

## MOROBE COUNTING SYSTEMS

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### INTRODUCTION

The aim of this paper is to investigate the counting systems of the Morobe Province, Papua New Guinea, and the relationship between these counting systems and the languages spoken in the area.

This investigation involved a number of stages. The first requirement was an exhaustive collection of counting data from all the languages of the province. Secondly, these data were categorised into a number of different types to demonstrate the variety of counting methods occurring. Thirdly, the distribution of the different types of counting system was correlated with the distribution of the various language families spoken in the province, and finally, the implications of this correlation for the culture history of North-East New Guinea were examined.

The idea for this research was a direct result of involvement with the Indigenous Mathematics Project, which was begun in 1976 by the Papua New Guinea Department of Education under the direction of Dr David Lancy, who was then Principal Research Officer. The Indigenous Mathematics Project had a number of aims, all connected with the relationship between traditional culture and cognitive ability, especially with respect to primary school mathematics performance. Help was enlisted from anthropologists, linguists, educationalists, psychologists and mathematicians, and the present writer contributed a small part of the resulting research (Smith 1978, 1980, 1981).

One of the cultural variables which was felt to be relevant to cognitive development was the traditional method of counting used in a society. Lancy notes (1978:6):

From its inception the Indigenous Mathematics Project has had as its goal to document the mathematics systems traditionally used in Papua New Guinea. Such systems are interesting in their own right but we felt they might also aid us in understanding the roots of cognitive variability in Papua New Guinea.

Information on counting systems was assembled by Lancy from a number of sources. Published accounts such as Kluge (1937-1942) and Wolfers (1972) provided surveys of some of the types of counting method employed by Papua New Guineans, and this was supplemented by unpublished material made available by the Mathematics Departments of the University of Papua New Guinea and the Papua New Guinea University of Technology. In addition, some studies of counting systems in

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individual cultures were carried out specifically for the Indigenous Mathematics Project, for example Cheetham (1978), Kettenis (1978) and Thune (1978). However, Lancy notes (1976:6) that the assembled data represented only about 30% of all the languages of Papua New Guinea. The present research was initiated to reduce this deficiency and provide additional data.

The Morobe Province was selected as the study area, as this is accessible to the University of Technology, which is located at Lae. The province is a political unit, not a linguistic or cultural one, and thus the boundaries are arbitrary from an ethnographic point of view. However, the size of the province made it suitable as a study area; there are 105 languages in the province, both Austronesian and non-Austronesian (see section 2.2). It was felt that the most significant contribution could be made by concentrating the survey on a limited but still considerable area of Papua New Guinea to obtain a complete set of data rather than a sample from a wider area. Reference is made to the situation in adjacent areas where this is relevant.

Collection of data was carried out as far as practicable from village informants in their own communities, and was supplemented by data from published sources and those provided by other linguistic field workers in the area, especially from the Summer Institute of Linguistics. Once collected, the counting systems were classified into several different types, and these data are now available for cognitive or educational research.

The main theoretical issue explored in this paper is the relationship between languages and counting systems in the province. Do closely related languages have similar types of counting systems? If not, what accounts for this discrepancy? Laycock (1977:219) suggests that no close correlation can be expected:

What is clear ... is that number systems, at least in the New Guinea area, afford few indications of genetic relationship of languages; closely related languages may show widely-differing systems.

With this statement in mind, the Morobe data were examined to see what types of counting systems are employed in the different languages and language families. A certain amount of consistency was found within some families, whereas in others the variety of counting types was more difficult to explain. In particular, the data from the Austronesian languages showed a puzzling range of types.

The paper begins with two introductory sections which serve to place the Morobe material in context. In section 1, counting in general is discussed. The historical development of counting methods in different cultures is followed by a review of research into counting systems, especially in the South-West Pacific area. Recent ethnographic studies of counting in Papua New Guinea are then described. Section 2 gives some background information on the Morobe Province. An account of its geographical features, population distribution and cultural characteristics lead up to the latest classification of Morobe's languages. The linguistic research which led to the formulation of this classification is briefly considered. Section 3 gives an account of research methods adopted for the purposes of this study. Details of how informants were selected, and of information gathering and transcription techniques are presented.

Sections 4 and 5 evaluate the data collected. In section 4, the counting methods of the languages of the province are classified into a number of different types, and in section 5, the distribution of these types in each of Morobe's language families is examined. Section 6 examines the implications of these findings for the culture history of the area, and suggests some possible explanations. These include the effects of language contact, and the economic and cultural needs of traditional societies.

## 1. COUNTING AND NUMBER

### 1.0 INTRODUCTION

This paper is concerned with counting and number and the relationship of these to language and to culture, in particular to that portion of North-East New Guinea known as the Morobe Province. Before considering data from Morobe, it will be instructive to get this study in its correct perspective, and this section looks at the significance of counting and numeral systems in the cultures of the world.

Firstly, a review of reconstructions of the counting systems of earlier cultures puts contemporary knowledge in historical perspective. Secondly there is an overview of counting and number in today's societies. A good deal of work has been devoted to the counting methods of the world, to regional surveys, ambitious global inventories, ethnographic studies and theoretical linguistic models. Some of these are considered in the remainder of the section, and provide a theoretical starting point for the later evaluation of data presented here.

### 1.1 A HISTORICAL PERSPECTIVE

Human beings have been using numbers for millenia, and it is possible to reconstruct some early counting systems from evidence left in writing. A great variety of written notations has been produced (Smith and Leveque 1970, Menninger 1977), and a brief review of counting systems known about from historical records is given here to provide a framework for considering the Morobe material. (See also Conant 1896, Boyer 1944, and Asimov 1977.)

The first attempts at counting presumably predated written records, and will always remain unknown. However, the earliest counting system indicated by a written form is a tally of marks, each representing a single object or event. Such tallies have been found among the most ancient inscriptions produced by man, such as cave paintings. The earliest written records from the Egyptian and Babylonian cultures around 3,000 to 3,500 B.C. contained tally marks for units up to nine, but also had a symbol for ten, showing that a decimal system of counting was probably already in use by this time. The decimal system, no doubt originating from counting the fingers of both hands, recurs in many different cultures, although other bases are also found.

The Romans were among those who used a base of ten, the symbol for which was X. Symbols for other numbers below this base were I for one and V for five. It has been suggested that V was derived from the shape of one hand held up with the thumb outstretched. Ten times ten was shown by the symbol C, and ten times ten times ten by M. In addition, there were symbols for 50 (L) and 500 (D). Thus the counting system used in Roman times was already quite a sophisticated one. To produce the written representation of a number, a simple grouping system was employed, where each symbol was repeated the required number of times. For example the number 73 was written:

$$\text{LXXIII} = 50 + 10 + 10 + 1 + 1 + 1$$

A smaller unit placed in front of a larger unit indicated subtraction, so that IV meant one subtracted from five, that is four. In addition to the Egyptian and Roman systems, Greek and cuneiform Babylonian systems also used clusters of symbols to represent numbers. Such systems were clearly much more convenient than simple tallies for recording large numbers, and Egyptian hieroglyphic symbols for one million are known. However, they did not allow easy computation, as digits were not represented by single symbols.

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Numeral systems employing a large number of symbols for multiples of the base evolved in several places. Egyptian hieratic numerals, the Greek Ionic or alphabetic system and Coptic, Hebrew, Hindu and early Arabic numerals were basically of this type, which may be referred to as ciphered numeral systems. For example, the Greek Ionic system had separate symbols for one to nine and the base ten, for multiples of ten from 20 to 90 and for hundreds from 100 to 900. One thousand was indicated by a bar. Such ciphered numeral systems required the memorising of a large number of symbols, but once this was achieved, computation was relatively easy.

The Ancient Chinese number system also had a base of ten, but had multiplicative grouping for numbers above ten. For example, to write the number 4,000, instead of repeating the symbol for 1,000 four times, the symbol for four preceded the symbol for 1,000. Thus the number 2,605 was written:

$$\begin{array}{cccccc}
 & \text{二} & & \text{千} & & \text{六} & & \text{百} & & \text{五} \\
 = & 2 & & 1,000 & & 6 & & 100 & & 5
 \end{array}$$

(Smith and Leveque 1970:758)

It is only a short step from here to the modern notation omitting the symbols for 100, 1,000 and so on, and using instead the position of the symbol to carry this information. However, the use of a symbol for zero is essential for a positional system to be unambiguous. The Babylonians employed a positional system four to five thousand years ago with a base of 60 and simple grouping to base ten within this (Thureau-Dangin 1939, Price 1961). However, there was no symbol for zero, and so the system was ambiguous. As will be seen in section 1.2.3, a base of 60 was also employed in the New Guinea area, and possible links between the two have been suggested. The Mayans of Central America used a sophisticated positional system with a base of 20 and the inclusion of a symbol for zero. It was used mainly for time calculation. However, the system's notation employed simple grouping of units to five, and thus was unsuitable for computation.

