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ABSTRACT

It is possible to apply Lamb's stratificational theory and analysis to English graphonomy, but additional notation devices must be used to explain particular graphemes and their characteristics. The author presents cases where Lamb's notation is inadequate. In those cases, he devises new means for performing the analysis. The result of this approach is set of stratificational diagrams; the performance of a diagram is expressed by impulses which move through it and which show the ordering of its several parts by successively activating those parts. References are given, and graphotactic diagrams are included. (VM)

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ORDEREDNESS AND STRATIFICATIONAL "AND" NODES

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Stratificational theory, as described by Lamb (1966), assumes that the structure of an individual utterance can be described by diagrams that contain ORDERED AND and UNORDERED AND nodes; and it assumes that the possible utterances of a language can be adequately defined by a diagram that contains these two kinds of AND nodes, DIAMOND nodes, ORDERED OR and UNORDERED OR nodes, and certain other elements. Recent efforts by the present author to formalize a description of the graphonomy of English have found some composite relationships which cannot be adequately described by these ORDERED AND and UNORDERED AND nodes. This paper discusses these troublesome composite relationships, and proposes an alternative notation which can describe them more adequately.[1]

Figure 1 gives an example of data which contains some of these troublesome composite relationships. Because the example is from the graphonomy of English, the marks which make up the one-word utterance "Cindy" are themselves the linguistic data to be described. Figure 2 shows the structure of this utterance on the morphemic sign level and the graphemic level, and also shows the recoding which takes place between those two levels. The DIAMOND nodes, which are graphemes, have labels with superscript "G". Five of these graphemes are letters of the alphabet; the symbol ^{G}/ ⫽⫽ / may be read "initial capital". Although stratificational linguists have usually understood the orderedness of the ORDERED AND node to be temporal, this node may be used to represent the spatial ordering of English letters because a literate speaker of English, when asked to "spell" a written English text, will name off the letter graphemes in a temporal order which matches their left-to-right spatial order. ORDERED AND nodes are therefore sufficient to show the structure of this utterance on these two levels.

[1]This paper is a revision of one with the same title which was read before the Michigan Linguistic Society on October 4, 1969. The author wants to thank D. G. Lockwood and C. R. Taber for their comments on the ideas presented in that earlier paper. The responsibility for any faults in the present form of this paper must belong to the author.

Each English grapheme which represents a letter of the alphabet is typically realized by two graphemic signs—one representing the abstract shape of the printed mark which embodies the grapheme, the other representing the height of this mark with respect to its neighbors. A realization formula for the letter graphemes ^{G}/C/, ^{G}/N/, ^{G}/D/, and ^{G}/Y/ is shown in Figure 3. The lines with labels with superscript "GS" represent graphemic signs; the line at the top of the diagram which is marked "/capitalization/"[2] realizes any of three graphemes which can cause a letter to be capitalized. All of the realizations in this formula can be shown adequately by UNORDERED AND nodes and by OR nodes.

The realization of ^{G}/I/ cannot be described so easily. Whenever it is not capitalized, ^{G}/I/ is embodied by two marks, and its realization must therefore include two of the graphemic signs which represent the shapes of marks.[3] Moreover, these two marks must be arranged spatially in a certain way in order to embody the grapheme ^{G}/I/; arranged in another way they will embody the grapheme ^{G}/exclamation mark/ (see Figure 4(a)). The diagram in Figure 4(b), which has a downward UNORDERED AND node at the point marked "/non-capitalized letter I/", is an inadequate realization formula because the part of the diagram below that node could represent either of the pairs of marks shown in Figure 4(a).

Moreover, the diagram in Figure 4(b) cannot be made adequate merely by using an ORDERED AND node in place of the UNORDERED AND node. It is true that the ORDERED AND node may be used to represent the left-to-right spatial relationship between the letters of English words; but the spatial relationship between the two marks which embody ^{G}/I/ is an over-and-under one, and there is no similar method by which the ORDERED AND node can be interpreted to represent this relationship. Literate speakers of English do not usually feel that the upper mark embodying ^{G}/I/ occurs before or after the lower mark. If the ORDERED AND node were used to represent this over-and-under spatial relationship, there would be no principled way to choose between the two diagrams shown in Figure 5.

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[2]This symbol, although bracketed by slant lines, does not represent a phoneme. In this notation, all linguistic symbols are bracketed by such lines. The symbols without superscripts represent points in the realizational network which are convenient for discussion of that network but which have no designations according to the regular system of Xemes, Xemic signs, and Xons (cf. Lamb, 1966: 19).

[3]The several marks which embody ^{G}/I/ show great variety, probably greater than for any other letter grapheme. However, the variety of marks which can embody the lower part of non-capitalized letter I does not affect the argument presented here about the relative locations of its two marks.

Even if some convention were used by which the ORDERED AND node could represent both the left-to-right spatial ordering and the over-and-under spatial ordering, the result would be a troublesome ambiguity. A person reading a stratificational diagram would never be sure, upon encountering an ORDERED AND node, just what it might mean; he might have to do some research in order to deduce its meaning from the rest of the diagram. To avoid this ambiguity, all non-temporal ORDERED AND nodes could be marked to show their respective meanings; two possible ways of doing this are shown in Figure 6. But, whatever notation may be used, it seems clear that ORDERED AND nodes do not always represent the same kind of orderedness.

Further down in the graphonomy of English, a similar problem occurs. Graphemic signs that refer to the shapes of marks are realized by graphons, which may be thought of as the contrastive features by which these shapes of marks are distinguished from one another. Figure 7(a) shows the shapes which correspond to three such graphemic signs—^{GS}/majuscule n/, ^{GS}/roman minuscule y/, and ^{GS}/majuscule y/. These graphemic signs are realized according to the formulas shown in Figure 7(b); the lines with superscript "GN" represent graphons.

The UNORDERED AND node serves adequately for the realizations of these three graphemic signs; it will not suffice, however, for the realizations of ^{GS}/minuscule d/ and ^{GS}/minuscule n/. Formulas which use UNORDERED AND nodes to realize these graphemic signs are shown in Figure 8(a). Although these diagrams join the graphemic signs to the graphons which respectively realize them, they are inadequate because the realization shown for ^{GS}/minuscule d/ could represent either of the marks shown in Figure 8(b), while that shown for ^{GS}/minuscule n/ could represent either of the marks shown in Figure 8(c). For these two graphemic signs, as for many others, it is not enough to show the graphons which realize them; the relationships between their realizing graphons must be specified. And, as in the case of /non-capitalized letter I/, the necessary relationship cannot be shown by the ordinary temporally-ordered ORDERED AND node. Moreover, this relationship cannot be shown by that node modified as it was to show the over-and-under spatial ordering. A further kind of ORDERED AND node will be needed.

