *b, m*.[42]

6.4.3 All the above are sound assignments in their networks and, ignoring the very real possibility that some augments result from phonological change, it is difficult to see the link between the intransitive and transitive groups save that, with the exception of Egyptian *mn'* the objects of the transitive verbs are not obviously animate, while the *m* of *mn'* could originate in *n*. Roots with PAR = *m* could also originate in pre-Semitic verbal nouns with prefix *ma-*, etc., as is the case with a number of Arabic quadriradicals ; compare for example *msḵr* 'ridicule' with *masḵara* 'cause of mockery'.[43]

6.5 Dental Group

6.5.1 The set of dental phonemes can be expressed as;

T = [ṭ, t, ḍ, d]

where the Egyptian equivalent to *ṭ* is taken to be *č* ([t̲]). Phoneme *ḍ* is replaced by *ṣ* in Hebrew and (probably) Egyptian. Intermittent members of the set are taken to be Arabic *t̲, d̲* and *ẓ*, also Arabic and Hebrew *z*.

6.5.2 Although there is no PAR with SSI in this group, as with the labials there are roots with fairly convincing Iod. In the absence of any phoneme with significant incidence it may therefore be that the more convincing examples originate in biconsonantals associating with 'Afroasiatic' deriving morpheme *t*, with typically passive or reflexive function, in the same way as certain of the sibilants and NLR dentals.

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[41] Lipiński, *Outline*, §11.13

[42] Lipiński, *Outline*, §11.15.

[43] Cf. Kuryłowicz, 'Verbal Root', p8.

This conjecture is supported by the paucity of examples from Egyptian, from which prefixed deriving morpheme *t* is absent. But this said, there are rather few roots that appear to originate in a deriving morpheme, the following list including almost all the relevant examples.

Ar (dk̲l : enter) source {k̲r : penetrate}	**Hb (dšn : be fat) source {šm : be fat}**
Eg (čḥn : approach) source {ḥn : approach}	**Eg (dhn : bow) source {ḥn : bend}**

6.5.3 On the other hand this group includes a few convincing Arabic roots with transitive sense, although some may derive from roots with sibilant PAR, as for example *d̲‘q*, related to *z‘j* ‘alarm someone’.

Ar (dḥr : drive away) source {ḥr : move away}	**Ar (dḥš : insert) source {k̲z : pierce}**
Ar (d‘s : crush) source {qṣ : crush}	**Ar (d̲‘q : frighten) source {‘q : cry out}**

6.6 Velar/Laryngal/Pharyngal Group

6.6.1 The set of velar/laryngal/pharyngal (‘velaph’) augments considered in this study can be expressed as;

Q = [q, ḥ, á, k̲, k, g, h, à, ġ]

With the exception of *ġ*, which appears to be confined to Arabic, and *k̲* which is taken to be absent from the Hebrew of the early first millennium BCE, these phonemes occur in all three languages under consideration, although recall that Egyptian character *3* often has the value *ʀ* (§6.3.1). Egyptian also has a phoneme here written *h̲* (although see §6.2.1), and Egyptian *č* may also belong here as a variant of *k*. The individual totals are modest and there is no phoneme with SSI. In Arabic and Hebrew phoneme *à* has the highest cluster index, shared with *á* in the case of Arabic. A sample of the more convincing roots is given in Table 6.5:

TABLE 6.5 VELAPH PARS

Root	Source	Root	Source
Ar (’zb : flow)	{sb : flow}	Hb (’hl : shine)	{hl : be apparent}
Ar (’zq : be narrow)	{dq : be thin}	Eg (’šr : roast)	{sr : burn}
Ar (qṭr : trickle)	{ṭr : flow}	Ar (kšḥ : scatter)	{š‘ : scatter}
Ar (jbr : repair)[44]	{rb : mend}	Hb (kḥš : become lean)	{qš : shrivel}
Ar (ḥdr : lower)	{dl : be low}	Ar (k̲rj : go out)	{rq : move}
Ar (ġbr : go by)	{br : pass through}	Hb (‘ng : be soft)	{rq : be soft}

6.6.2 Although all these roots have convincing Iod it must be questioned whether they originate in a

[44] See also §6.2 above.

velaph prefixed augment. Some may originate in a sibilant and result from a shift, say, *s* → *h* → *à*, although most roots with PAR = *à* are intransitive. Arabic roots with PAR = *j* may similarly originate in a sibilant (§6.2), and perhaps even those with PAR = *ḩ* or *k̲*. However the remainder are something of a problem, although there is ample evidence in Semitic for *à* as a worn-down version of other phonemes. One or two may even have arisen through a two-step metathesis from an equivalent suffix.