An improved decimal system with each digit represented by a single symbol and including a zero was based on ideas originating from the Hindus and reaching Europe via the Arabs around the 10th century. It is a base ten positional system, using the position of each symbol to determine the power to which the base has been raised. Moving one position to the left indicates the raising of the base to another power. For example, the expression 43,552 means:

$$\begin{array}{r}
 2 \quad \times \quad 1 \\
 + \quad 5 \quad \times \quad 10 \\
 + \quad 5 \quad \times \quad 100 \\
 + \quad 3 \quad \times \quad 1,000 \\
 + \quad 4 \quad \times \quad 10,000
 \end{array}$$

The modern positional decimal system is now almost universally adopted for trade, commerce, science and technology, and one is tempted to imagine that the system has now been perfected. However, Morgan (1982:221) points out that this system does not necessarily make arithmetical calculations as easy as possible, and suggests that if a subtractive system had been adopted, computation would be much easier. Counting would proceed as follows: one, two, three, four, five, four less than ten, three less than ten, two less than ten, one less than ten, ten, ten and one, ten and two, and so on. The corresponding numbers in written form would be: 1, 2, 3, 4, 5, 14\*, 13\*, 12\*, 11\*, 10, 11, 12, etc. This is rather similar to the way time is calculated by using such expressions as

'twenty past two', but 'twenty to three'. Such a numerical system would reduce the number of symbols needed, and is claimed by Morgan to make arithmetical calculations easier to learn. It is interesting to note that a subtractive component was a feature of the Roman system and is also present in some 'incomplete decimal' systems found in parts of Melanesia (Firchow, n.d.).

Although the decimal system is the dominant system in the world today, a binary system using only the symbols 0 and 1 is more appropriate for certain applications. Binary numbers are positional in a similar way to the decimal system described above, but have only two instead of ten symbols. For example, the expression 110,101 means:

$$\begin{array}{r}
 \phantom{+} \phantom{0} \phantom{x} \phantom{1} \\
 + \phantom{0} \phantom{x} \phantom{1} \phantom{1} \\
 + \phantom{0} \phantom{x} \phantom{1} \phantom{1} \\
 + \phantom{0} \phantom{x} \phantom{1} \phantom{1} \\
 + \phantom{0} \phantom{x} \phantom{1} \phantom{1} \\
 + \phantom{0} \phantom{x} \phantom{1} \phantom{1} \\
 \hline
 = 53 \quad \text{in decimal notation}
 \end{array}$$

Binary digits, or 'bits', making use of the choice between only two alternatives, are suitable for on/off or yes/no systems used, for example, in computer technology.

## 1.2 RESEARCH ON COUNTING SYSTEMS

### 1.2.1 A GLOBAL VIEW

The variety of counting systems in the world has engaged the attention of researchers and scholars for some time, and there have been a number of attempts to provide comprehensive accounts, for example Pott (1847) and Schmidt (1926). The most notable attempt was that of Kluge, whose monumental five-volume collection (1937-1942) represents a significant part of his life's work. It is unfortunate that much of the information contained in these works was obtained from sources whose reliability is doubtful. The cultural context of counting is largely ignored, and very little information was collected by the authors themselves. Seidenberg's more recent work (1960) continues in the same tradition, and even at this late date it was possible for him to state that 'many groups of savages cannot count beyond two' (p.216). His data from the New Guinea area are somewhat out of date, and classifications, such as whether finger counting begins on the left or right hand, or on the thumb or the index finger are of doubtful value.

Some reviews of counting practices in particular regions of the world have also appeared. An account of counting in American Indian languages can be found in Dixon and Kroeber (1907). Counting in the African region was reviewed by Schmidl (1915), while the New Guinea and Pacific region also received attention from Codrington (1885) and Ray (1907).

Detailed ethnographic studies of counting in action in different societies have recently provided a much more useful data base. An example is Araujo's (1975) description of the Basque method of counting sheep. Similarly, Zasalavsky's study (1973) of counting and pattern in Africa relies on careful participant observation, unlike Schmidl's earlier survey. She notes that the development of numeracy in many West African societies is greatly assisted by a variety of 'mathematical recreations', such as the construction of 'magic' number squares, or playing board games involving strategies of the 'backgammon' variety. A number of finger symbols are described, which are quite

distinct from the marking off of fingers during tallying. A certain finger held in a definite position unequivocally represents a certain number, and thus the finger symbols represent a kind of numeral notation. A variety of detailed ethnographic studies in the New Guinea area have been carried out, and will be briefly described in section 1.2.3.

### 1.2.2 LINGUISTIC STUDIES

Numeral systems have also been examined from a purely linguistic point of view. Salzmann (1950) introduced a method for the analysis of numeral systems based on three types of pattern. According to his theoretical model, the 'frame pattern' describes the succession of morphemes in a numeral, while the 'cyclic pattern' is roughly equivalent to the concept of base. Finally the 'operative pattern' shows the arithmetical processes by which numerals are constructed. Corstius (1968) includes a number of papers which adopt a generative or transformational approach to the analysis of numeral systems in various European, American and Asian languages, while Hurford (1975) and Stampe (1977) adopt a similar generative approach. The latter makes a number of generalisations on the basis of his analyses, for example that higher numbers tend to act more like nouns, while lower numbers act more like adjectives. Dorothy Hymes (1955) examined 40 American Indian languages and analysed their number systems. All were decimal systems, but only some had a complete set of numerals, while the others were classified by the way the numerals six to nine were constructed. In the process of this analysis Hymes found Salzmann's model inadequate for her purposes.

The most comprehensive linguistic study of counting systems is part of Greenberg's (1978) work on language universals. Drawing on an extensive and accurate data base, he formulates 54 generalisations about number systems as they occur in the languages of the world. Ironically, it is the very first generalisation, that 'every language has a numeral system of finite scope' with which Comrie took issue in a recent review (1980:836). It was pointed out that the English system can theoretically proceed infinitely, and therefore does not conform to this generalisation. Some of the generalisations are concerned with somewhat specialised aspects of linguistics, but others are of more general interest. The fourth generalisation, for example, states that in every system, at least some numbers receive simple lexical representation, that is that all languages have some number words. This contradicts older ideas to the effect that certain languages do not have numbers, but the limit may be remarkably low. The Macro-Ge language of Brazil is the single case of a language reported to have number words only for 'one' and 'many'. Systems involving tallying on the hands and feet are examined by Greenberg, and he distinguishes verbalisations of this kind of tallying procedure from other types of numeral series, stating that:

In these and similar instances it seems that numerals are never used without their accompanying gestures, and the gestures are often used without verbalization. It seems doubtful that such expressions are used attributively to nouns in sentences.

Also of interest with respect to the Morobe data are the following observations from Greenberg (1975). It is stated that higher numerals are more commonly borrowed than lower ones, usually in a sequence starting at a certain point (p.288). Some examples of this type of borrowing will be discussed in section 6. Evidence is also given for a certain psychological reality attached to the notion of 'base' (p.289). This can be seen, for example, in the case of the replacement of the Benue base twelve system by the Hausa base ten system in West Africa. Instead of the last two numerals of the series being abandoned, as would seem logical, the old word for twelve was used to mean ten, the new base, while the old words for ten and eleven were dropped. Similarly, the old higher base of

144 became the new word for 100. In Morobe, a similar phenomenon is apparent when considering bases of twenty and ten in some languages (see Appendix A). Finally, generalisation number 35 states that 'if 1 is expressed as a multiplier with a particular base, it is expressed with all higher bases' (p.178). This appears to be contradicted by some of the Morobe data, for example in the Mutu language, where a base of 20 is used with one as a multiplier, whereas the higher base of 400 apparently is not (see Appendix A).

### 1.2.3 THE NEW GUINEA AREA

#### 1.2.3.1 SURVEYS OF COUNTING SYSTEMS

As noted in the introduction, knowledge about the counting systems of the New Guinea area (that is the island of New Guinea and adjacent islands to the north and east) is by no means complete, but information is available from a number of sources. Since there is no written evidence of past systems, information about earlier periods comes from accounts by visitors to the region, such as missionaries, anthropologists or linguists, and from oral tradition.

The first research into the counting systems of an area usually coincided with the first linguistic research, as some number words were, and still are, included in most vocabulary lists when carrying out even the briefest language survey (see Laycock 1970:1157). Body counting systems, being somewhat exotic to Europeans, caught the attention of early missionaries and anthropologists, and there are published accounts of some of these, for example Aufenanger (1938, 1959), Kirschbaum (1938) and Williams(1940-1942). In addition to notes on individual languages or systems, there have been some attempts at surveys and classifications of counting systems in the region, for example Codrington (1885), Ray (1907), Kluge (1938-1942), Galis (1960) and Wolfers (1969, 1971, 1972).

The earliest attempt at a classification of counting systems on the island of New Guinea appears to have been that of the linguist Sydney Ray (1907) following his visit to the area as part of the second Cambridge Anthropological Expedition to Torres Strait in 1898. His survey was based on data he obtained from the Western and Central areas of Papua (then British New Guinea) as well as from Torres Strait, and from all available manuscripts from the British New Guinea area. Ray modelled his investigation of counting methods on that of Codrington, whose *Melanesian Languages* appeared in 1885. Codrington's data covered the 'Melanesian Islands', which comprised Fiji, New Hebrides (now Vanuatu) and the Solomon Islands.

Ray claims the first use of the terms 'Papuan' and 'Melanesian' to describe the two basic language types of the area in his 1892 address to the International Congress of Orientalists in London (Ray 1907:287). The terms correspond to what were later usually known as 'non-Austronesian' and 'Austronesian'. The term 'non-Austronesian' was adopted to avoid the implication that the group was made up of related languages, but instead implied that it included all those languages which were not Austronesian. Later, as more genetic relationships were established, the term 'Papuan' regained popularity among some authorities (Wurm 1975:4). One of the criteria Ray used to distinguish speakers of Melanesian languages from those of Papuan languages was the type of counting system used. He notes (1907:283) that for Papuan languages:

Distinct numerals are in use only for 'one' or 'two', rarely 'three'. Higher numbers are remembered by using parts of the body as tallies.

For Melanesian languages, on the other hand,

Numbers at least as far as five are counted. Though counting is performed on the fingers, other parts of the body are not used as tallies.

