

THE APPLICATION OF MATRIX TO GAHUKU VERBS

ELLIS DEIBLER, JR.

As investigations are carried on in more and more languages in various areas of the world, it becomes increasingly important to seek new avenues of presentation of findings in order that other linguists may be able to grasp the salient features with a minimum of time and effort. One of the most fruitful developments in the last two years has been the increasing use of matrices in the description of grammar. This paper is an attempt to show the use of matrices in a description of the verb structure of Gahuku, a language spoken by about 8,000 people in the Goroka area in the Eastern Highlands of New Guinea. An attempt is also made in this paper to present the use of a numerical notation system which is directly tied to the various matrices.

Following the tagmemic approach of Pike¹, if one starts with the premise that two constructions are different if they have two differences, at least one of which is internal, we find that in Gahuku we have 95 clause types to describe. To list the features of these one by one would not only be exhaustively time-consuming but would fail to bring out those features which separate one from the other. Therefore we make our initial breakdown into four basic clause types as shown in the following Kernel Matrix (M_k).

		POSITION	
		<i>Medial</i>	<i>Final</i>
DEPENDENCY	<i>Independent</i>	100	200
	<i>Dependent</i>	300	400

In our numerical notation system all clause types are assigned a 3-digit number, of which the hundreds digit signifies the Position and Dependency indicated in M_k .

Each of the four clause types has different morphology on the verb (which constitutes the only obligatory unit in the clause) and different distribution in sentences. The distribution of these four types is as follows:

Independent Medial (100) clauses occur in non-final position in a sentence, and have verbs which are independent of the subject and tense of the verb of the final clause. Independent Final (200) clauses occur sentence final and have no dependency on other clauses.

Dependent Medial (300) clauses occur in non-final position in a sentence and have verbs which demonstrate dependency as to subject and tense on the verb of the succeeding or final clause.

Dependent Final (400) clauses occur sentence final but are dependent on the action of another clause which may be expressed or implied from the context.

Any of the four basic clause types may occur as a Transitive, Intransitive or Stative Clause. The Transitive and Intransitive clauses may be further subdivided into Benefactive (Ben) and Non-benefactive (Non-ben) clauses. These subdivisions give us the following Action Matrix (M_A):

 M_A

BASIC TYPE	ACTION				
	<i>Transitive</i>		<i>Intransitive</i>		<i>Stative</i>
	<i>Non-ben</i>	<i>Ben</i>	<i>Non-ben</i>	<i>Ben</i>	
<i>Ind. Medial</i>	110	120	130	140	150
<i>Ind. Final</i>	210	220	230	240	250
<i>Dep. Medial</i>	310	320	330	340	350
<i>Dep. Final</i>	410	420	430	440	450

The tens digit in the numerical notation system signifies the action of the clause.

Examples of the four basic clause types, using a transitive non-benefactive verb, are as follows:

Ind. Med.	(110)	húk-a-nazo...	<i>cut-he-because...</i>	"Because he cut it,..."
Ind. Fin.	(210)	húk-á-mo?	<i>cut-he-emphatic</i>	"He cut it."
Dep. Med.	(310)	húk-á-ke...	<i>cut-he-after...</i>	"After he cut it, he..."
Dep. Fin.	(410)	húk-a-líne	<i>cut-he-would</i>	"He would have cut it."

The features distinguishing between Transitive, Intransitive and Stative clauses are different verb manifesting classes and different

obligatory and optional items which may occur in the clause. Non-benefactive and Benefactive clauses have different verb morphology and different optional items which may occur in the clause.

Each of the groups of four basic clause types is further subdivided into types characterized by different function and/or distribution; and in each case this corresponds with different verb morphology. Thus we have the following matrices in which the units digit of the numerical notation system signifies the mood of the clause.

M_{IM} of Independent Medial Clauses -

CFR = Contrary to Fact Result

CR = Contrary Result

CFC = Contrary to Fact Condition.