It happens to be a fact of English graphonomy that a mark never has significant shapes at two opposite corners. The significantly shaped parts of a mark may therefore be partially located by stating the diagonals along which they occur. If the diagonals are named as shown in Figure 9, realization formulas for the graphemic signs ^{GS}/minuscule d/ and

GS/minuscule n/ may be adequately written with marked nodes in the manner shown in Figure 10.

The description of English graphonomy now requires ORDERED AND nodes which show at least three different kinds of orderedness. Sydney M. Lamb has remarked, informally, that linguists may find it necessary to indicate separately the "ordered" aspect and the "and" aspect of the customary ORDERED AND node. Although when Lamb made this remark he was probably thinking of orderedness in the customary temporal way, the author would like to take up his suggestion and apply it to the situation which has been described in this paper. How can stratificational descriptions of composite relationships be revised to show these different kinds of relationships which exist within language?

This may be done by making two changes in the customary stratificational notation. For the first change, the lines from the multiple side of an AND node, whenever they are ordered, will have their ordering shown by a separate symbol which represents that ordering as a separate linguistic unit. Examples of symbols for these units are shown in Figure 11(a); these units may be called "taxemes",[4] and their symbols are therefore written with a superscript "T". Each taxeme symbol consists of an upper and a lower part—the upper part gives the name of the relationship; the lower part is divided into several sections, each of which gives the name of one pole or alternative of the relationship.[5] From each lower section of a taxeme symbol, a line—which may be called a "valence"[6]—runs to and indicates the thing which is ordered in the way shown by that part of the symbol.

Taxeme symbols, when written as shown in Figure 11(a), are cumbersome, and it may be convenient to abbreviate them in the way shown in Figure 11(b). The name of the relationship is then abbreviated between the slant lines, and the names of the poles or alternatives are abbreviated and written around it.

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[4]The word "taxeme" has been used by so many linguists for so many different purposes that the author hopes he may be forgiven for using it for yet another purpose. These taxemes are very similar to the "relationals" used by Taber (1966).

[5]It happens that each of the taxemes shown in Figure 11(a) has two lower sections, but there is no reason why a taxeme cannot have three or more.

[6]The term "valence" has been used by H. A. Gleason, Jr., for some very similar indicators of relationships in semology. These are not the things for which Lamb (1966:59) has used this term.

The second notational change is possible because every ORDERED AND node will now have attached to it a taxeme symbol which shows the exact ordering relationship which occurs at that node. The orderedness of the ORDERED AND node is therefore redundant, and stratificational diagrams which include taxemes will need only one kind of AND node. For convenience, this AND node may be drawn in the same way as the former UNORDERED AND node.

These taxemes, which explicitly state linguistic relationships, make it possible to write more precise and efficient realization formulas. The problems which are met while writing a realization formula for ^{G}/I/ have already been demonstrated. Using a taxeme ^{T}/diacrisis/, the realization of ^{G}/I/ can be described by the formula shown in Figure 12. In this formula, the node labeled /non-capitalized letter I/ is neither ordered nor unordered; it is merely a downward AND node. The lines which run from this AND node to the graphemic signs ^{GS}/high and middle/, ^{GS}/vertical/, and ^{GS}/dot/ show that those graphemic signs are included in the realization of /non-capitalized letter I/. In addition, a line runs from this node to an occurrence of the taxeme ^{T}/diacrisis/, and two valences run from this taxeme symbol—the "up" valence running to ^{GS}/dot/, the "down" valence running to ^{GS}/vertical/. The taxeme and its valences thus explicitly show the spatial relationship which exists between the two marks which embody /non-capitalized letter I/.

The realizations of the graphemic signs ^{GS}/minuscule d/ and ^{GS}/minuscule n/ have also been shown to involve difficulties. Figure 13 shows a realization formula for these graphemic signs which uses taxemes. In this formula, each graphemic sign is realized through a downward AND node, with lines running from each node to the appropriate graphons. In addition, a line runs from each node to an occurrence of the taxeme ^{T}/orientation/. Valences from each taxeme symbol then show which graphon describes which part of its respective mark. For both of these graphemic signs, the shape of the mark along its major diagonal is described by ^{GN}/square or notched corner/. For ^{GS}/minuscule d/, the shape along the minor diagonal is described by ^{GN}/straight appendage/; for ^{GS}/minuscule n/, the shape along the minor diagonal is described by ^{GN}/rounded corner/. With these taxemes and and their valences, these descriptions on the graphonic level can only represent the correct, and cannot represent the incorrect, shapes of marks shown in Figures 8(b) and 8(c).

The alternative stratificational notation which is proposed by this paper may have another advantage. Stratificational linguists have been quite successful in their efforts to construct a performance or communica-

tion model of language; but, for certain important linguistic phenomena, they are still unable to say precisely how such a model would operate. The use of taxemes such are described in the present paper may alleviate some of these difficulties.

One of these troublesome phenomena is exemplified by the portmanteau realization of ^{G}/F/ and ^{G}/I/. The facts will be familiar to every literate in English: Whenever the letter ^{G}/F/ immediately precedes the letter ^{G}/I/ and neither of them is capitalized, both graphemes are realized by one graphemic sign, ^{GS}/f i ligature/. Otherwise, (assuming that neither of them is capitalized) ^{G}/F/ is realized by ^{GS}/minuscule f/ and ^{G}/I/ is realized as it would be if it were not preceded by ^{G}/F/. Figure 14(a) shows examples of marks which embody ^{GS}/minuscule f/ and ^{GS}/f i ligature/.

Figure 14(b) shows a partial realization formula for ^{G}/F/ and ^{G}/I/, written in the usual stratificational notation with the ordering of the two letters being shown by ORDERED AND nodes. This formula is very restricted; the wiggly lines below the DIAMOND nodes show where the possibility of capitalization has been omitted, and graphemic signs for the relative heights of these marks have also been omitted.

The performance of a diagram such as this is described by impulses which move through the diagram and successively activate its various parts. In Figure 14(b), the ORDERED AND node in the graphotactics generates graphic syllables. To generate or transduce an utterance containing ^{G}/F/, an impulse must run from this ORDERED AND node down its branch leading to the DIAMOND node for ^{G}/F/. This impulse will run through that DIAMOND node and (assuming that ^{G}/F/ is not capitalized) will eventually arrive at the left branch of the upward ORDERED AND node which is above the line representing ^{GS}/f i ligature/. There the impulse will reach an impasse. If an impulse subsequently reaches the right branch of this upward ORDERED AND node—which will happen if and only if the grapheme following ^{G}/F/ is ^{G}/I/ and is not capitalized—both impulses will proceed as one through this node and along the line representing ^{GS}/f i ligature/. But, if no impulse subsequently reaches the right branch of this upward ORDERED AND node, the original impulse must return to the ORDERED OR node[7] above, and must then proceed down along the line representing ^{GS}/minuscule f/. The same impulse cannot, of course, stay at the left branch of the upward ORDERED AND node and also go traveling through the diagram to possibly arrive at its right branch; but the original impulse may be allowed to stay at the left branch.