A considerable amount of material is analysed by Ray from the non-Austronesian languages of the Trans-Fly area, the Papuan Gulf and Central and Eastern Papua, and for each language a list of numeral terms is given. In addition, several body counting systems are described. Ray's data sometimes appear to contradict his conclusions, and the method used to elicit numerals is not described, but some possible sources of misunderstanding which may arise when collecting data are discussed by Codrington (1885:222). It is possible that some words in Ray's lists refer to the individual names for fingers or body parts rather than numerals. At any rate, the issue of the lack of numeral words in Papuan languages appears to have been pre-judged, as Ray dismisses any exceptions as being due to 'borrowing', 'imperfect knowledge' or 'imitation' (1907:463).

Ray devotes considerable attention to the counting systems of the Melanesian languages of British New Guinea. His previous criteria notwithstanding, he notes that in some Melanesian languages there are 'traces of a former inability to count beyond three', where languages have been 'modified by other, perhaps Papuan languages' (1907:463). The significance of this observation for the culture history of the area is taken up in detail in section 6. Following exactly Codrington's (1885) classification, four types of counting system are distinguished in the Melanesian languages: the quinary or base five, the imperfect decimal, the perfect decimal and the vigesimal or base twenty systems. Characteristics of these four types can be summarised as follows:

The quinary system was distinguished by Codrington on the basis that 'ten' was referred to as 'two fives', as for example in the Fate language of the New Hebrides. However, no unit is described as equivalent to 'five times five', and it is thus not a base five system in the logarithmic sense. It is more likely to be a stage in a vigesimal or base twenty system. Such systems usually employ counting on the fingers and toes as far as twenty, or 'one whole man', while higher numbers continue on another body. Ray notes that in some languages included in his vigesimal group, multiples of five are used to indicate ten and fifteen, while in others, paraphrases indicate the number of fingers and toes marked off. Systems which have a separate word for ten, such as Dobu, are distinguished from those which do not, for example Wedau. Imperfect decimal systems have a base of ten, but some words, usually six to nine are not distinct lexical items, but are combinations constructed from previously used elements. This construction may involve the following processes (Ray 1907:465):

(a) addition, for example Sinaugoro:

6 = *imaima sebona* = five one (5 + 1)

7 = *imaima lualua* = five two (5 + 2)

(b) multiplication, for example Roro:

6 = *aba-aihao* = two three (2 x 3)

8 = *aba-bani* = two four (2 x 4)

(c) subtraction, for example Hula:

7 = *mapere kaula vaivai* = one less four four (8 - 1)

9 = *mapere-ka-gahalana* = one less ten (10 - 1)

'Pure' or 'perfect' decimal systems in which there is a base of ten and separate words for all numerals from one to ten are not common in the area, and Ray notes only three examples, although



Codrington has several examples from Fiji, New Hebrides and especially the Solomon Islands (1885:236). Ray's examples are all from the East Papuan Island region. Two are from Melanesian languages on Brierly and Tagula (Sudest) Islands, and one is from a Papuan language spoken on Rossel Island called Yela by Ray, and now usually referred to as Yeletne (Henderson 1975). On Rossel, the words for one, two and three are not of Austronesian origin, while the words for four to ten appear to have been borrowed from neighbouring Austronesian languages. In Misima and Panaieti, an imperfect decimal system is used for numbers below ten, but the words used for counting tens up to 100 constitute a perfect decimal series.

Evidence of counting to higher numbers involving progressive powers of ten (100, 1,000, 10,000, etc.) is also presented by Ray. A word for 100 is given in several languages of the Central Papuan coastal region, for example Hula, Motu, Roro and Keapara, all of which have 'imperfect decimal' systems as far as ten. 'One thousand' is translated as *daha* in Motu, *raha* in Hula and *daga* in Sinaugoro. In Motu, a word *gerebu* was given for 'ten thousand' (the Hula word *rabuia* probably meant 'don't know') and *domaga* for 'one hundred thousand'. The latter may, however, be the word for 'too many' or 'an excess'. If these words were used as described, it would imply the existence of a sophisticated base ten system. However, no observations of people counting as far as these large numbers were documented.

Later surveys supplemented Ray's pioneering work. From 1937 to 1942, Kluge published accounts of a wide-ranging survey of the world's counting systems. The second section, 'Die Zahlenbegriffe der Australier, Papua und Bantuneger' (1938) and the fifth section, 'Die Zahlenbegriffe der Sprachen Central- und Sudostasiens, Micronesiens, Melanesiens und Polynesiens' (1942) contained data from the South-West Pacific area. As noted in section 1.2.1, the questionable accuracy of sources consulted during compilation of these works detracts from the value of the data presented, and classifications based on them.

Specifically in the New Guinea area, Galis (1960) carried out a comprehensive survey of the counting systems of the western half of the island of New Guinea and offshore islands, then known as Dutch New Guinea, now the Indonesian province of Irian Jaya. Drawing on earlier work by Friederici (1913), Frobenius (1935) and Kluge (1942) as well as more recent data, Galis classified the counting systems into six types, and also included a map showing how these were distributed. The six basic types in his classification were as follows:

(1) Body counting systems

(2) Simple base two systems (1, 2, 2 + 1, 2 + 2, 2 + 2 + 1, etc.) which he referred to as the 'Australian type' because of the use of this type of system in many Australian languages.

(3) A base-six system found only on Fredrik Hendrik Island and in the extreme south-eastern corner on mainland Dutch New Guinea. This is confusingly called the 'Melanesian type', and its unusual distribution is used as evidence to support certain migration theories.

(4) A base-four system found only near Hollandia (now Jayapura) referred to in the translation from Dutch as the 'tetraden type'.

(5) A base-five-twenty system using hands and feet until 'one man' is reached.

(6) A 'perfect' decimal system with a base of ten and separate words for one to ten. This is referred to as the 'Austronesian type', and is described as relatively modern and imported, although 'the words used are Old Austronesian and the languages remain Papuan' (Galis 1960:150). This appears to be another case of the borrowing of a complete set of numeral terms.

The base five-twenty system is described as the most widespread, and the body counting system as 'probably the most primitive' (Galis 1960:150). Galis also makes the observation that people are frequently familiar with more than one system.

A survey of the counting systems of the whole of what was then the Territory of Papua and New Guinea was made by Wolfers, and in his publications (1969, 1971, 1972) a number of basic types are distinguished. Several tallying devices are described where sticks, knots or marks represent various items of importance. Included with the tallying devices are the body counting systems, for example that of the Telefomin, and counting on the fingers and toes. A detailed account of the parts of the body used in the Kewa system is given. Different numeral systems are classified according to their base. These included bases of two, e.g. Kiwai; three, e.g. Bine; five-twenty, e.g. Wedau; and following Ray, 'perfect' and 'imperfect' decimal systems. The five-twenty systems sometimes have a word for ten, for example Suau, and are sometimes built up from a base two system, for example Kamano. Some other bases are also described.

Wolfers distinguishes rather carefully between systems which have a base and those which have a modulus, depending on whether or not a completed total is 'carried'. It appears, for example, that some users of body systems can readily assign numbers higher than the base to their correct position in the body sequence, thus mentally carrying the base, whereas others need bodies to be physically present to be able to do this, indicating that the system has a modulus. However, Wolfers' distinction does not appear to be very clear-cut or very useful. It seems likely that informants differed in their familiarity with the systems they were describing, which may have accounted for some of the distinction. In the present study, the word 'base' is used in both these situations, and indicates any number which acts as a grouping total. Where necessary, further description indicates whether progressive powers of the base are used or whether it involves merely addition. For example, a system which progresses 1, 2, 2 + 1, 2 + 2, 2 + 2 + 1, etc. is described as a base two system, although it is clearly not the same as a binary system where powers of the base, 2 squared, 2 to the power of three, etc. are used.

Some interesting examples are given by Wolfers (1972) of systems which do use progressive powers of a base, although the powers of ten of the Central Papuan coastal region reported by Ray are not mentioned. The Huli of the Southern Highlands are described as having a base of 15, not derived from body counting (but see Cheetham 1978), and proceeding as far as the base squared ( $15 \times 15 = 225$ ). The Gembadi and Semariji of the Trans-Fly area are described as employing a base six system for counting yams where progressive powers of six are employed. Two men carry three yams each to make a unit pile of six. This is repeated six times to make one *peta*, and the series continues from here:

$$\begin{array}{lll}
 6 \times 6 & (6 \times 6 = 36) & = 1 \text{ } \textit{peta} \\
 6 \times \textit{peta} & (6 \times 6 \times 6 = 216) & = 1 \text{ } \textit{tarumba} \\
 6 \times \textit{tarumba} & (6 \times 6 \times 6 \times 6 = 1,296) & = 1 \text{ } \textit{dameno}
 \end{array}$$

Williams (1936:226), who originally documented this system, notes that there is a practical basis for counting out such a large number. One *dameno* is considered to be an adequate quantity to provide sufficient planting material for the following season, as well as being a public demonstration of gardening prowess.

In Wolfers' account of the unusual base three system of the Bine of Western Province he states (1972:218): 'There are a few systems with numbers that are wholly abstract with bases not anatomically derived' and gives the Bine system as an example of this:

- 1 *iepa*
  - 2 *neneni*
  - 3 *nesae*
  - 4 *nesae iepa*
  - 5 *nesae neneni*
  - 6 *nesae nesae*
  - 7 *nesae nesae iepa*
- etc.