6.7 Weak Phonemes w and y/i

6.7.1 As noted in §6.1, phoneme *w* has SSI as a PAR in both Arabic and Egyptian, along with Hebrew *y* and Egyptian *i*, suggesting that these phonemes should in general be taken as a group. As the following table shows, a number of fairly secure roots with PAR = *w* and *y* (*i* in Egyptian), have intransitive or passive sense;

TABLE 6.6 'WEAK' PARs

Root	Source	Root	Source
Ar (wk̲m : be unhealtthy)	{k̲m : decay}	Ar (wġr : be hot)	{ḥr : be hot}
Ar (wzb : flow)	{sb : flow}	Ar (wġl : penetrate deeply)	{k̲r : penetrate}
Ar (wl‘ : burn)	{lḥ : burn}	Eg (wšr : dry up)	(ṣr : become dry}
Ar (wḍḥ : be clear)	{ṣḥ : be pure}	Hb (yr‘ : quiver)	{rq : shake}
Hb (yṣ’ : go out)	{ṣ’ : go out}		

6.7.2 Although the evidence suggests that 'intransitive/passive' may be the original function of this/these PARs, there are nonetheless good examples of transitive roots, as;

Ar (wk̲z : pierce) source {k̲z : pierce}   Ar (wšr : saw apart) source {šr : cut off}

Hb (ynq : suckle)[45] source {nq : suckle}   Eg (wḥs : cut off) source {ḥṣ : cut}

Eg (wgs : cut open) source {gz : cut}   Eg (wṣ‘ : sever) source {š‘ : cut}

Note the prevalence of roots with the sense or implication of 'cutting'.

7 Suffixed Augment Analysis and Functions

7.1 Introduction

7.1.1 Table 7.1 shows the raw (unstandardised) observed and expected values for putative suffixed augment reflexes (SARs) in the three languages under consideration. Once again, observed values clearly exceeding the corresponding expected values are shaded. Applying the procedures outlined in §5.1 and §5.2, the following suffixed augments are identified as having significant standardised incidence (SSI), although the value for Arabic *r* is in fact slightly less than significant.

[45] Compare Eg (mnq) with the same sense.

Arabic	***r***	***q***	***w***	
Hebrew		***q***	***y***	
Egyptian	***R***	***à***	***ì***	***s***

TABLE 7.1 SUFFIXED AUGMENT REFLEXES (RAW DATA)

	Arabic		Hebrew		Egyptian	
	o	e	o	e	o	e
’	23	22.99	16	10.89	15	14.09
b	35	38.59	13	17.31	10	8.5
t	8	16.08	5	6.42	6	4.61
ṯ	6	13.83	-	-	-	-
j/g	13	17.37	2	6.14	2	1.46
ḥ	27	23.48	-	-	6	7.53
ḵ	11	11.74	24	18.15	5	4.61
ẖ	-	-	-	-	0	0.49
d	26	31.52	9	17.59	4	6.80
ḏ	1	5.31	-	-	-	-
r	60	53.87	31	39.93	6	11.90
z	11	11.26	3	4.19	-	-
s	27	20.42	8	9.77	11	8.50
š	13	13.83	17	16.20	4	2.67
ś	-	-	1	1.95	-	-
ṣ	8	10.45	10	12.01	1	2.43
ḍ	11	9.17	-	-	-	-
ṭ	17	14.63	12	9.77	-	-
č	-	-	-	-	2	2.91
ẓ	1	4.02	-	-	-	-
‘	34	25.24	19	15.08	5	7.04
ġ	1	4.98	-	-	-	-
f/p	34	29.75	24	17.31	9	8.74
q	37	25.24	28	18.99	5	3.40
k	16	12.54	6	10.61	1	1.46
l	42	40.04	19	25.97	-	-
m	43	39.07	17	17.59	10	9.71
n	16	30.23	7	11.17	10	12.87
h	4	8.68	1	1.68	0	0.49
w	48	35.37	1	0.28	3	3.40
y/i	34	37.30	61	44.96	38	29.39

7.1.2 Although Ehret makes a determined attempt to assign functions to suffixed augments, in what follows his conclusions will not be taken fully into account for the following reasons:

1. **His study is confined to Arabic and thus does not reflect the richer patterns afforded by the wider range of languages;**
2. **He further restricts himself to Arabic triradicals sharing two consonants. Although this yields a number of interesting patterns, given the early date at which triradicalisation is likely to have taken place it is impossible to accept that original pre-Semitic biconsonantals and augments have not undergone phonological change.**
3. **From a general-linguistic perspective it is also impossible to accept that there were originally 37 ways of expanding biconsonantals. Moreover, his assignment of functions to suffixed augments is speculative in the extreme, and his conclusions are generally not supported by the tables below, which incorporate the**

statistically most convincing roots on which this study is based;[46]

4. Ehret's failure to recognise that phonological change must have affected both biconsonantals and augments results in a situation where two augments which are clearly phonological variants are assigned different functions. Compare for example his *farq* and *farj*, both with the senses 'separate, split'. The latter has almost certainly arisen in consequence of the common Arabic shift *q → g → j* and yet the suffix of the former is assigned the function 'intensive (effect)' and that of the latter 'finitive fortative';[47]
5. He does not consider prefixed or infixed augments, so that it is likely that a number of his roots in fact incorporate one or other of these;
6. There is no attempt at statistical analysis, so that his methodology is not only impressionistic but untestable.