MOOD	ACTION				
	Transitive		Intransitive		Stative
	Non-ben	Ben	Non-Ben	Ben	
CFR-contrast	111	121	131	141	151
CFR-Reason	112	122	132	142	152
Contrast	113	123	133	143	153
CR-Contrast	114	124	134	144	154
CR-Reason	115	125	135	145	155
Reason	116	126	136	146	156
CFC	117	127	137	147	157

Examples of M_{IM} clauses:

- | | | | |
|-------|------------------------------|--------------------------------|---------------------------------------------|
| (111) | húk-ati-liná-mo?za... | <i>cut-you-would-but...</i> | "You would have cut it, but..." |
| (112) | húk-atí-li-nazo... | <i>cut-you-would-because</i> | "Since... you would have cut it..." |
| (113) | húk-aní-mo?za... | <i>cut-you-but...</i> | "You cut it, but..." |
| (114) | húk-ókat-áni-mo?za... | <i>cut-lest-you-but...</i> | "You might have cut it, but..." |
| (115) | húk-ókat-áni-nazo... | <i>cut-lest-you-because...</i> | "Since otherwise you would have cut it,..." |

- (116) **húk-áni-nazo...** *cut-you-because...* "Because you cut it,..."
 (117) **húk-atf-lini...** *cut-you-if...* "If you had cut it..."

M_{IF} of Independent Final Clauses

MOOD	ACTION				
	Transitive		Intransitive		Stative
	Non-ben	Ben	Non-ben	Ben	
<i>Indicative</i>	211	221	231	241	251
<i>Interrogative</i>	212	222	232	242	252
<i>Imperative</i>	213	223	233	243	253
<i>Question</i>	211Q	211Q	231Q	241Q	251Q ²

Examples of M_{IF} clauses:

- (211) **húk-avé** *cut-he* "He cut it"
 (212) **húk-ahé** *cut-he?* "Did he cut it?"
 (213) **húk-ozó** *cut-imp.* "Cut it!"
 (211Q) **nána-mu? húk-avé** *What-for cut-he* "Why did he cut it?"

M_{DM} of dependent Medial Clauses

MOOD		ACTION				
		Transitive		Intransitive		Stative
		Non-ben	Ben	Non-ben	Ben	
<i>Non-fut. Final Clause</i>	<i>same subj.</i>	316 ³	326	336	346	356
	<i>diff. subj.</i>	317	327	337	347	357
<i>Future Final Clause</i>	<i>same subj.</i>	318	328	338	348	358
	<i>diff. subj.</i>	319	329	339	349	359

Examples of M_{DM} clauses:

- (316) **húk-á-ke** *cut-he-when* "After he cut it, he...."
 (317) **húk-agó** *cut-he* "After he cut it, (someone else)...."
 (318) **húk-óko** *cut-he* "After he cuts it, he will...."
 (319) **húk-ikó** *cut-he* "After he cuts it, (someone else) will...."

M_{DF} of dependent Final Clauses

ACTION

MOOD	<i>Transitive</i>		<i>Intransitive</i>		<i>Stative</i>
	<i>Non-ben</i>	<i>Ben</i>	<i>Non-ben</i>	<i>Ben</i>	
	<i>CFR Indicative</i>	411	421	431	
<i>CFR Interrog.</i>	412	422	432	442	452
<i>CR Indicative</i>	414 ³	424	434	444	454
<i>CR Interrog.</i>	415	425	435	445	455

Examples of M_{DF} clauses:

- (411) **húk-u-l íné** *cut-I-would* "I would have cut it."
 (412) **húk-u-l íné-hé** *cut-I-would-?* "Would I have cut it?"
 (414) **húk-ókat-óvé** *cut-lest-I* "Lest I cut it", "I might have cut it"
 (415) **húk-ókat-óhé** *cut-lest-I?* "Might I cut it?"

It is well to note here that as we present each new matrix in our grammatical description we must list in detail those criteria which distinguish one clause type from another. For example, we must note the difference in morphology between benefactive and non-benefactive; between indicative, interrogative and imperative. We must list the obligatory and optional features of transitive, intransitive and equational clauses.