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However, this conflicts with Ray's data from 1898. Using the name Kunini, which is the main Bine village, he recorded the system as follows:

- 1 *iepa*
- 2 *neneni*
- 3 *nesae*
- 4 *neneni neneni*
- 5 *imegube* (hand)
- 6 *matemate* (wrist)
- 7 *nawenawe* (elbow)

and thence to a body counting series (Ray 1907:229). A possible explanation for this is that the body element has dropped out of use, probably due to the adoption of English base ten numerals, and only the three original numeral words have been retained.

Wolfers notes that the same group of people may use different systems for different purposes. An example comes from the Austronesian-speaking people of the Duke of York Islands, where people normally count by tens, but count coconuts, taro and yams by fours, and shell money by sixties. He also comments that many groups now employ the decimal system with English or Tok Pisin words, or occasionally translated vernacular versions, for most non-traditional purposes.

The most recent reviews of counting in Papua New Guinea are by Laycock (1975) and Lancy (1977). Laycock reviews previous accounts of the various systems and provides some new data from the Sepik and other areas. Body tally systems from ten areas are compared. He also describes the Buin system, a decimal series which has different sets of number words according to the class of noun qualified. The Buin language has words for '1,000' (*kukurei*) and '10,000' (*taarina*), giving it one of the most extensive counting systems described for Papua New Guinea in spite of the fact that it is one of the non-Austronesian languages, which are not normally noted for the extent of their numeral series. It would appear that the influence of neighbouring Austronesian languages is involved here, and as noted in the introduction, Laycock comments on the variety of counting methods which may be found in closely related languages.

Lancy (1977) has unpublished data at his disposal which are said to constitute a representative sample from all the different provinces of Papua New Guinea, even though the percentage of the total number of languages in the country (about 30%) is fairly small. He classifies the counting systems into four basic types, and the approximate distribution of each type is indicated. Lancy's classification is as follows:

Type I constitutes systems using body parts as tallies. These systems are found in the Southern Highlands, West Sepik and Madang Provinces. (Enga could also be added.)

Type II systems employ named sets of objects of fixed size, for example the Kilenge group of four coconuts, or tallies of objects, for example the bundle of sticks described for the traditional Kiwai system. In addition there are only a small number of numeral words. The occurrence of type II systems without the use of additional systems is said to be characteristic of Western, Gulf and West Sepik Provinces.

Type III systems are described as 'true' counting systems, and usually have bases of five and twenty, employing the fingers and toes as aids. They are typical of Morobe, East Sepik, Eastern and Western Highlands, Northern, Milne Bay and New Ireland Provinces. This conflicts slightly with Wolfers' classification, where such systems are grouped with other types of tallying.

Type IV systems have a base of ten and employ no body parts, but use several discrete number words (that is, they include both the 'imperfect' and 'perfect' decimal systems). They are said to be typical of Austronesian languages of the New Guinea islands and East Papuan region. (The Central Papuan coast could also be added.) Some of the series described for Manus display several powers of the base ten, as does the Buin system described above.

Lancy, like Wolfers, notes that different systems may be used in the same society for different purposes, and he gives two examples from the North Solomons Province. The Buin, who normally use a type IV system, use a type I system for measuring shell money and on Petats Island, where a type IV system is also normally used, a type II system is used for counting coconuts. (This system also has parallels in the Morobe data.) He notes that in most of Papua New Guinea it appears that Tok Pisin or English numbers are fast replacing the indigenous systems. Where traditional systems are retained, they tend to be of type IV.

The above surveys provide a good introduction to the types of counting system in Papua New Guinea and adjacent areas, and a remarkable variety of systems emerges. As well as tallying devices and body counting systems, numerical bases of two, three, four, five, six, eight, ten, fifteen, twenty and sixty are described.

### 1.2.3.2 ETHNOGRAPHIC STUDIES

In addition to general surveys, a number of more specific studies of counting and numeration in various societies give useful insights into the way counting takes place. A mere statement of the words used in counting gives little indication of the importance attached to counting and number in that society, and some in-depth studies, which have only relatively recently been carried out, remedy this deficiency to some extent. Kettenis (1978) notes that most Kilenge are confused by their traditional counting system and that Tok Pisin numerals are more commonly used for most purposes. However, traditional systems of grouping taro in twos and breadfruit, coconuts or sewn sago leaves in fours are still widely used. Panoff (1970) also describing a New Britain society, the Maenge, likewise noted that only a few old people were fully familiar with the traditional method of counting. Thune (1978) comments on how little the potential of their counting system is utilised by the Loboda, even for traditional purposes.

By contrast, Pospisil (1963, 1978) reports that the Kapauku of Irian Jaya have many and frequent uses for counting and notes (1978:94): 'people show a peculiar obsession for numbers and a craving for counting'.

The Kapauku have a decimal system as far as the base of 60, with higher units of 600 and 3,600. The similarity of this method of numeration to that of the Ancient Babylonians (see Price 1961)

prompted Price and Pospisil (1966) to describe the Kapauku system as a possible 'survival' in New Guinea of this feature of Babylonian culture. Bowers and Lepi were not convinced, and in a somewhat scornful criticism commented (1975:322):

We deplore the racist implications of Price and Pospisil's fanciful effort to derive Kapauku numeration from Babylonia and feel that a better understanding of the Kapauku system could be obtained by examining counting in its present context among the Kapauku and their neighbours.

Pospisil and Price defended their position (1976:382), pointing out evidence for the borrowing of numeral sets in the Kapauku language, but the last word remained with Bowers (1977) who systematically challenged the validity of their arguments.

Like the Kapauku, the Huli of the Southern Highlands are described as having an almost obsessive preoccupation with counting (Cheetham 1978:24). He described how seedlings of a newly introduced plant or ducklings on a pond would be counted daily, even by children who appeared too young to go to school. He elaborates:

The Huli are very conscious of how much they possess, and it is therefore not surprising that they place great importance on counting. Compensation claims, too are a very frequent occurrence, and these involve marking a price to be paid back.

The Huli system has a base of 15 (Wolfers 1972), but Cheetham notes that the last three numerals of the series, 13, 14 and 15, are also the words for body parts, even though these body parts are not referred to when counting, and the words now appear to be true numerals. Cheetham conjectures that the following development may have taken place. Formerly, counting took place on the fingers of one hand with six indicated by placing the completed hand on the chest. This was repeated on the other side to give the original base of twelve. At some time in the past, the base twelve system was expanded to one with a base of fifteen by the incorporation of the three body counting elements. Today, multiples of fifteen are used in counting up to *ngui ngui* 'fifteen fifteens' and occasionally beyond this when counting pigs. However, expressing numbers intermediate between the multiples of fifteen is quite cumbersome, and the decimal system is reported to be gaining ground.

Franklin and Franklin (1962) describe the Kewa counting system in use. In addition to a body tallying series, there is also a base four system which uses the fingers of the hands without the thumbs. The body system is only used for specific purposes such as calendar reckoning, when points on a cycle of ceremonies are determined, and informants generally could not give a body-part equivalent of a base four number (1962:189). A variation on this system is described by Pumuye (1975), who also gives a detailed account of the Kewa calendar (1978). Biersack (1968) gives an account of the counting system of the Paiela of Enga Province, and attempts to explain why the body is used in counting in terms of the function of abstraction in the Paiela language. This theme is later ingeniously developed (1980, 1982) taking into account the perspective of cybernetics and information theory. Strathern (1977) gives an account of the mathematics of the *moka* ceremonies of the Western Highlands, and further details appear in Lancy and Strathern (1981). The counting system of the Upper Kaugel valley is described by Bowers and Lepi (1975). These important studies will be referred to again in section 6, where the significance of the cultural context of counting is examined.

Some other studies look at specialised aspects of counting in individual cultures. Fillery (1969) looks at the Kuman counting system from the point of view of a primary teacher in the Chimbu Province and considers implications for the teaching of mathematics in the area. May and Loeweke

(1967) use Fasu number concepts as a starting point for educational materials dealing with the introduced decimal money system. The writer (Smith 1978) observed that although the Kiwai traditionally used a simple base two system of counting, number markers in the grammar are unusually complex. Saxe (1979, 1980, 1981) examines the Oksapmin body counting system from a cross-cultural point of view. His 1979 paper compares the acquisition of number by children in Oksapmin and America. He concludes that in both cultures there is an imitative, pre-quantitative use of counting before the child coordinates progressive summation with the recitation of numerals words, and that the development of this coordination involves similar psycholinguistic processes.

### 1.3 PROSPECTS FOR FURTHER STUDY

The Indigenous Mathematics Project has given a considerable stimulus to studies of counting and other cognitive phenomena in Papua New Guinea, and it is likely that further ethnographic studies in the country will devote some attention to these areas.

The study of traditional counting practices is now part of the grade 7 mathematics syllabus in Papua New Guinea's provincial high schools (Britt 1981) and students are encouraged to record counting systems they are familiar with from their own areas. However, there seems to have been no systematic attempt to collect these and make them generally available. It is hoped that more data will become available in the future, from this and other sources, to allow a comprehensive survey of all the counting systems of Papua New Guinea to be made. In addition, the relationship between traditional counting methods and subsequent performance in primary school mathematics and other cognitive tasks has not been fully developed, and would be a fruitful area for further research.

## 2. THE MOROBE PROVINCE, ITS PEOPLE AND LANGUAGES

### 2.0 INTRODUCTION

This section introduces the Morobe Province and some of its cultural, geographical and political features. The first section looks at its landscape, population and communications, and this is followed by a consideration of the cultures of Morobe as described in ethnographic studies. The second section looks at the languages of the province; how the complex linguistic situation was gradually deciphered to yield the latest classification. Finally, some other linguistic considerations, such as the effects of multilingualism, the role of lingua francas and the future of small language groups, are discussed.