7.1.3 Botterweck's study is more traditional. He interprets III-weak roots as originating in the addition of a short vowel to a biconsonantal, and indeed seems to regard these augment vowels as essentially identical, at whatever position they occur in the root ; other triradicals with SAR are analysed as incorporating original deictic markers.[48]

7.1.4 Kuryłowicz on the other hand analyses III-weak roots as originating in nouns with final vowel of some type. He doubts that augmentation by suffixes, as usually understood, was a productive process, on the ground that the morphemes traditionally proposed as suffixed augments cannot be shown to have been morphemes in Semitic.[49] To the extent that his less than clear notation and argument can be followed, Kuryłowicz appears to suggest that many biconsonantals first became geminates (which may well be correct) and that the geminate consonants were then often dissimilated to yield triradicals with apparent SAR or IAR.[50] This almost certainly did occur in some cases, but as an explanation for the very large number of roots displaying an apparent SAR it is inadequate, not least because the number of triradicals vastly exceeds the number of geminates.

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[46] Ehret, 'Origins', p109-12.

[47] 'Origins', p177 (item 37)

[48] *Triliteralismus*, p49 ff.

[49] 'Verbal Root', §9 and §10. Superficially this appears to be an argument of some substance, but see in particular *Towards a Morphology of the pre-Semitic Verbal System*.

[50] 'Verbal Root' §30 and §33..

7.2 Sibilant Group

7.2.1 The sibilant group is as defined in §6.2. Only Egyptian *s* has SSI as a suffixed augment although, as Table 7.1 shows, the observed total for Arabic *s* considerably exceeds that expected. The Arabic and Egyptian cluster indices point to *s* as the more nearly original value; Arabic *s* is of course generally equivalent to Hebrew *š*, and the latter has the highest cluster index among the Hebrew sibilants. Thus it is at least possible that there was an original sibilant-based suffixed morpheme, a conjecture supported by the following sample of relevant roots (intransitive roots shaded).

TABLE 7.2 SIBILANT SARS

Root	Source	Root	Source
Ar (nft̲ : puff smoke)	{nf : blow}		
Ar (k̲rz : pierce}	{k̲r : penetrate}	Hb (rqz : quiver)	{rq : shake}
Ar (frz : separate)	{pr : separate}		
Ar (ḥms : c excited)	{ḥm : be hot}	Hb (ḥms : treat violently)	{mḥ : treat violently}
Ar (dfs : push)	{dp : push}	Hb (kms : store up)	{gm : gather}
Ar (dhs : crush)	{dḥ : crush}	Hb (prs : divide)	{pr : separate}
Ar (sls : be smooth)	{sl : slide}	Eg (š‘s : go)	{ṣ’ : go out}
Ar (bṭš : attack)	{bṭ : attack}	Hb (r‘š : quake)	{rq : shake}
Ar (‘fš : gather)	{qp : gather}	Eg (q’s : bind)	{‘q : bind}
Hb (ḥbš : bind)	{ḥb : bind}	Eg (ntš : besprinkle)	{nṭ : be moist}
Hb (nqš : hit)	{nk : hit}	Eg (k̲nš : stink)	{k̲m : decay}
Ar (rk̲ṣ : be tender)	{rq : be soft}	Hb (mrṣ : be sick)	{mr : be ill}
Hb (mḥṣ : smite)	{mḥ : treat violently}	Eg (dmṣ : unite)	{d̲m : bind}

7.2.2 In the relevant Afrrican languages deriving morphemes are generally suffixed to their stems.[51] The SAR data in general could then be taken to imply that if deriving morphemes were an introduction into the language from which Semitic and Egyptian are descended they also may have been initially suffixed to their stem, followed at some point, and for some reason, by a switch to prefixing morphemes.[52] However, the intransitive roots in Table 7.2 present the same problems as the intransitiives with sibilant PAR (§6.2 above), although some, particularly those with C_3 = *z, ṣ*, may originate in a dental augment (below at §7.4). That Egyptian *s* has SSI draws attention to the fact that Egyptian in some respects displays more transparently African features, so that whatever the origin of Semitic roots with SAR = *sibilant*, at least some Egyptian roots with this SAR may well originate in forms with the ‘African’ deriving morpheme.

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[51] The ‘Cushitic’ languages Beḍawie and Saho/ʿAfar display both prefixing and suffixing morphemes. See *Beḍawiē : a Semitic Language?* §6.1.

[52] Lipiński (*Outline*, §41.7) lists a number of apparently denominative roots with C_3 = *sibilant*.

7.2.3 Another possibility is that, just as Semitic-speaking peoples have at various times migrated into N.E. Africa from W. and S.W. Arabia, the reverse was almost certainly also the case so that, say, Cushitic-speaking peoples at some point crossed in substantial numbers from N.E. Africa into S. Arabia. It would then be tempting to speculate that at least some Arabic roots identified as having sibilant-based SARs may originate in 'African' derived forms. But, of course, while this might account for Arabic roots it is obviously less likely to apply to roots of N. and E. Semitic origin.

7.3 'Velaph' Group

7.3.1 The membership of this group is as given in §6.6. 'Velaph' suffixed augments comprise the largest group at any root position. There are significant standardised incidences in all three languages, *q* in Arabic and Hebrew and *à* in Egyptian, with Arabic *á*, Hebrew *ḥ* and Egyptian *q* displaying substantial if not statistically significant standardised values. The cluster indices tend to support the standardised incidences, and together suggest that the most likely original value for this phoneme was *q*. For Egyptian, the evidence could thus be taken to imply that *q* had in many cases weakened to *à* although, as previously noted, the Egyptian character *3* often represents phoneme *ʀ*. Although the statistical method almost guarantees that some of these roots have been incorrectly analysed there can be no doubt that this group of phonemes played a major role in suffix augmentation, and whatever the original function of the morpheme (or morphemes) from which these augments derive, it was clearly in widespread use in the language in which Semitic and Egyptian originate. But note that if *q* was indeed the original consonantal value of this augment, this is a case where an augment morpheme appears to have no Semitic cognate. A selection of the relevant roots is given in Table 7.3, intransitive roots shaded.