We may continue both our matrices and the numerical notations on the morphological level to describe the various tenses, aspects and person-numbers with which each verb may occur. For example, in Independent Final clauses in the Indicative mood we may have the tenses and aspects shown in the following matrix (M_{IF-ITA}):

$$M_{IF-ITA}$$

ASPECT	TENSE						
	<i>Past</i>	<i>Stat.</i>	<i>Pres.</i> <i>Prog.</i>	<i>Fut.</i>	<i>Fut.</i> <i>Prog.</i>	<i>Perf.</i>	<i>Con-</i> <i>tinuat</i>
<i>Declar.</i>	.011	.021	.031	.041	.051	.061	.071
<i>Declar. neg.</i>	.012 ⁴	-	-	.042	.052	.062	.072
<i>Emph.</i>	.013	.023	.033	.043	.053	.063	.073
<i>Emph. neg.</i>	.014	-	-	.044	.053	.064	.074
<i>Paratactic</i>	.015	.025	.035	.045	.055	.065	.075
<i>Paratactic neg.</i>	.016	-	-	.046	.054	.066	.076

Here we continue to represent intersections of contrasting features by numerals, writing them to the right of the decimal point to indicate that they indicate multiplications of verb morphology which do not have clause-type significance. Note also that the matrix enables us to spot readily those affix combinations which do not occur.

All verbs filling head slots of verb phrases in all clauses occur with the following person-number subjects: first singular, second singular, third singular, first dual, second/third dual, first plural, second/third plural. We symbolize these in the following person-number matrix (M_{pn}):

NUMBER	PERSON		
	1	2	3
<i>Singular</i>	.100	.200	.300
<i>Dual</i>	.400	.500	
<i>Plural</i>	.600	.700	

In certain verb affixes there is only a dual distinction made between the person and number of the subject. One form occurs when the subject is either singular or first person; these we call mono-focal affixes and assign decimal .800. Another form occurs with second or third person dual or plural subjects; these we call poly-focal affixes and assign decimal .900 to them. The focus matrix (M_F) shows this:

M_F	NUMBER	PERSON		
		1	2	3
<i>Singular</i>		.800	(mono-focal)	
<i>Dual</i> <i>Plural</i>			.900 (poly-focal)	

At this point it may be well to point out the distinctive feature of this numerical notation system. One may readily link the description of affixes with their numerical designations; e.g. the discussion of future tense morpheme may be headed *Future Tense* (.040). Having presented the complete morphology one may subsequently note all the information on a particular verb form, including clause type, mood, aspect, tense and person-number, with a number. For example:

al-e ge-t-o no-u-moq nehe *get-vowel you-benefactive-vowel*
perfect-I-emphatic interrogative

"Have I gotten (it) for you?" may be designated "get - you - 222.163"

The use of matrix is helpful in recognition of recurring partials in individual morphemes. Note these person-number morphemes of past tense indicative mood (allomorphs are not included in discussion of individual morphemes here).

M_{PN-PI}	PERSON	NUMBER		
		<i>Singular</i>	<i>Dual</i>	<i>Plural</i>
<i>First</i>		-uve	-usive	-une
<i>Second</i>		-ane	-asive	-ave
<i>Third</i>		-ive		

We note that the recurring partial **-si** is characteristic of dual. Rotation of the matrix points out another recurring partial more easily.

NUMBER	PERSON		
	<i>First</i>	<i>Second</i>	<i>Third</i>
<i>Singular</i>	-uve	-ane	-ive
<i>Dual</i>	-usive	-asive	
<i>Plural</i>	-une	-ave	

Here we see **-u** a characteristic of first person.