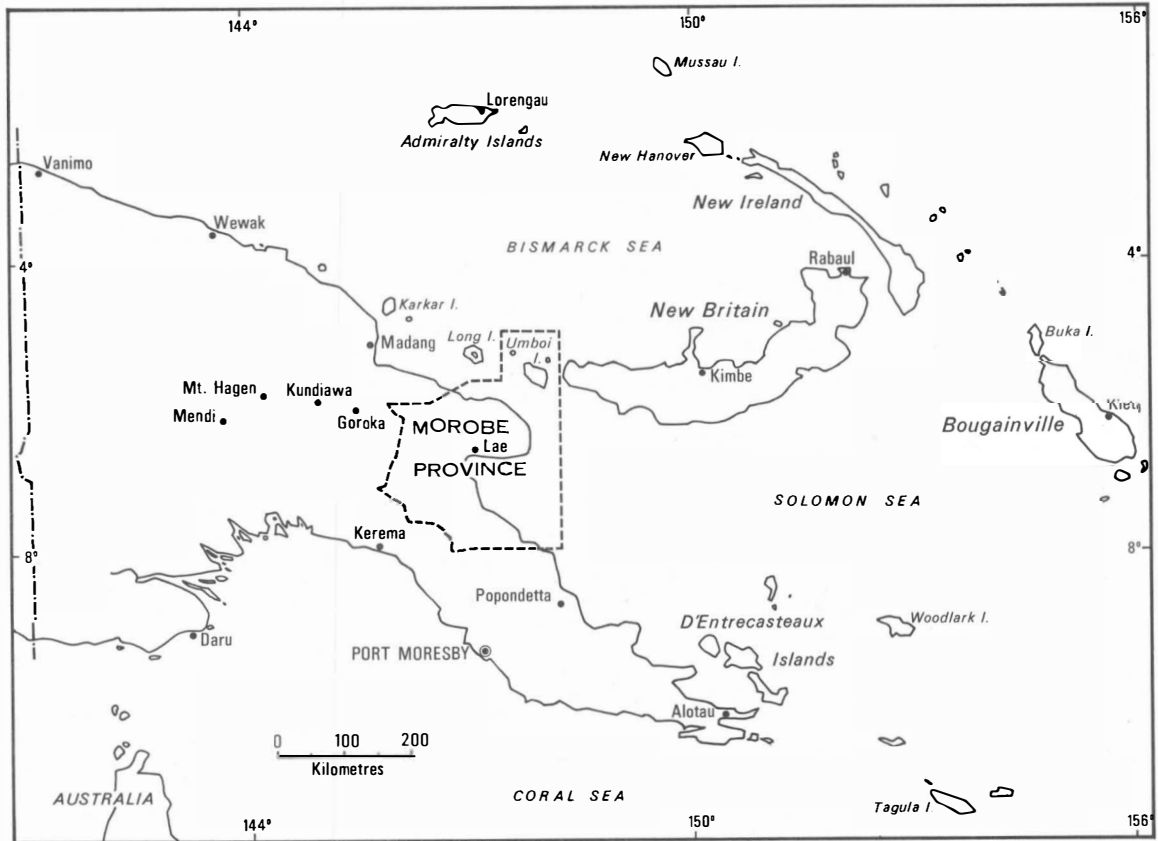
### 2.1 MOROBE PROVINCE AND ITS PEOPLE

#### 2.1.1 GEOGRAPHICAL AND POLITICAL FEATURES

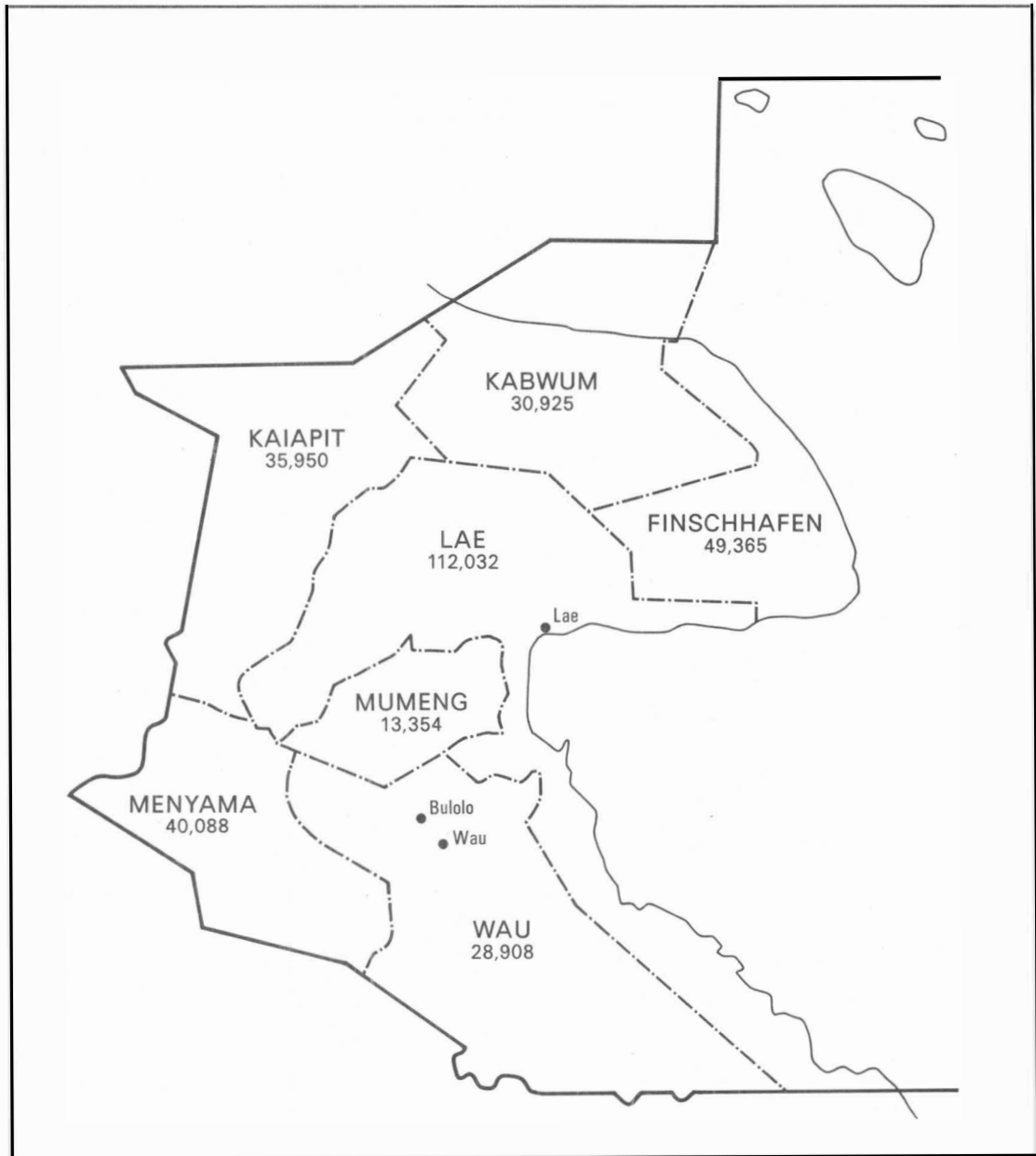
Papua New Guinea is divided into 19 provinces, formerly known as districts. The Morobe Province is the largest in population (310,526 according to the 1980 census), and one of the largest in land area (34,500 square km). It is also one of the most diverse in geographical features, containing within its boundaries coral reefs and islets, volcanic islands, lowland grassland and forest, wide river valleys, mountain forest, spectacular limestone gorges and peaks of over 4,000 metres. The broad Markham valley divides the province roughly down the middle. To the north-east of this lies the Huon Peninsula, with its precipitous Finisterre and Saruwaged Ranges, and off the east coast of the

peninsula lie the coral and volcanic islands of the Siassi District. To the south-west of the Markham lie the Bowutu, Kratke and Herzog Ranges, the Bulolo, Wau and Garaina Valleys, and the densely populated Aseki and Menyamyia area around the Ekuti Dividing Range. The province is divided into seven districts, formerly known as sub-districts. Map 2 shows these districts with their population figures from the 1980 census.

Five other provinces in mainland Papua New Guinea have land borders with Morobe. They are the Madang, Eastern Highlands, Central, Gulf and Northern Provinces (see Map 1). In addition there is a sea boundary with West New Britain running through the Dampier Strait. The land borders are somewhat arbitrary dividing lines, drawn by previous colonial administrations, and do not correspond to natural geographical or cultural boundaries. The Umboi and Siassi Islands were formerly part of West New Britain, but are now part of Morobe in spite of separation from the mainland by the Vitiaz Strait and close cultural ties with West New Britain.



MAP 1: PAPUA NEW GUINEA SHOWING THE MOROBE PROVINCE



MAP 2: DISTRICTS OF MOROBE PROVINCE AND THEIR POPULATION



Communications within the province have improved enormously in the last 30 years, but still present a certain amount of difficulty. All-weather roads run from Lae up the Markham Valley and to Mumeng, Bulolo, Wau and Upper Watut. In addition, there is seasonal access by road to Aseki and Menyamya from Bulolo; to Boana on the southern slopes of the Huon Peninsula; to Wagau from Mumeng along the Snake River Valley; and to a number of villages close to main roads. Otherwise access to villages is by air, water or bush walking track. There are a large number of small airstrips serviced by third level airlines, although many of these are closed periodically due to adverse weather conditions. Coastal villages usually have their own boat or access to commercial shipping services, while canoe transport is used in the lower reaches of the major rivers. Most villages are within three days walk of a road, an airstrip or a coastal port.