7.3.2 It will be seen that the base senses of these roots are transitive and/or fientive to a substantial degree, although there are exceptions ; for example, the roots with SAR = *à* include three which are clearly stative, namely Arabic *ḥmà* and *swà* and Hebrew *nṣà*. But *à*, along with *h*, being the weakest of the velaph phonemes in articulatory terms, roots with this SAR may well originate outside the velaph group, as in Egyptian. Other non-fientive roots are Arabic *k̠mj*, *tfḥ* and *zlq* which, if correctly analysed, cannot readily be explained by the 'transitive / fientive' hypothesis, although it is possible that the *j* of *k̠mj* derives from an original sibilant in the same way as *j* as PAR.[53] Also, given the large number of roots assigned to this group it may be that some, especially Arabic, are the result of subsequent innovation.

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[53] See §6.2.1. With Arabic *k̠mj* compare Hebrew *ḥmṣ* and Egyptian *k̠nš*, both 'stink'.

TABLE 7.3 VELAPH SARS

Root	Source	Root	Source
Ar (ḥm’ : be angry)	{ḥm : be hot}	Hb (nk’ : smite)	{nk : hit}
Ar (rf’ : repair)	{rb : repair)	Eg (nf’ : blow nose)	{nf : blow}
Ar (sw’ : be bad)	{sw : be bad}	Eg (nṣ’ : be parched)	{nṣ : be dry}
Ar (lk’ : hit)	{nk : hit}	Eg (dm’ : bind together)	{ḍm : bind}
Ar (k̲mj : decay)	{k̲m : decay}	Ar (hzj : sing)	{hz : be cheerful}
Ar (frj : separate)	{pr : separate}		
Ar (tfḥ : overflow)	{ṭp : overflow}	Ar (nfk̲ : blow)	{np : blow}
Ar (flḥ : split)	{pr : separate}	Hb (ndḥ : thrust)	{nd : push}
Ar (msḥ : stroke)	{ms : touch}	Hb (snḥ : descend)	{ḍn : be low}
Ar (ndḥ : moisten)	{nṭ : be moist}	Eg (rtḥ : restrain)	{rt : bind}
Ar (rḍk̲ : smash)	{rṭ : crush}		
Ar (jm‘ : gather)	{gm : gather}	Ar (hm‘ : shed tears)	{hm : lament}
Ar (k̲z‘ : cut)	{gz : cut}	Hb (gd‘ : cut)	{qṭ : cut}
Ar (df‘ : push)	{dp : push}	Hb (qb‘ : rob)	{qb : rob}
Ar (ḥrq : burn}	{ḥr : be hot}	Hb (zrq : scatter)	{zr : scatter)
Ar (k̲rq : bore)	{k̲r : penetrate}	Hb (ntq : pull away)	{nt : pull}
Ar (zlq : slip)	{sl : slide}	Hb (prq : tear apart}	{pr : separate}
Ar (sḥq : crush)	{šḥ : crush}	Eg (fdq : tear asunder)	{pḍ : force open}
Ar (dhk : crush)	{dḥ : crush}	Eg (ḥṣq : cut off)	{ḥṣ : cut}

7.4 NLR Dental Group

7.4.1 The membership of this group is as given in §6.3. In contrast to the equivalent group of PARs, where *n* has significant standardised incidence and is also prominent in the cluster indices, *n* is not particularly common among SARs suggesting that, as a suffixed augment, *m* should not be regarded as an intermittent member of this set. Arabic *r* has near SSI and its cluster index is consistent with the value for standardised incidence. Although the observed totals for *l* and *r* in Hebrew are quite substantial, in neither case does the observed total exceed the expected. In Middle and Old Egyptian these SARs are divided between *r*, *ʀ* and *n*, of which *n* has the highest cluster index[54] suggesting that, in contrast to Semitic, some Egyptian roots with SAR = *m* may belong here as variants of *n*. A sample of the more convincing roots with NLR dental SAR is given in Table 7.4.

7.4.2 Fleisch proposes that Arabic NLR phonemes were commonly used to dissimilate geminated phonemes in D-form verbs and so create quadriradicals.[55] But although inspection of the Arabic quadriradicals suggests that this is so for some roots, it is more probable that the majority of such quadriradicals have arisen through the use of *r*, *l* or *n* as a ‘filler’ phoneme to facilitate generation of a

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[54] Approximately 50 per cent (i.e. 8) of Egyptian roots having *3* at C_3, and fitted to networks, can be fairly convincingly related to Semitic roots with *r* at C_3 and this is reflected in the calculations of cluster index.