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[7]The orderings of the lines from ORDERED OR nodes are shown in this paper numbers written next to the nodes.

of this node while it generates a second, temporary impulse to go tracing through the diagram.

The diagram in Figure 14(b) will function adequately so long as every non-capitalized ^{G}/F/ is followed by a non-capitalized occurrence of ^{G}/I/. Unfortunately, it will not function if the occurrence of ^{G}/F/ is followed by any other grapheme. When non-capitalized ^{G}/F/ is realized, a temporary impulse may be assumed to run back to the ORDERED AND node in the graphotactics and may be assumed then to run down the next line from that node. But the graphotactic network does not assure that this temporary impulse will arrive at the ^{G}/I/ DIAMOND node. And if it does not, the original impulse which was left waiting at the left branch of the upward ORDERED AND node will face a dilemma. How long should it wait there for an impulse to come down to the right branch of the node? When should it stop waiting and backtrack through the ORDERED OR node and proceed down the line representing ^{GS}/minuscule f/? If the performance of a stratificational diagram is to be expressed by impulses which move through it and which show the ordering of its several parts by successively activating those parts, there seems to be no good answer.

In Figure 15, this same portmanteau realization of ^{G}/F/ and ^{G}/I/ is described by a realization formula which includes a taxeme. This formula is restricted in the same ways as that shown in Figure 14(b). Large parts of these two formulas are the same; their essential difference is the taxeme ^{T}/sequence/, which appears in Figure 15. This taxeme has two valences —the "left" valence runs to the line below the ^{G}/F/ DIAMOND node and the "right" valence runs to the line below the ^{G}/I/ DIAMOND node, thereby showing that ^{G}/F/ occurs toward the left and ^{G}/I/ occurs toward the right. The AND node which appears in the graphotactic part of Figure 15 and the AND node which is attached to the line representing ^{GS}/f i ligature/ are both neither ordered nor unordered. Each of these AND nodes has a line which runs to the taxeme ^{T}/sequence/, thereby implying that any realization through the upper AND node will include this taxeme, and that this taxeme will be part of any realization through the lower AND node.

When the transduction of an utterance is described in a diagram such as that in Figure 14(b), the various points which describe the utterance are activated at different times in order to show their relationships to one another. When a transduction is described in a diagram such as that in Figure 15, the points which describe the utterance on one level of the language are activated at the same time, and their relationships are shown by the taxemes which are activated simultaneously with them. Thus, for example in Figure 15, an utterance which contains non-capitalized ^{G}/F/

followed by non-capitalized $^{G}/I/$ will be described on the graphemic level by activating the $^{G}/F/$ DIAMOND node, the $^{G}/I/$ DIAMOND node, and a taxeme $^{T}/sequence/$ which shows this relationship between them. The graphotactics shows that this is a grammatical sequence of graphemes in English. Because it is assumed that these letters are not capitalized, the wiggly lines below these DIAMOND nodes will both be activated; because the taxeme is activated, the line below it is also activated. The upward AND node above the line representing $^{GS}/f\ i\ ligature/$ will be satisfied, not because impulses arrive there in any particular order, but simply because all the lines which lead into that node are activated. If an utterance contains $^{G}/F/$ followed by some grapheme other than $^{G}/I/$, or contains $^{G}/I/$ preceded by some grapheme other than $^{G}/F/$, or contains some grapheme which will capitalize either $^{G}/F/$ or $^{G}/I/$, this upward AND node will not be satisfied. The failure to satisfy this node will be immediately apparent, without waiting for any impulse to trace through the diagram, and the realization of $^{G}/F/$ or of $^{G}/I/$ can proceed at once down the alternative line from the appropriate ORDERED OR node in the realization formula.

The method of realization described by formulas such as that in Figure 15 is, properly speaking, one of logical implication. Such a diagram states, in general, that "if A and B which share relationship C are activated on one level of the language, then D and E which share relationship F will be activated on their adjacent level of the language". It should be noted, however, that the realization of $^{G}/F/$ and $^{G}/I/$ which has been discussed here is a very simple example of conditioned realization, and that more complicated conditioning can occur. Even though one point in a linguistic network conditions the realization of another point, the result need not be a portmanteau realization. There may be some points which are always realized by certain points lower in the network, and which also condition the realizations of other points on their own level. Moreover, the conditioning environment for a point in a network need not be joined to it through valences from one taxeme, but may lie at some distance from it and may be related to it through a concatenation of taxemes.

REFERENCES

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Taber, C. M. 1966. The Structure of Sango Narrative. (Hartford Studies in Linguistics No. 17.) Hartford, Conn.: Hartford Seminary Foundation.

Figure 1.

Cindy

Figure 2.

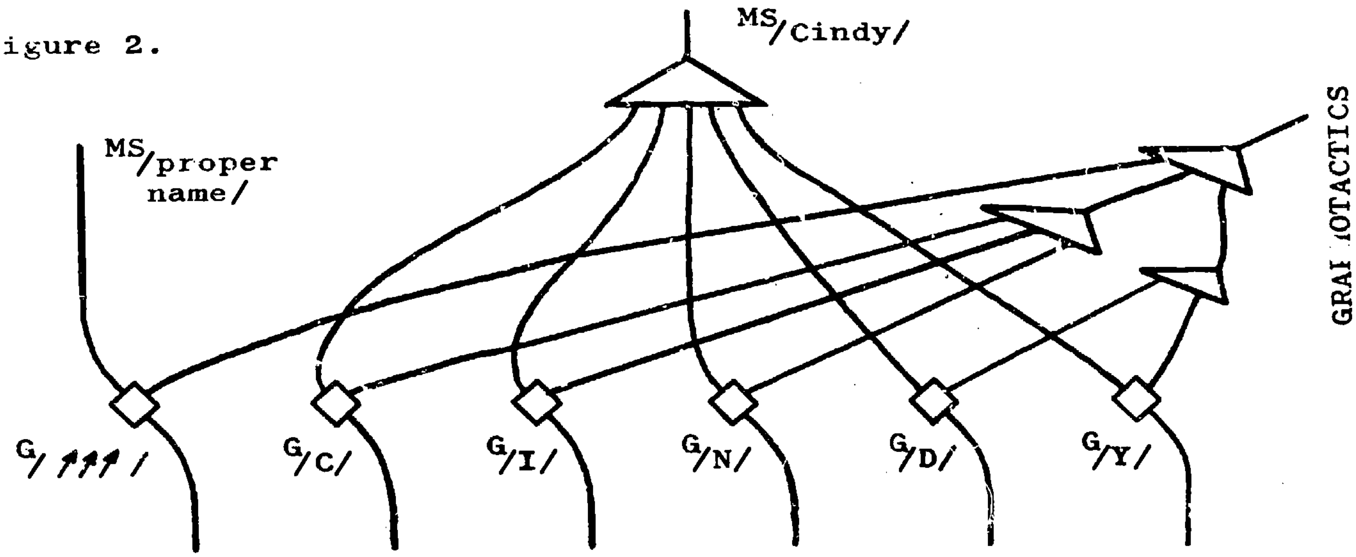


Figure 3.