Although there were sporadic visits by earlier explorers and traders, European influence in the area really began in the 1880s. North-East New Guinea and neighbouring islands were declared a German Protectorate in 1884, but it was a trading company, the Deutsch-Neu-Guinea Kompanie, which assumed responsibility for its administration from Finschhafen the following year. A short time later, the Neuendettelsau Lutheran Mission established stations at Simbang and Sattelberg, which are also in the Finschhafen area. Responsibility for the territory's administration returned to the German government in 1899. The name 'Morobe' comes from the Morobe Patrol Post some 130km south-east of Lae. This border post was established by the German administration early in the 20th century as the nearest harbour to the Australian territory, and it later became the headquarters of the district. During the First World War, in 1914, the post was taken over by Australia. On patrols from Morobe in the 1920s, the rich goldfields of the Wau and Bulolo areas were discovered, and the district headquarters were moved to Salamaua, which was the nearest port to the goldfields. Salamaua, however, was not suitable for the establishment of a large aerodrome, and one was built instead near the mouth of the Markham River at Lae. There followed considerable debate about the suitability of the respective sites to be the major centre (Robson 1932), but eventually the administration headquarters were moved to their present location at Lae after World War II.

Today Lae is the largest industrial centre in Papua New Guinea, and its population of over 60,000 constitutes about 20% of the total population of the province. The city's population includes a considerable number of expatriates (7%) and a fairly large though indeterminate proportion of Papua New Guineans from other provinces. Migration from the Highlands provinces in particular has been facilitated in recent years by improvements in the Highlands Highway road network. In addition, many Morobeans from all districts leave their villages for varying lengths of time to come to Lae to find employment or to visit relatives.

The city of Lae is the major source of employment in the area, and is also a centre where health and education facilities are sought. Mission activity is strong in the province, and the greatest percentage of the population belong to the Lutheran Church, whose national headquarters are at Ampo, in Lae. Other churches also have supporters, especially the Catholics, Anglicans, United Church and Seventh Day Adventists, as well as a variety of smaller missions. Following the country's independence in 1975, moves were made towards decentralisation, and the Morobe Province attained limited political autonomy in 1980 with the establishment of an elected provincial government.

### 2.1.2 ETHNOGRAPHIC STUDIES

The indigenous cultures of the province show a good deal of diversity, from the maritime traders of Siassi to the mountain dwellers of the Menyamya area. It is doubtful whether a distinctive

'Morobe Culture' exists, as provincial boundaries cut through related cultural groups, but there may be certain art styles or social features which will in the future come to be associated with the name 'Morobe'. The earliest ethnographic accounts are probably those of Finsch (1882, 1887) who described the people and houses of the Finschhafen area. Other descriptions of this area were provided by Schellong (1889, 1891), while Bonaparte (1888) commented on the impressive sailing canoes built by the Tami people. The first detailed ethnographic account was Neuhauss's three-volume work *Deutsch-Neu-Guinea* (1911), which gives much useful information about aspects of Morobe cultures in the early stages of European contact, as well as data from further west along the north New Guinea coast. Chapters in this work by Zahn on the Yabim, Keysser on the inland (kai) people, Lehner on the Bukaua, Bamler on the Tami and Stolz on the Sialum give valuable insights into traditional life in these societies. Keysser (1912) added further observations on the life of the inland people of the Huon Peninsula, while Andexer (1914) described life in the Watut area.

In later pre-World War II studies, Groves (1934) gave an account of the inhabitants of Sio Island off the north coast of the Huon Peninsula, while the Upper Watut area was investigated by Blackwood (1939, 1940, 1978). The government officer Vial described mortuary practices among the Buang (1936), the ceremonial life of the Wantoat (1937) and various aspects of demography (1938) and general features (1943) of Huon Peninsula life. Lehner (1935) wrote a description of male initiation into the *balum* cult, based on his studies of the Bukaua.

During the Second World War, Lae and most of the Morobe Province were occupied by Japanese forces, although an important Allied base was maintained at Wau. Heavy fighting took place before Australian control was re-established, and the war had a profound effect on the indigenous population, who had no choice but to be involved in the conflict. Their help was successively recruited by both sides, and in addition to casualties resulting from this, many were traumatised by the sheer scale of the military activity. Various Allied 'coast watchers' remained behind enemy lines during the occupation, and interesting accounts of this period may be found in Freund (1946), Ryan (1959) and Robinson (1972).

Since the war, a number of detailed anthropological studies have been carried out in the province. Hogbin (1946, 1946-1947, 1947d, 1947a, 1947b, 1947c) described a variety of aspects of the life of the people of the Huon Gulf, especially at Busama village. Much of his work is summarised in *Transformation Scene* (Hogbin 1951). Hogbin first investigated the area during the war, and change is naturally a focus of his attention. However, in spite of an acceleration in the rate of change brought about by the war, Hogbin notes that some of the agents of change had already been present for some time (1951:1):

Europeans entered the area before 1900, and for two generations the old way of life was being steadily modified. Government officers stamped out raiding and introduced a different set of laws; missionaries preached the Christian religion and established a church and a school; labour recruiters took the young men away to work in distant places; and traders operated stores in neighbouring towns where cash earned as wages could be exchanged for tools more effective than those made of stone and volcanic glass.

The anthropologist Hans Fischer made a study of the Lower Watut area (1963) and of the Yagwoia people of the central ranges (1968). The latter people belong to a group which straddles the borders between Morobe, Eastern Highlands and Gulf Provinces, formerly known as the Kukukuku. However, Lloyd (1973:97) notes that the term is considered offensive by many people from the area and suggests that the term 'Angan' be substituted. There are several popular accounts of early contact

with this group of people, for example Simpson (1965) and Sinclair (1966), often focusing on their legendary aggressive tendencies. Read (1950) described the political system of the Ngarawapum of the Upper Markham Valley, while Schmitz (1955, 1958, 1960a, 1960b) made a number of studies of Huon Peninsula cultures, and wrote a detailed account of the art styles and religious practices of the Wantoat people (1963). The Buang of the Mumeng area have been investigated by Girard (1968-1969) and also by Hooley (1970), whose work was mainly linguistic, but contains much information of general anthropological interest. Art styles of the Tami have been described by Bodrogi (1955, 1956, 1961) and Coote (1977) and the musical instruments of the Markham area by K. Holzknacht (1956).

The history of Lae and surrounding villages has been discussed in Hogbin (1951), Robinson (1972), Willis (1972, 1974) and Sack (1976). Traditional trading networks in the province have received considerable attention, and accounts appear in Hogbin (1947b) and Harding (1967, 1970). A detailed account of the social organisation of the Siassi Islanders can be found in Freedman (1967, 1970). It is encouraging to note that some recent social research has been conducted by Morobeans themselves, for example Gipey (1978) and Wamma (1979). Research of a purely linguistic nature will be discussed in the following section.

## 2.2 LANGUAGES OF MOROBE PROVINCE

### 2.2.1 RESEARCH INTO MOROBE LANGUAGES

Like many other parts of Papua New Guinea, the Morobe Province is linguistically diverse, with a large number of languages spoken by relatively small populations. Linguistic research in Morobe is only about 100 years old, and there is still an enormous amount of work to be done on the languages, although a reasonably clear picture of their family relationships is gradually emerging. There are just over 100 indigenous languages in the province, two of which were adopted as *lingua francas* by the Lutheran Mission and became well-known in certain areas. Another *lingua franca*, Melanesian Pidgin or Tok Pisin, is probably the most widely spoken language, while English has been adopted as the language of nearly all formal education. Multilingualism is the norm in most communities.

Descriptive work on Morobe languages began in the 1880s and was carried out mainly by early missionaries. Shortly after the Lutheran Mission arrived in the Finschhafen area in 1886, Flierl and Tremel established a station on the coast at Simbang, where the Yabim language was spoken. Schellong of the New Guinea Company produced a list of kinship terms for this language (1889) followed by a rather inaccurate dictionary (1890). Later, the missionaries Vetter and Zahn, and Dr Dempwolff of the University of Hamburg also worked on the Yabim language, while the journalist Zoller (1890, 1891) produced word lists from a large number of languages in the area. Other word lists were produced by Schmidt (1900-1902). In 1892 the mission moved inland to Sattelberg, and the language of this area, now known as Kâte, was investigated by the missionaries Flierl, Keysser and Pilhofer, assisted by Dempwolff (Renck 1977a). Later work was carried out by Neuhaus (1911) and Keysser (1911), who worked on a number of languages spoken by a group then known as the *kai* people. The term *kai*, meaning 'forest' in the Tami language, was used loosely by Neuhaus to distinguish inland people from those on the coast, but in Keysser's case it was used to refer to Kâte speakers (McElhanon 1970b:1183). Schmidt (1926) reviewed work around the Finschhafen area, and Pilhofer (1927) produced further material on Kâte grammar. The adoption of Yabim and Kâte as *lingua francas* by the mission led to a concentration of effort on these two

languages and a neglect of others for many years. However, a study of the Ono language spoken near Kalasa on the east coast of the Huon Peninsula was published by Wacke (1930-1931).