[55] *Traité*, Vol II, p428.

new sense.[56] If so, it is tempting to speculate that this may also have been the primary function of NLR phonemes in the creation of triconsonantal roots, although perhaps merely to achieve triradicalisation rather than necessarily to generate new senses. For it will be seen that the sense of many triradicals in Table 7.4 closely matches that of their postulated source, always recognising of course that the senses of the latter are hypothetical. As with sibilant SARs, it is also just possible that some of these SARs originate in a suffixed *n*-based deriving morpheme.

TABLE 7.4 NLR DENTAL SARS

Root	Source	Root	Source
Ar (bqr : split open)	{pq : force apart}	Hb (gzr : cut)	{gz : cut}
Ar (ḥšr : gather)	{qš : gather}	Hb (gmr : complete)	{km : complete}
Ar (dfr : push)	{dp : push}	Hb (qṣr : harvest)	{qš : gather}
Ar (šṭr : sever)	{šṭ : cut off}	Eg (ṣ‘r : seek)	{ṣ‘ : seek}
Ar (jml : summarise)	{gm : gather}	Ar (hml : shed tears)	{hm : lament}
Ar (sḥl : scrape off)	{sḥ : scrape}	Hb (ḥdl : cease)	{ḥd : be still}
Ar (qṭl : cut off)	{qṭ : cut}	Hb (qml : be decayed)	{qm : rot}
Ar (ḥṣn : be inaccessible)	{ḥš : isolate}	Ar (šjn : be sad)	{šk : be unhappy}
Ar (sḥn : crush)	{šḥ : crush}	Ar + Hb (t‘n : pierce)	{ṭ‘ : pierce}
Ar (smn : be fat)	{šm : be fat}	Hb (ṭmn : conceal)	{ḏm : cover}
Eg (pk̲R : split)	{pq : force apart}	Eg (k̲bR : destroy)	{k̲b : destroy}
Eg (sčR : weave)	{sk : intertwine}		

7.5 Labial Group

7.5.1 The membership of this group is as set out in §6.4 above. No phoneme in this group has SSI as an SAR. Although *b* has the highest cluster index in both Arabic and Egyptian, and nearly so in Hebrew, in neither Arabic nor Hebrew does the observed total exceed the expected. On the other hand the observed totals for Arabic *m* and *f*, along with Hebrew *p*, all exceed the expected. Thus, notwithstanding limited statistical support, it may be that this group reflects an original labial augment, not least as there are sound examples of roots with SAR = *b*. However, as noted above, given the prominence of *n* as an SAR in Egyptian it may be that at least some Egyptian roots with SAR = *m* originate in an earlier *n*.

7.5.2 Slightly over 30 per cent of these roots are intransitive or stative (shaded in Table 7.5). This is markedly higher than the perecentage, say, of velaph SAR intransitives and suggests that the original function of a possible labial SAR might be sought in this grammatical/semantic area. None the less, transitive roots are in the majority, and indeed a number of roots with labial SAR appear to have

[56] Such forms are fairly common in the N. Ethiosemitic languages (typically with *n*). For E. Semitic see Lipiński, *Outline,* §41.42.

meanings almost identical with those with velaph SARs; compare for example Arabic *qṣb* ‘cut up’ and *gdá* ‘cut’, both assigned to source {qṭ : cut}. The Cushitic equivalent of the Semitic prefixed *n*-based deriving morpheme being a suffixed *m*-based morpheme, it may be, as conjectured for the sibilant group, that SAR = *m* may again reflect a stage in the pre-history of the Semitic languages when there was greater flexibility in the position of deriving morphemes.

TABLE 7.5 LABIAL SARS

Root	Source	Root	Source
Ar (ḥrb : be angry)	{ḥr : be hot}	Ar (qṣb : cut up)	{qṭ : cut}
Ar + Hb (rṭb : be moist)	{nṭ : be moist}	Ar + Hb (nqb : pierce)	{nq : pierce}
Ar (šṭb : slice)	{šṭ : cut off}	Hb (ndb : impel)	{nd : push}
Ar (š‘b : scatter)	{š‘ : scatter}	Hb (ṣrb : burn) [vi]	{sr : burn}
Eg (s‘b : castrate)	{š‘ : cut}	Eg (tk̲b : immerse)	{k̲ṭ : immerse}
Ar (qṣf : smash)	{qṣ : crush}	Ar (nḥf : be thin)	{nḥ : be narrow}
Ar (d̲rf : flow forth)	{d̲r : flow}	Hb (nṭp : drip)	{nṭ : be moist}
Ar (rjf : shake) [vi]	{rg : shake}	Hb (rḥp : become soft)	{rq : be soft}
Eg (ntf : irrigate)	{nṭ : be moist}	Eg (stp cut up)	{šṭ : cut off}
Ar (k̲rm : pierce)	{k̲r : penetrate}	Ar (qnm : be rancid}	{qm : rot}
Ar (ṣrm : cut off)	{sr : cut off}	Hb (ṣnm : dry up)	{nṣ : be dry}
Ar (‘lm : be cognisant)	{‘l : be evident}	Hb (rtm : bind)	{rt : bind}
Ar (qṣm : break)	{qṣ : crush}	Eg (zḥm : pound)	{sḥ : beat}

7.6 Dental Group

7.6.1 The membership of this group is as given in §6.5 above. Although there is no phoneme with SSI in any of the three languages, many of the relevant roots can be assigned to their networks with confidence, albeit in the case of Egyptian the numbers are small and could be due to chance. Table 7.6 lists some of the more convincing roots. Recall that Arabic *ḍ* is equivalent to Hebrew *ṣ* and Egyptian *č* is taken to be equivalent to Semitic *ṯ* in some environments.