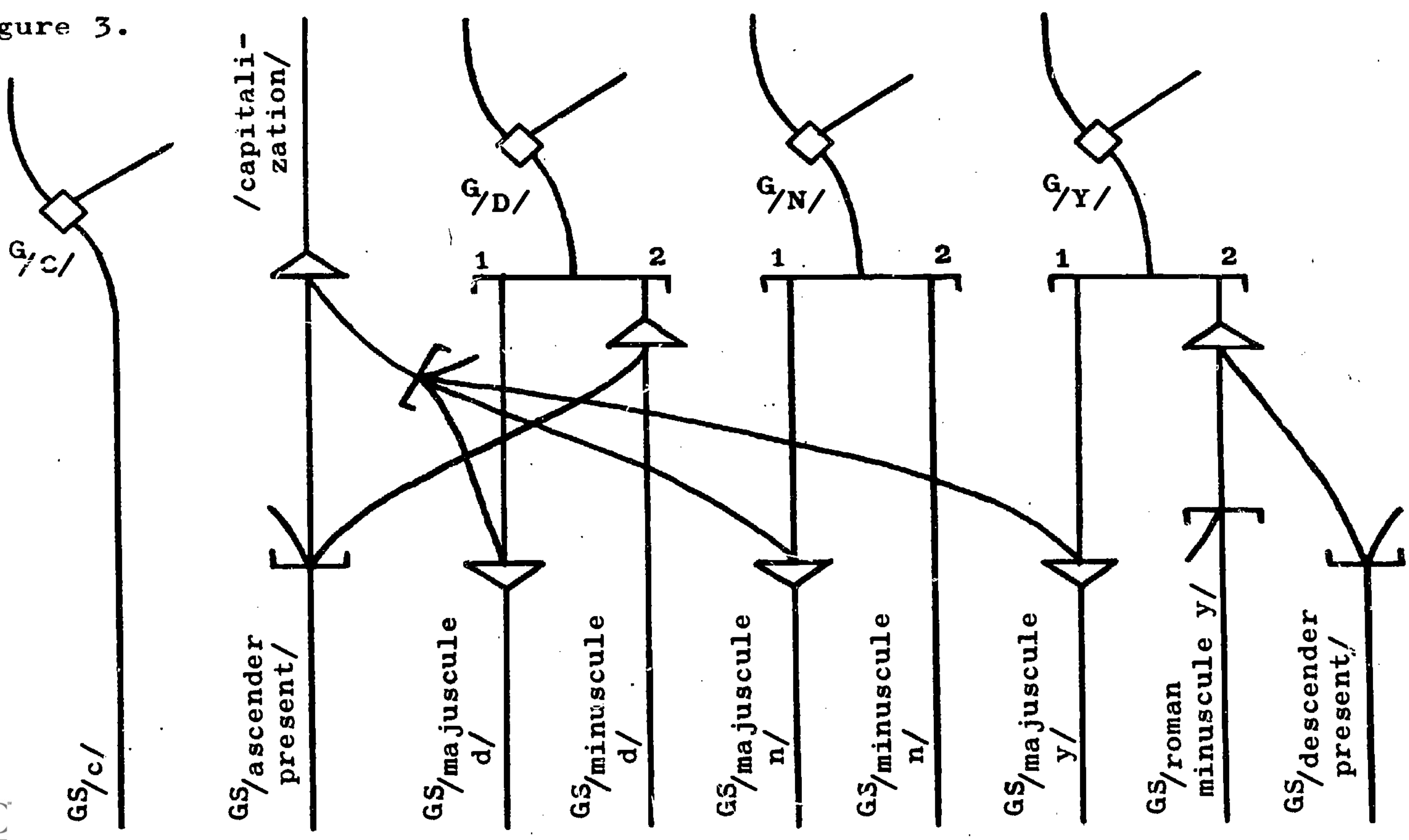


Figure 4(a).

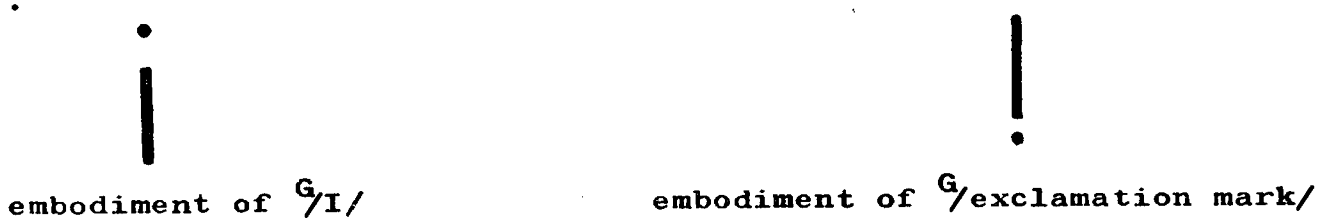


Figure 4(b).