A major survey of the languages of the South-west Pacific by Capell (1954) added several more languages to the Morobe list, and Schmitz (1955) produced some further information in his survey of the Huon Peninsula area. A classification of non-Austronesian languages was attempted by Loukotka (1957) based on a somewhat cursory investigation of the available materials (McElhanon 1970b:1190). Salzner (1960) produced a language map of the Huon Peninsula area and classified the languages into seven groups, three non-Austronesian and four Austronesian, although there were many inaccuracies. Schmitz's 'Historische Probleme in Nordost-Neuguinea, Huon Halbinsel' (1960a) contains a linguistic survey of the area from Madang to Umboi including the Huon Peninsula, Finisterre Range and Markham Valley, but this also has many inaccuracies. Capell's revised survey (1962) added more languages, but also contains much unreliable information, including that drawn directly from Schmitz (1955). In 1963, Fischer published some work on the Lower Watut languages, while Sankoff (1968) compared languages of the Buang area with other Austronesian languages of the province in her study of multilingualism. A long-term study of the Adzera language of the Upper Markham Valley by K. Holzkecht remained in manuscript form for many years, but some publications later appeared (1973a, 1973b, 1973c).

In the late 1960s, the first serious attempt to produce a comprehensive and accurate language survey of the whole province using reliable data was made by Hooley and McElhanon and other linguists from the Summer Institute of Linguistics. McElhanon's 'Preliminary observations on Huon Peninsula languages' (1967) reviewed current knowledge of languages north of the Markham, and in 1970 Hooley and McElhanon's 'Languages of the Morobe District, New Guinea' appeared. For the first time a reasonably reliable classification of all the languages of the province was available, and a list of languages taken from the works of Capell, Schmitz and Salzner was compared with language names presented in this new classification.

In Hooley and McElhanon's 1970 classification, the position of the non-Austronesian languages of the Huon Peninsula was considerably clarified. Available data indicated the existence of two micro-phyla in this region, the Huon and Finisterre Micro-phyla. The former contained 22 languages grouped into five families and one stock-level isolate, and generally described the languages in the eastern half of the Huon Peninsula and Umboi Island. The Finisterre group of the western Huon Peninsula area included some languages spoken in the Madang Province, and consisted of 35 languages grouped into five families. Other non-Austronesian languages in other parts of the province are members of groups spoken mainly in other provinces: the Binandere Stock located mainly in Northern Province; the Kunimaipa Family, mainly in Central Province; the East New Guinea Highlands Stock, mainly in the Eastern Highlands Province and the Anga Stock, found also in the Gulf and Eastern Highlands Provinces, but well represented in Morobe also. The 38 Austronesian languages of the province were classified into four families, the Azera, Buang, Jabem and Siassi Families, with a remainder of three unclassified languages. The members of the Buang Family were termed 'groups', as their status as languages or dialects had not been confirmed.

The position of the Austronesian languages was further clarified in Hooley's 'Austronesian languages of the Morobe District, Papua New Guinea' (1971). More comprehensive cognate percentages were now available, but Hooley notes the difficulty of deciding the cut-off point for determining where a dialect ends and a language begins. He concludes (1971:91):

The best solution ... is to examine the data themselves to see if there are natural plausible groupings somewhere around those suggested by Swadesh. That is we are applying a functional rather than a formal criterion.

For the 1971 material, 77% of apparent cognates on the basic vocabulary list is used as the cut-off point for dialects, and 28% for languages of a family. Hooley's 1971 conclusions are basically similar to Hooley and McElhanon's 1970 classification except that the 'Jabem' and 'Siassi' Families are now combined as the 'Siasi' Family. A fourth family consisting of the Hote and Yamap languages is suggested as a link between the Buang and Siasi Families. The Buang Family is reduced from nine 'groups' to six languages.

Hooley's classification is clearly at variance with that of Capell's 1969 survey, where Austronesian languages of the area are divided into AN1 and AN2 groups according to certain grammatical features. According to Capell, AN1 languages typically have the word order subject-verb-object, whereas AN2 languages are typically subject-object-verb. Other typical AN2 features are the placing of the demonstrative after the noun in noun phrases and the absence or unimportance of dual and trial forms. Hooley attacks Capell's position in 'Austronesian languages of the Morobe Province' (1976), a further refinement of the position of the group. In noting that there are a number of discrepancies in Capell's classification, he states (1976:337):

Since these discrepancies do relate to his principal identifying criterion, his whole theory is called into serious question. At least for the Morobe Province, the classification of the AN languages into AN1 and AN2 groups is inconsistent and not particularly helpful. At the present state of our knowledge, therefore, a classification based on lexicostatistical studies would seem to be more enlightening.

Hooley's 1976 classification is basically similar to that of 1971 except that two previously unclassified languages, Yalu and Lae, are added to the Adzera Family. This family is now subdivided into the Lower Watut, Markham and Musom Sub-families. The Buang Family is further modified, the six languages of 1971 now being reduced to five. More recent work on Morobe Austronesian languages has been carried out by Lincoln (1976), Bradshaw (1977, 1978a, 1978b), S. Holzknacht (forthcoming), Siegel (1984) and Siegel and Kamake (n.d.), while their position within the Austronesian group has been discussed by Grace (1961, 1968), Dyen (1965), Milke (1965), Chowning (1970, 1973), Capell (1976a) and Pawley (1978). Teams from the Summer Institute of Linguistics have been collecting data in the Mumeng, Buang, Hote and Iwal (Kaiwa) areas.

The non-Austronesian languages of Morobe are all included in what is now known as the Trans-New Guinea Phylum (Wurm 1975:299). The position of those north of the Markham was further refined in McElhanon's 'The north-eastern areas of the Trans-New Guinea Phylum' (1975). Here McElhanon combines what were previously classified as the Huon and Finisterre Micro-phyla into a single stock, the Finisterre-Huon Stock. This stock consisted of nine families plus Kovai, which remained as a family-level isolate. Four of these families are located wholly or mainly in the Madang and Eastern Highlands Provinces. Family relationships and grammatical details of non-Austronesian languages south of the Markham have also received attention. The Binanderean Family was investigated by Wilson (1969), the Angan Family by Lloyd (1973) and the Goilalan or Kunimaipen Family by Dutton (1975). The Waffa language is the single Morobe representative of the Eastern Family of the East New Guinea Highlands Stock described by McKaughan (1973). Finally the Wasembo language of the Markham headwaters was considered to be a phylum-level isolate, but McElhanon (1975:902) gives evidence to suggest its inclusion in the Madang and Adelbert Range

Sub-phylum of the Trans-New Guinea Phylum. Summer Institute of Linguistics field workers are continuing investigations into 17 of the non-Austronesian languages of the province.

### 2.2.2 THE LATEST CLASSIFICATION

The language classification adopted for the purposes of this study is the latest and most comprehensive yet produced (McElhanon 1984). In this classification, the position of the Austronesian languages takes into account recent studies of Chowning (1970) and Z'graggen (1976), and the Siasi Family languages of Morobe now appear in both the Vitiazan and Bariai Sub-families. McElhanon acknowledges that the classification is as yet tentative, and it will no doubt be modified as more linguistic evidence comes to light.

Two additions have been made to McElhanon's list here. Firstly the Susuami language of the Upper Watut Valley is provisionally included with the Angan Family. This language is only spoken by a few dozen people, and was apparently not recorded until investigated by the writer in the course of field work in the area (Smith forthcoming). Secondly, although McElhanon tentatively includes the village of Koripon in the Isan language area, its status is not certain in the absence of adequate information. Counting data obtained at Koripon were quite unlike those of other villages in the same language area, and thus it is here given a separate status.

A full classification appears below. Population figures, based on censuses carried out between 1969 and 1976, are also given for each group. Where a language or family is also spoken in other provinces, the figures refer only to the Morobe population.

#### PART ONE - AUSTRONESIAN LANGUAGES (75,015)

A. SIASI FAMILY	(29,351)	BARIAI SUB-FAMILY	(2,632)
VITIAZAN SUB-FAMILY	(26,719)	16. Gitua	(483)
HUON GULF GROUP	(17,243)	17. Mutu	(2,149)
1. Bukauac	(9,694)	B. ADZERA FAMILY	(22,506)
2. Kaiwa	(923)	LOWER WATUT	
3. Kela	(2,750)	SUB-FAMILY	(1,407)
4. Labu	(1,522)	18. Dangal	(365)
5. Lae	(<10)	19. Maralango	(171)
6. Numbami	(270)	20. Silisili	(871)
7. Yabim	(2,084)	MARKHAM SUB-FAMILY	(16,927)
ISLAND GROUP	(9,655)	21. Adzera	(15,382)
8. Barim	(469)	22. Ngariawan	(367)
9. Lokep	(639)	23. Sirasira	(601)
10. Malasanga	(435)	24. Sukurum	(577)
11. Mangap	(2,294)	25. Unank	(no figures)
12. Nenaya	(315)	26. Wampar	(5,085)
13. Roinji	(114)	27. Wampur	(274)
14. Sio	(1,774)		
15. Tami	(904)		

BUSU SUB-FAMILY	(1,281)	34. Mapos	(6,666)
28. Duwet	(363)	35. Mumeng	(9,186)
29. Musom	(231)	36. Piu	(130)
30. Sirak	(145)	37. Vehes	(100)
31. Yalu	(542)		
C. BUANG FAMILY	(18,094)	D. HOTE FAMILY	(3,064)
32. Kapin	(1,841)	38. Hote	(1,310)
33. Manga	(2,688)	39. Misim	(251)
		40. Yamap	(1,310)