TABLE 7.6 DENTAL SARS

Root	Source	Root	Source
Ar (k̲rt : pierce) [vt]	{k̲r : penetrate}	Ar (kbt : crush)	{k̲b : destroy}
Ar (k̲ft : die away)	{k̲p : {fade}	Hb (nšt : be parched)	{nṣ : be dry}
Ar (ṣlt : be smooth)	{sl : slide}	Hb (‘wt : be bent)	{‘w : bend}
Ar (’wd : bend)	{áw : bend}	Hb (‘qd : bind)	{‘q : bind}
Ar (ṣld : be hard)	{ṣl : be hard}	Hb (ṣmd : join)	{ḍm : bind}
Ar (ḍmd : bandage)	{ḍm : bind}	Hb (r‘d : tremble)	{rq : shake}
Ar (qšd : take off)	{qš : take off}	Eg (š‘d : cut off)	{š‘ : cut}
Hb (ḥsd : be kind)	{ḥṣ : be cheerful}	Eg (ṣnd : rage)	(šn : be angry}
Ar (k̲fḍ : lessen)	{k̲p : fade}	Ar (‘rḍ : appear)	{‘r : rise}
Ar (šrṭ : slit)	{šr : cut off}	Ar (lġṭ : be noisy)	{lġ : speak}
Ar (frṭ : escape)	{pr : separate}	Hb (l‘ṭ : swallow greedily)	{l‘ : eat}
Ar kšṭ : take off)	{qš : take off}	Ar (śk̲ṭ : squeeze out)	{šḥ : crush}
Eg (šnč : be hostile)	{šn : be angry}		

7.6.2 As with the sibilants and labials it could be conjectured that these roots evolved from earlier

forms with a suffixed dental-based deriving morpheme having passive or reflexive sense, and about half the roots in the table (shaded) fit comfortably with such a conjecture : others may originate in sibilant SARs.

7.7 Weak Phonemes w and y/ỉ

7.7.1. As noted at §7.1.1, Arabic *w*, Hebrew *y* and Egyptian *ỉ* all have SSI as SARs. Some Arabic roots with SAR = *w* may belong with the labial group but in general, the majority of roots with SAR = *weak* are taken to originate in stems on Pattern CvCv, where the second vowel, and perhaps both, had the value *u* or *i*.[57] A selection of the more convincing roots is given in Table 7.7. The fact that Arabic and Egyptian display both III-*w* and III-*y/ỉ* roots begs the question as to whether they originally expressed distinct types of sense, for the majority of Egyptian III-*ỉ* roots are intransitive although there is no particular tendency towards transitivity or intransitivity in the senses of the verbs listed (intransitives shaded).

TABLE 7.7 'WEAK' SARS

Root	Source	Root	Source
Ar (dḥw : flatten)	{dḥ : crush}	Ar (ṣḥw : be bright)	{ṣḥ : be pure}
Ar (ḏrw/y : scatter)	{zr : scatter)	Ar ('lw : rise)	{'r : rise)
Ar (rḵw/y : be relaxed)	{rq : be soft}	Eg (ḵrw : cry)	{ḵr : make noise}
Ar (rfw : mend)	{rb : repair}	Eg (mdw : speak)	
Ar (jny : gather)	{gm : gather}	Hb (pśy : spread)	{pš : spread}
Ar (ḥdy : stay)	{ḥd : be still}	Hb (qšy : be severe)	{qš : be severe}
Ar (lġy : talk nonsense)	{lġ : speak}	Hb (šḥy : bow down)	{kš : bow down}
Ar (wny : be weak)	{nw : be weak}	Eg (bsỉ : flow)	{ṣb : flow}
Hb (gzy : cut)	{gz : cut}	Eg (prỉ : go forth)	{pr : separate}
Hb (dky : crush)	{dk : crush}	Eg (ngỉ : penetrate)	{nq : pierce}

Kuryłowicz considers these roots to originate in substantives, but this is unlikely to be an adequate explanation for all III-weak roots.[58] Indeed, although he provides a sample list of roots he fails to propose substantives from which they may have derived.

8 Infixed Augment Analysis and Functions

8.1 Table 8.1 shows the raw (unstandardised) observed and expected values for putative infixed

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[57] Stems on this pattern are fairly common in the Cushitic languages although how many are original is difficult to say. Lipiński (*Outline*, §43.2) asserts that 'a large part of these [III-weak] verbs are originally monosyllabic, and that additional morphemes, secondary diphthongisation, nasalisation, or morpho-phonemic glides are responsible for the emergence of a supplementary consonant…'.