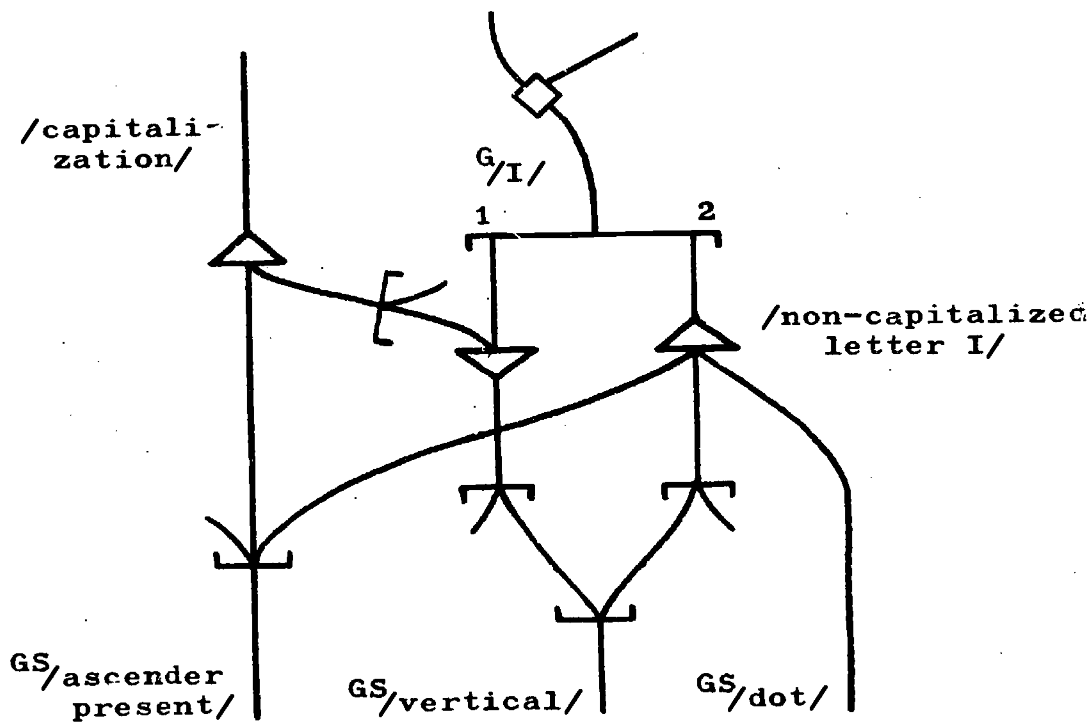


Figure 5(a).

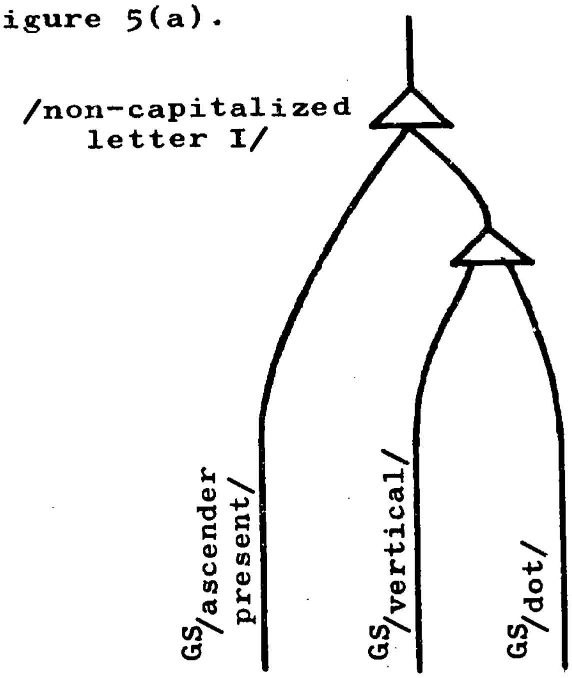


Figure 5(b).

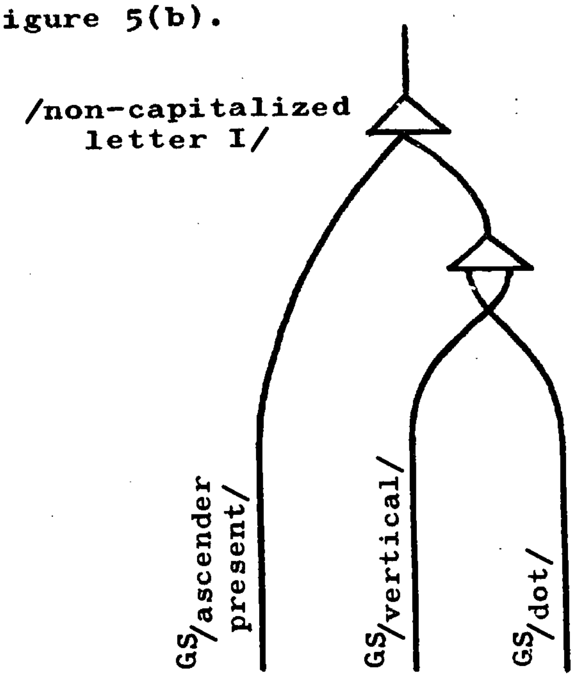


Figure 6(a).

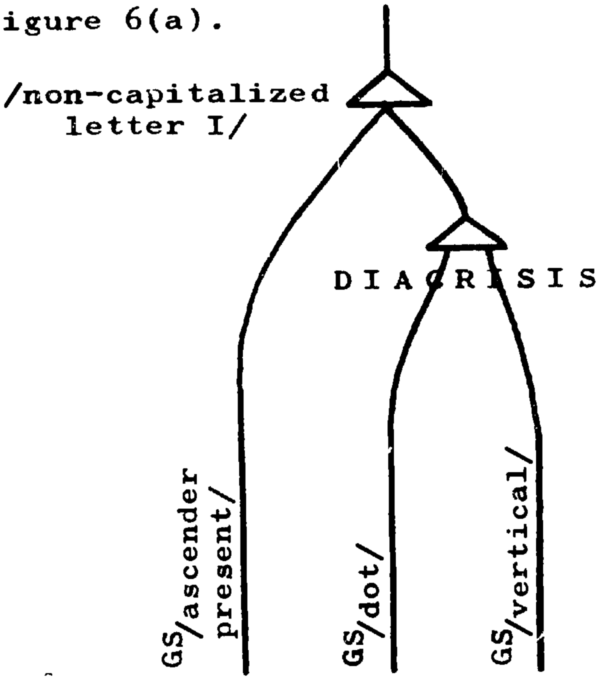


Figure 6(b).

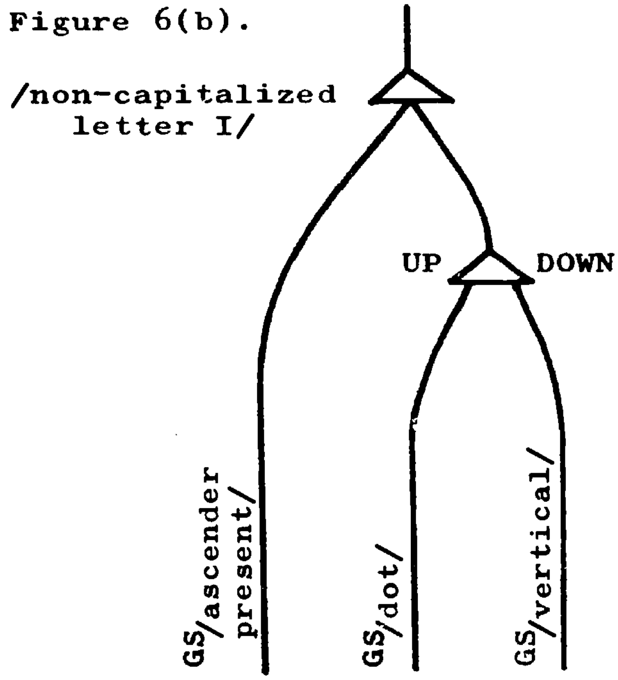


Figure 7(a).

Figure 7(b).