A further matrix presents a very interesting feature of the person-number morphemes in Gahuku. This consonant matrix (M_C) presents the consonants which occur in the various person-number morphemes of various tenses, aspects, moods and clause types:

CLAUSE TYPE	PERSON-NUMBER		
	<i>Second sing., first plural</i>	<i>First dual, sec./third dl.</i>	<i>1 and 3 sing., 3rd plural</i>
<i>Past-Decl.-Interrogative</i>	-p-	-s-h	-h-
<i>Past-Decl.-Indicative</i>	-n-	-s-v-	-v-
<i>Past-Emph.-Indicative</i>	-n-	-s-	-
<i>Future-Decl.-Interrogative</i>	-p-	-?-h-	-h-
<i>Future-Decl -Indicative</i>	-n-	-?-v-	-v-
<i>Contrary to Fact</i>	-t-	-s-	-
<i>Dep. Med. same Subject</i>	-k-	-s-g-	-g-

Here a matrix has shown us consistencies in consonant patterns between these rather unusual combinations of person-number morphemes that would hardly be apparent otherwise.

A matrix is also of value in noting patterns among the various classes of verbs. Verb stems are divided into classes according to the group of allomorphs of various suffixes with which they occur when these suffixes occur in first position following the stem, and by the occurrence of stem changes and prefixes. The following verb class matrix (M_{VC}) notes the classes which occur:

M_{VC}	SUFFIXED FORM			
	<i>No stem change or prefix</i>	<i>Oblig. prefix</i>	<i>Oblig. V change</i>	<i>Oblig. V change and prefix</i>
<i>Occur with allomorph set A (Class 10)</i>	11 l- 'burn'	12 -l- 'be hungry'	13 mVl- 'put'	(14) (-lVqm-) 'take'
<i>Occur with allomorph set B (Class 20)</i>	21 z- 'hit'	22 -m- 'give'	23 gVl- 'hear'	24 -pVl- 'kill'
<i>Occur with allomorph set C (Class 30)</i>	31 v- 'go'	-	-	-

Here verb classes are assigned to a two-digit number, of which the tens digit signifies the first-position suffixes which occur and the units digit the form to which the suffixes are added.

This verb class matrix illustrates the possibility of using matrix as a search device. We are led to query why there are no classes 32, 33 and 34 until we know that there are only three numbers of class 31 (the stems l- "eat", v- "go" and #- "be". We expect to find a class 14 but do not find any, until we discover that the verb "to take" falls into this class when occurring as a verb auxiliary in a verb phrase.

In summary we may note the following positive values of the use of matrix⁵ with regard to the Gahuku verb system:

1. It enables others to gain a quick and graphic outline of structure.
2. It eliminates a great amount of repetition in description by noting successive breakdowns of units.
3. It points to holes in patterns, either for further investigation or for recognition.

4. It enables us to note patterns of structure that would probably remain undetected otherwise.

In addition we suggest the following positive values of the numerical tagmeme rotation system:

1. We may designate not only morphemes but contrastive tagmemic features by numerals which are intersections of labelled axes.
2. We may specify clause types as well as morphological units, and distinguish that morphology which has clause significance from that which does not.
3. We have a very convenient shorthand for identification of verbal units in literal translations accompanying texts.

NOTES

1. K.L. Pike, "Dimensions of Grammatical Constructions", *Language* 38, 1962; also R.E. Longacre "String Constituent Analysis", *Language* 36, 1960.
2. The number 1 in the units digit is used again as a memory device to remind us that the real morphology in question clauses is identical with that for Indicative clauses.
3. As an aid to memory an attempt is made to have the numbers in the units column in matrices M_{IM} , M_{IF} , M_{DM} and M_{DF} signify as far as possible the same features with respect to mood. Hence in M_{IF} and M_{DF} , 1 and 2 in the units column refer to indicative and interrogative. 413 is omitted because 3 in the units column in M_{IF} refers to imperative. M_{DM} starts with 316 because the indicative-interrogative-Imperative distinctions of M_{IF} are not pertinent to M_{DF} .
4. An alternative is to make negative vs. affirmative a separate matrix. Its disadvantage is that it would necessitate an additional numeral.
5. For further discussion of matrix, see K.L. Pike, "A Syntactic Paradigm", *Language* 39, 1963.