[58] 'Verbal Roots', §9.

augment reflexes (IARs) in the three languages. Once again, observed values that clearly exceed the corresponding expected values are shaded. Applying the procedure outlined in §5.2 the following are identified with significant standardised incidence:

Arabic	***r***	***w/y***
Hebrew	***r***	***w***
Egyptian	***à***	

8.2 The observed totals are generally small, especially in Egyptian, and the relevant roots are likely to have arisen through metathesis, particularly from original SARs. A possible exception is the NLR dental series, where *r* has SSI in both Arabic and Hebrew. As suggested in §7.4 for the equivalent suffixed series, these phonemes may have been utilised as fillers to bring former biconsonantals into conformity with the triradical system, and the totals suggest they may have been deployed directly as IARs rather than have arisen through metathesis.

TABLE 8.1 INFIXED AUGMENT REFLEXES (RAW DATA)

	Arabic		Hebrew		Egyptian	
	o	e	o	e	o	e
’	2	3.59	3	2.96	9	4.29
b	9	11.90	3	6.09	5	2.86
t	6	4.93	2	3.91	4	2.39
t̲	0	2.99	-	-	-	-
j/g	8	6.62	1	3.48	0	1.09
ḥ	4	6.13	4	4.61	1	1.57
k̲	1	3.78	-	-	1	1.64
h̲	-	-	-	-	0	0.61
d	6	7.77	0	4.26	3	1.84
d̲	0	3.19	-	-	-	-
r	41	14.99	22	10.09	1	1.98
z	5	5.38	0	2.61	-	-
s	4	6.42	1	3.22	2	2.93
š	1	5.38	1	4.26	1	1.57
ś	-	-	1	0.78	-	-
ṣ	1	4.48	0	4.00	1	1.29
ḍ	2	3.39	-	-	-	-
ṭ	6	4.83	4	2.78	-	-
č	-	-	-	-	0	0.55
ẓ	0	1.25	-	-	-	-
‘	8	6.47	3	5.39	2	1.77
ġ	2	3.29	-	-	-	-
f/p	9	8.47	5	5.22	2	2.80
q	2	5.98	2	4.96	2	0.89
k	0	5.33	2	3.30	0	0.95
l	10	11.40	12	7.74	-	-
m	13	10.01	4	5.13	0	2.32
n	0	8.12	1	3.65	6	4.63
h	6	6.32	1	2.60	0	1.29
w	23	14.49	32	11.13	1	3.07
y/i	18	11.11	0	2.09	2	0.68

8.3 It will be seen (§8.1) that *w* has SSI in both Arabic and Hebrew. This phoneme is of course characteristic of many II-weak roots in the Semitic languages and it could be that many such roots originate in a biconsonantal root/stem with long medial vowel, rather than in the weakening of a stronger infixed augment in position C_2. Botterweck and Kuryłowicz[59] both interpret II-weak roots as originating either in gemination or vowel lengthening in a biconsonantal. Table 8.2 lists a selection of the relevant roots.

TABLE 8.2 INFIXED AUGMENT REFLEXES

Root	Source	Root	Source
Ar (k̲rb : destroy)	**{k̲b : destroy}**	**Ar (frš : spread)**	**{pš : spread}**
Ar (k̲rz : pierce)	**{k̲z : pierce}**	**Hb (grz : cut)**	**{gz : cut}**
Ar (srb : flow)	**{sb : flow}**	**Hb (ḥrṣ : cut)**	**{ḥṣ : cut}**
Ar (ḥlq : shave)	**{ḥq : shave}**	**Hb (ḥlṭ : snatch)**	**{ḥṭ : seize}**
Ar (qlṣ : diminish)	**{qṣ : cut short}**		
Hb (gnb : steal)	**{qb : rob}**	**Eg (qnd : be angry)**	**{qḍ : be angry}**
Eg (w'ṣ : be green)	**{bṣ : bud}**	**Eg (č'm : be veiled)**	**{ḍm : cover}**
Ar (k̲wr : moo)	**{k̲r : make noise}**	**Hb (dwk : pound)**	**{dk : crush}**
Ar (lwḥ : scorch)	**{lḥ : burn}**	**Hb (lw‘ : swallow)**	**{l‘ : eat}**
Ar (syb : flow)	**{sb : flow}**	**Hb (qwṣ : loathe)**	**{qṣ : loathe}**
Ar (šy‘ : spread)	**{š‘ : scatter)**	**Eg (sw' : cut off)**	**{š‘ : cut}**
Ar (qyḍ : break)	**{qṣ : crush}**	**Eg (sin : cut off)**	**{šr : cut off}**
Ar (ṣbḥ : be radiant)	**{ṣḥ : be pure}**	**Hb (sbk : interweave)**	**{sk : weave}**
Ar (ḥfz : pierce)	**{k̲z : pierce}**	**Hb (‘bš : shrivel)**	**{qš : shrivel}**
Ar (rft : crush)	**{rṭ : crush}**	**Hb (ḥpr : dig)**	**{k̲r : penetrate}**
Ar (ṣmd : oppose)	**{ṣd : obstruct}**	**Eg (sbn : glide away)**	**{sl : slide}**
Ar (štr : cut off)	**{šr : cut off}**	**Hb (qṭp : pluck off)**	**{qp : gather}**
Ar (ktm : conceal)	**{km : cover}**	**Eg (qdf : gather)**	**{qp : gather}**
Eg (sd' : tremble)	**{s‘ : tremble)**		
Ar (bjs : flow)	**{sb : flow}**	**Ar (s‘r : kindle fire)**	**{sr : burn}**
Ar (fjr : cleave)	**{pr : separate}**	**Eg (h̲áq : shave)**	**{ḥq : shave}**
Ar (dḥr : drive away)	**{dr : drive out}**	**Eg (dqr : expel)**	**{dr : drive out)**
Ar (nzk : pierce)	**{nq : pierce}**	**Eg (sṣm : hear)**	**{sm : hear}**
Ar (bsṭ : spread)	**{bṭ : spread}**		

8.4 The hypothesis that the NLR phonemes were used as fillers is supported by the fact that almost all roots with IAR = *r, l* have exactly the same sense as their postulated source, and are also predominantly transitive, which is not the case among roots with IAR = *w, y*.