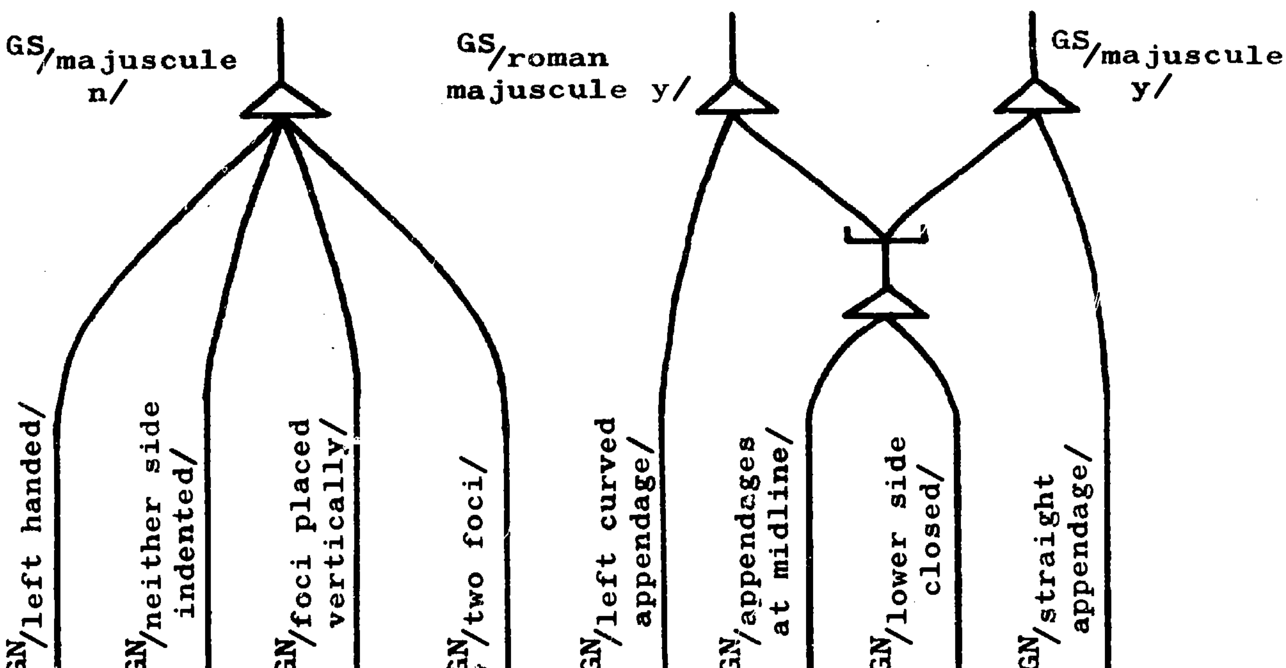


Figure 8(a).

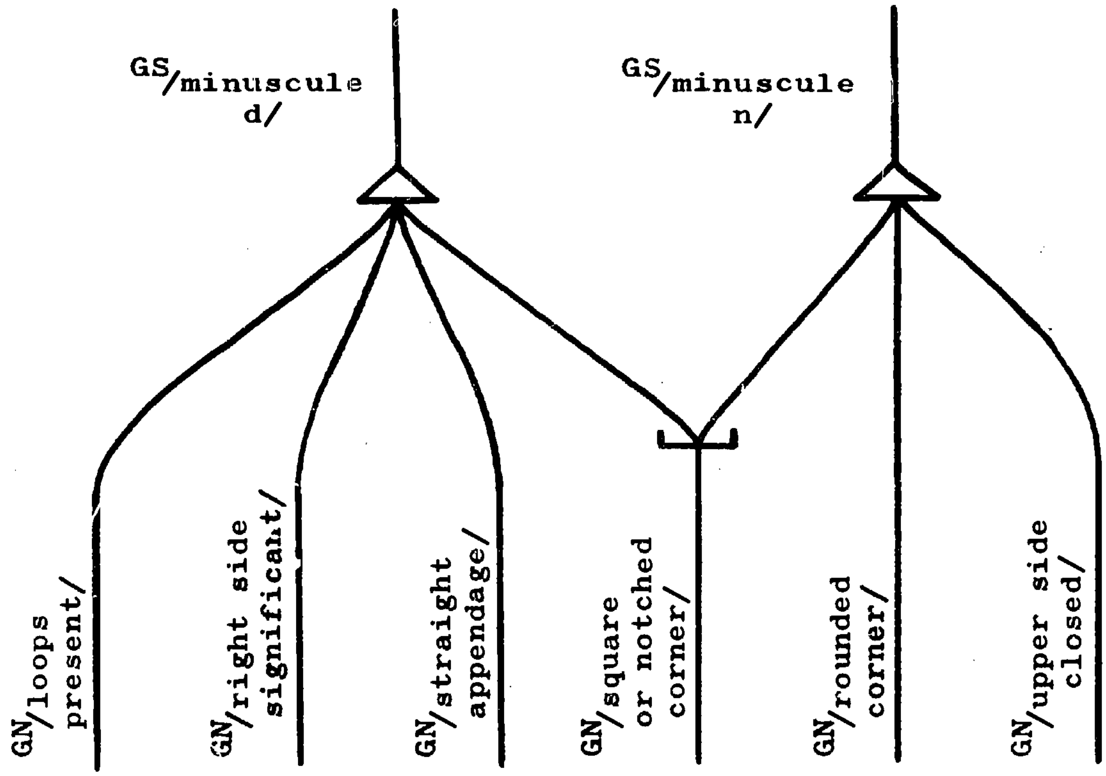
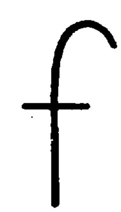


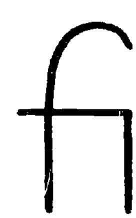
Figure 8(b).

Figure 8(c).

Figure 14(a).



GS/minuscule f/



GS/f i ligature/

Figure 9.

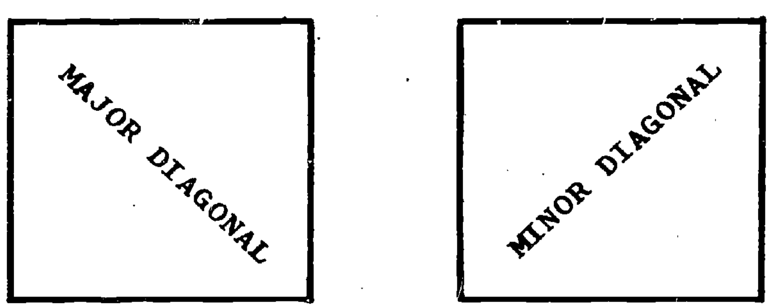


Figure 10.