[59] 'Verbal Roots', §5-8 and §33 (note the sample roots on p10/11).

Appendix A Augment Cluster Indices

Throughout the following tables the highest values of cluster index are shaded.

A1 Prefixed Augment Reflexes

Table A1 Observed Incidences (O) and Cluster Indices (CI) for Sibilant PARs

Phoneme	Arabic		Hebrew		Egyptian	
	O	CI	O	CI	O	CI
S	2	12.25	5	14.25	0	0
z	9	14.75	5	9.75	-	-
s	5	16	2	12.5	12	13
š	11	16.75	10	15.75	2	8
s	-	-	2	8.75	-	-

Table A2 NLR Dental PARs

Phoneme	Arabic		Hebrew		Egyptian	
	O	CI	O	CI	O	CI
l	3	26.25	3	18.5	-	-
r	7	28.25	8	21.0	1	7.75
n	34	44.5	22	28.5	13	15.0
m	11	30.5	2	15.75	3	9.75

Table A3 Labial PARs

Phoneme	Arabic		Hebrew		Egyptian	
	O	CI	O	CI	O	CI
m	11	21.75	2	7.75	3	9.25
b	9	27.0	10	12.5	0	-
p/f	4	16.5	3	8.5	7	10.5
w	21	29.25	0	-	11	13.5

Table A4 Dental PARs

Phoneme	Arabic		Hebrew		Egyptian	
	O	CI	O	CI	O	CI
D	1	4.5	-	-	-	-
T	1	4.0	1	2.75	-	-
d	4	675	5	575	1	325
t	3	6.0	1	4	2	3.5
d̲	1	4.0	-	-	-	-
C	-	-	-	-	1	2.5

Table A5 Velaph PARs

Phoneme	Arabic		Hebrew		Egyptian	
	O	CI	O	CI	O	CI
à	8	14.5	8	135	3	35
g	4	6.25	3	5.0	0	-
H	3	13.25	-	-	0	-
K	3	8.5	4	10.25	1	1.5
K̲	-	-	-	-	0	-
á	6	14.75	5	10.25	0	-
G	1	8.25	-	-	-	-
q	1	12.75	0	-	0	-
k	2	6.25	2	5.5	1	1.5
h	5	13.0	4	11.75	1	2.5

A2 Suffixed Augment Reflexes

Table A6 Sibilant SARs

Phoneme	Arabic		Hebrew		Egyptian	
	O	CI	O	CI	O	CI
S	8	30.75	10	23.5	1	8.5
Z	1	15.0	-	-	-	-
z	II	29.75	3	13.75	-	-
s	27	44.75	8	23.25	11	13.5
Š	13	36.5	17	27.25	4	10.0
s̲	-	-	1	14.0	-	-
I	6	21.25	-	-	-	-

Table A7 NLR Dental SARs

Phoneme	Arabic		Hebrew		Egyptian	
	O	CI	O	CI	O	CI
l	42	90.75	19	42.25	-	-
r	60	99.75	31	48.25	6	13.5
n	16	88.5	7	40.5	10	20.0
R					8	13.5

Table A8 Labial SARs

Phoneme	Arabic		Hebrew		Egyptian	
	O	CI	O	CI	O	CI
m	43	81.0	17	29.75	10	18.0
b	35	97.5	13	34.0	10	21.0
p/f	34	74.25	24	35.0	9	17.25
w	48	84.75	1	17.75	3	12.75

Table A9 Dental SARs

Phoneme	Arabic		Hebrew		Egyptian	
	O	CI	O	CI	O	CI
D	11	34.75	-	-	-	-
S	-	-	10	17.25	1	6.0
T	17	33.0	12	21.75	-	-
C	-	-	-	-	2	6.5
d	28	40.25	9	28.25	4	7.75
t	8	32.5	5	18.75	6	9.5
d̲	1	18.75	-	-	-	-
z	-	-	3	8.75	-	-

Table A10 Velaph SARs

Phoneme	Arabic		Hebrew		Egyptian	
	O	CI	O	CI	O	CI
à	23	58.25	16	40.0	15	20.25
g	13	57.5	2	25.0	2	9.0
H	27	83.25	-	-	6	17.5
K	11	55.0	24	55.5	5	11.5
K̲	-	-	-	-	0	6.75
á	37	72.75	19	48.75	5	15.75
G	1	42.5	-	-	-	-
q	37	91.75	28	57.75	5	17.0
k	16	62.0	6	38.0	1	9.75
h	4	49.5	1	34.25	0	14.25

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