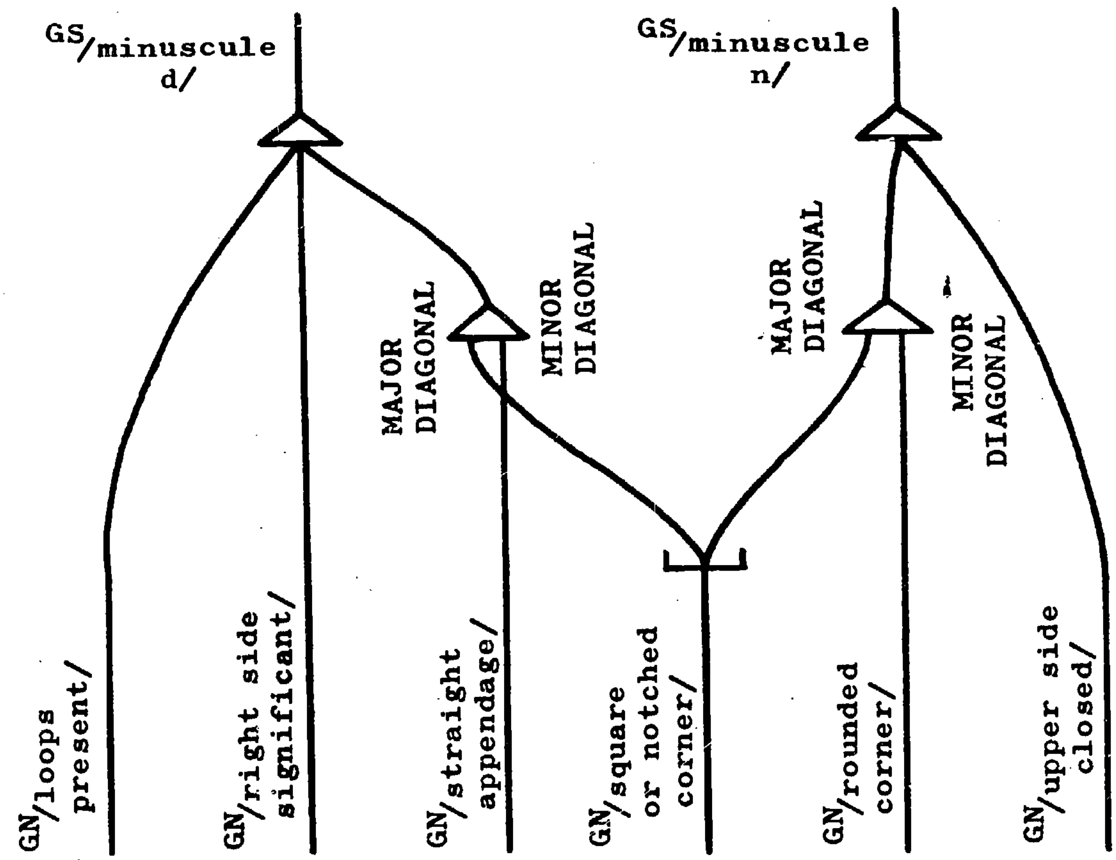


Figure 11(a).

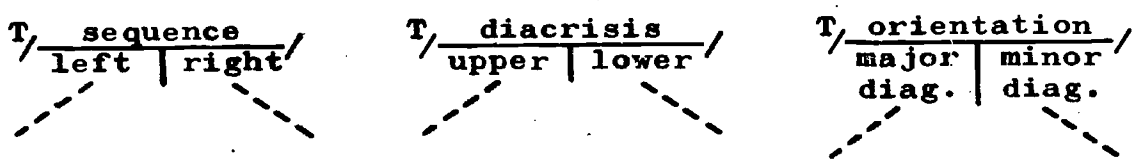


Figure 11(b).

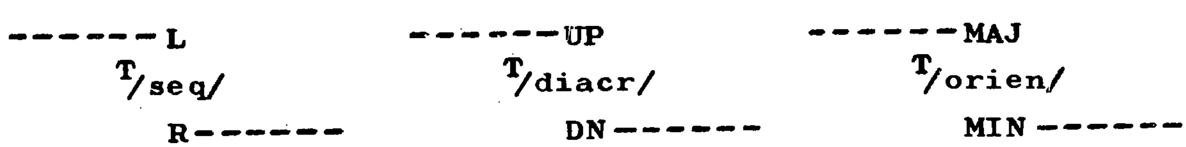


Figure 12.

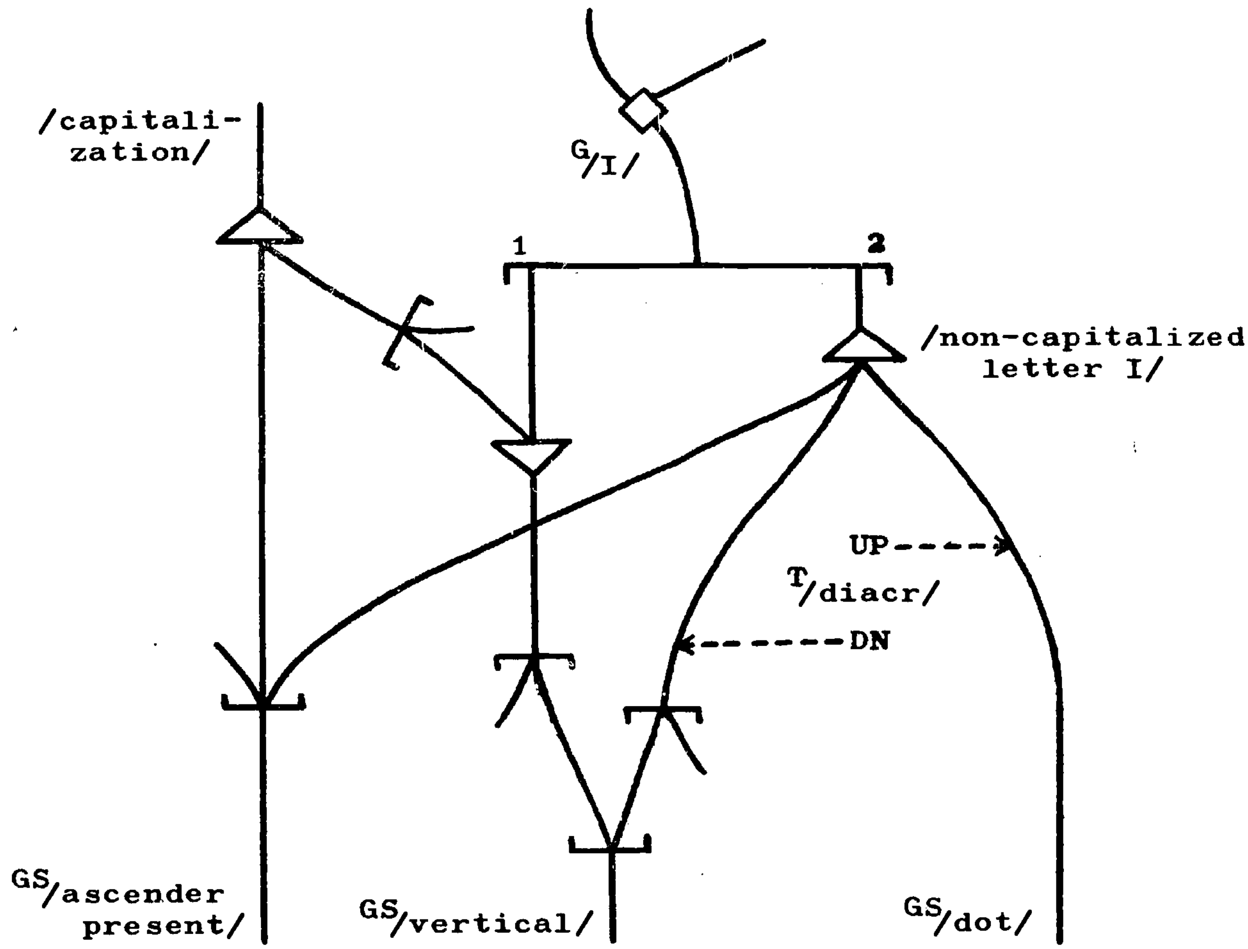


Figure 13.

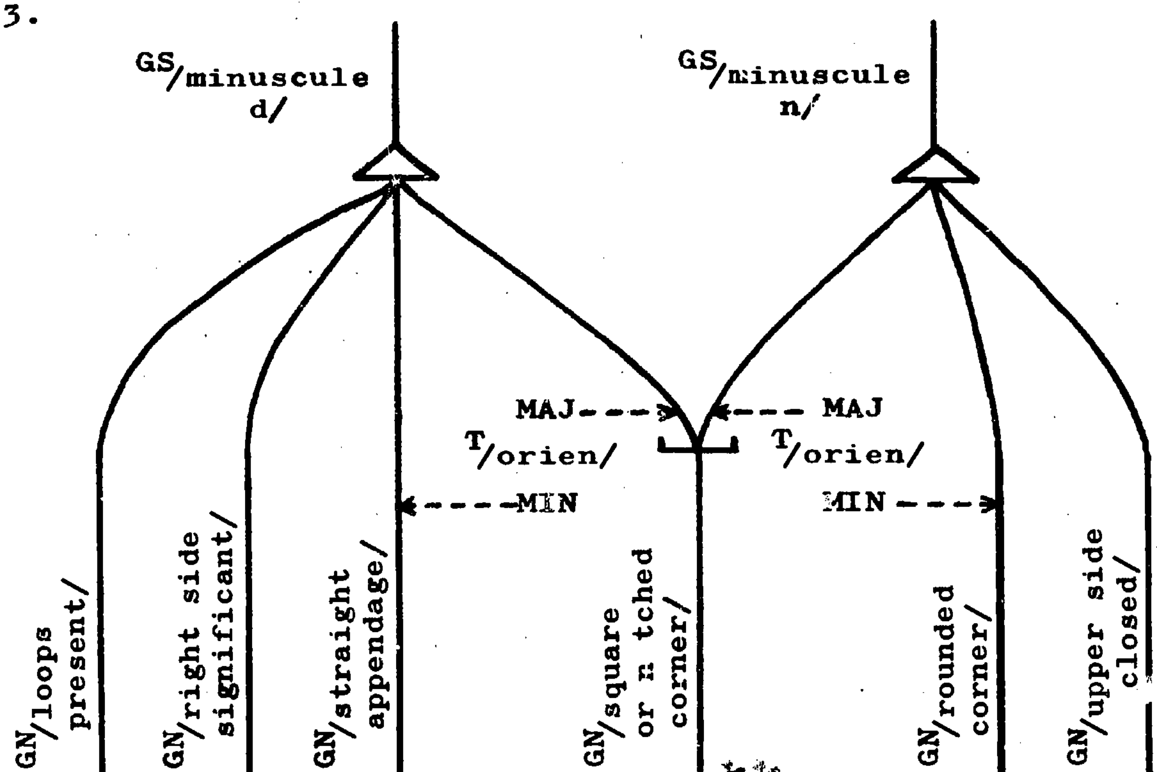


Figure 14(b).

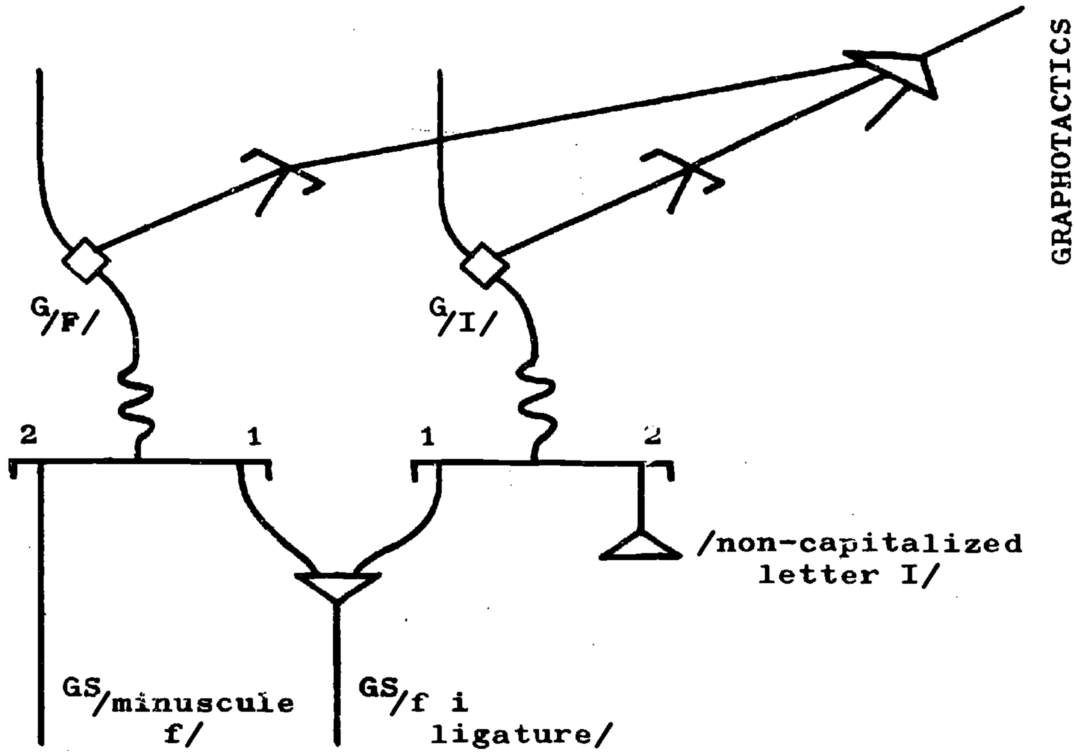


Figure 15.