## PART TWO - NON-AUSTRONESIAN LANGUAGES (174,468)

E. ISOLATE		71. Numanggang	(2,274)
41. Kovai	(3,216)	72. Sauk	(605)
F. EASTERN HUON FAMILY	(24,836)	73. Urii	(2,470)
42. Dedua	(4,743)	I. WANTOAT FAMILY	(9,815)
43. Kâte	(6,125)	74. Bam	(393)
44. Kosorong	(1,563)	75. Irumu	(1,614)
45. Kube	(5,864)	76. Wantoat	(7,316)
46. Mape	(5,117)	77. Yagawak	(492)
47. Migabac	(1,050)	J. GUSAP-MOT FAMILY	(550)
48. Momare	(374)	78. Ufim	(550)
49. Sene	(>10)	K. YUPNA FAMILY	(216)
G. WESTERN HUON FAMILY	(56,943)	79. Bonkiman	(54)
50. Burum	(4,086)	80. Isan	(100)
51. Kinalakna	(219)	80a. Koripon	(62)
52. Komba	(12,235)	L. URUWA FAMILY	(2,547)
53. Kumukio	(552)	81. Komutu	(510)
54. Mesem	(1,750)	82. Sakam	(510)
55. Nabak	(9,505)	83. Som	(88)
56. Nomu	(807)	84. Weliki	(127+)
57. Ono	(4,550)	85. Yau	(1,312)
58. Selepet	(6,353)	M. PIHOM STOCK	(464)
59. Sialum	(641)	86. Wasembo	(464)
60. Timbe	(11,279)	N. EASTERN FAMILY, EAST N.G.	
61. Tobo	(2,888)	HIGHLANDS STOCK	(1,000)
62. Yaknge	(2,078)	87. Waffa	(1,000)
H. ERAP FAMILY	(12,793)	O. ANGAN FAMILY	(42,077)
63. Finungwa	(469)	88. Agaataha	(1,003)
64. Gusan	(869)	89. Hamtai	(19,900)
65. Mamaa	(194)	90. Kamasa	(20+)
66. Munkip	(137)	91. Kawatsa	(30)
67. Nakama	(1,036)	92. Menya	(12,056)
68. Nek	(1,461)	93. Safeyoka	(3,120)
69. Nimi	(1,558)		
70. Nuk	(1,720)		

94.	Yagwoia	(6,098)	Q. BINANDEREAN FAMILY	(13,292)	
94a.	Susuami	(50?)	98.	Binandere	(312)
P. KUNIMAIPAN FAMILY		(6,719)	99.	Guhu-Samane	(6,289)
95.	Biangai	(1,261)	100.	Mawae	(943)
96.	Kunimaipa	(1,349)	101.	Suena	(2,272)
97.	Weri	(4,109)	102.	Yekora	(674)
			103.	Zia	(2,802)

### 2.3 OTHER LINGUISTIC CONSIDERATIONS

The listing above gives population figures for each language, but ignores the fact that most people speak more than one language, usually including at least one of the three lingua francas (Sankoff 1971, 1977). An in-depth sociolinguistic study of multilingualism in the Buang community by Sankoff (1968) indicates some of the functions of different languages in different contexts. The two mission lingua francas, Kâte and Yabim, are still spoken in a variety of language groups. Kâte was used by early missionaries mainly in inland areas of the Huon Peninsula, and further afield where non-Austronesian languages were spoken. Yabim was used mainly along the coast and in the Markham and Mumeng areas, but not all of the groups adopting it spoke Austronesian languages (Renck 1977a, 1977b, McElhanon 1979). In the early stages, both were successful, partly due to the unifying effect they had on congregations from linguistically different and traditionally hostile areas. Mission schools taught literacy in Kâte or Yabim, and most of the reading material which became available to the indigenous population was in these languages. Hence the languages came to have a certain amount of prestige. Later, as more vernacular translations appeared, and the Australian administration withdrew funding from all except English-medium schools, the languages declined in importance. However, funding may not have been the only reason for the decline. As McElhanon (1979:283) notes:

Far more important was the fact that nationals recognised that education in Kâte represented a 'dead-end road', and that at the end there was no economic advantage.

Today, Kâte seems to be more widely used and viable as a lingua franca than Yabim, whose use is largely confined to mission contexts, and there is a decline in the popularity of mission education in general.

Tok Pisin, on the other hand, appears to be gaining in influence, and is widely used at informal gatherings and in government and business contexts. Several varieties of Tok Pisin have been distinguished by Mühlhäusler (1975), and it seems that some of the prestige associated with speaking English can still be gained by using a variety of Tok Pisin which includes a sprinkling of phrases taken directly from English. These may or may not be comprehensible to the listener. English is the official language of education, and is a pre-requisite for the more attractive employment opportunities. It is widely used in many urban institutions, especially those where expatriates are employed. However, it seems that Tok Pisin is being increasingly used in schools, especially in lower primary grades, to provide supplementary instruction. Although German was the official administration language for approximately 30 years, the only vestiges apparent today are German words which have entered Tok Pisin, such as *beten* 'prayer', *rausim* 'expel', from the German *heraus*, and *popaia* 'miss', from the German *vorbei*.

In a multilingual situation, the future of small language groups would appear to be precarious (Laycock 1979:94). However, languages may persist because of their role in maintaining the identity



of a group. Grace (1975) points out some other factors leading to diversity rather than homogeneity, and Bradshaw (1978a:31) and Wamma (1979:79) discuss the use of vernaculars in excluding others from conversations. In spite of these considerations, it appears that the Lae language may already be extinct, while the Sene language has been so influenced by Kâte that its independent existence is threatened. A similar situation may obtain in the case of the Weliki language, which has been greatly influenced by Selepet and Timbe (McElhanon personal communication). The future of Kamasa, Kawacha and Susuami, all spoken in heterogeneous language communities and conforming to what Laycock (1979) describes as a 'swamp situation', likewise seems uncertain. Other languages with very few speakers such as Som may have a better chance of survival, as they are apparently spoken by all members of the single village community (Laycock's 'wash situation').

### 3. FIELDWORK PROCEDURES

#### 3.0 INTRODUCTION

As was seen in the last section, a considerable amount of work has been done on Morobe languages, and word lists compiled by other researchers were used as one source of data on counting systems. Other data assembled as part of this project were collected from informants in various parts of the province. This section gives some details of how and from whom data were elicited and recorded.

#### 3.1 INFORMANTS

The population of Morobe lives in villages and hamlets scattered throughout the province as well as in the small centres of population at district and mission headquarters and the large population centre at Lae. As noted in section 2, access to many of the rural areas presents considerable difficulty. However, an attempt was made to contact informants in the home language area wherever possible, as well as the more easily contacted city dwellers.

The most accessible informants are those living in Lae. The population of Lae is large and varied, comprising representatives of most if not all of the language groups of Morobe, as well as people from other provinces of Papua New Guinea and from other countries. The simplest method of obtaining information might appear to be to search out people from the various Morobe language groups living in Lae. However, such informants were often found to be unsuitable or unreliable. Many had been away from their rural villages for a long time, while still describing themselves as being from that place. In many cases the mother tongue was spoken little or not at all during this period away from the place of origin. The use of Tok Pisin in Lae is widespread. It is common even among speakers of the same language, and the vernacular may be reserved for use when outsiders are to be specifically excluded from conversations (Bradshaw 1978:31). In the urban situation, counting in particular tends not to be of the traditional kind, as people need to be familiar with and make use of Tok Pisin and English numbers to cope with the everyday world of wages, prices and fares. Thus, even if urban-based informants retain some knowledge of the traditional systems, it may be difficult for them to recall immediately and out of context when asked by an investigator. The search for information from city residents proved to be somewhat unproductive, and other sources were sought.

Students in high schools were considered as a source of information as they are from a number of different areas, are temporarily concentrated in one place and are thus easily available. Also, they do some work on traditional counting systems in Grade 7 of the mathematics syllabus and might be

expected to provide some useful data. In fact, high school students were found to be interested and willing informants, but the reliability of some of their information is open to question. Many students in Lae's high schools have been effectively excluded from much of their traditional culture since the beginning of their school days, usually at the age of seven or eight, and may have forgotten, or never have known, much about traditional counting methods. Boarding students are housed in dormitories where a variety of language areas are represented, and the normal medium of communication is English or Tok Pisin. Alternatively, day students live in the kind of urban situation referred to above. It was also difficult to dispel the idea among many students that the investigator wanted 'correct' answers only, and there was a tendency to copy systems from one another in an effort to produce the desired result. Some students simply stated that they did not know traditional counting words or methods and would have to ask older village people on their return home during school holidays. These limitations notwithstanding, some useful information was obtained from high school students at the Bugandi, Bumayong and Busu Provincial High Schools in Lae, and others outside Lae at Dregerhafen, Kaiapit and Siassi Provincial High Schools. This information was used as a check and for clarification of the meaning of some terms rather than a primary source of data.

### 3.2 COLLECTION OF DATA IN VILLAGES

The best informants were found to be those normally resident in the villages where a particular language is spoken. Hence a considerable effort was made to reach these villages, involving patrols by air, sea, road and foot into all districts of the province. In the villages, informants usually presented themselves willingly, and a small gift or payment was given. Some questions about language use in the area were asked, both to establish rapport and because multilingual situations are common in the province, and it was necessary to be sure exactly which language was being discussed. Occasionally information provided by villagers about language relationships in the area was quite different from linguists' published classifications, although, as Hooley notes (1971:85), this should be treated with caution in the absence of follow-up studies. Information about counting and numbers was then sought. If difficulties arose, prospective informants would usually call together some senior men who would provide the definitive information on the subject. Wherever possible, data were recorded in a group situation, where slips could immediately be corrected and clarification obtained. Although some excellent information was obtained from single informants, there was occasionally the suspicion that responses were given without sufficient attention to accuracy for the sole purposes of obtaining payment for the service. Extra information from different informants speaking the same language was obtained where possible, and there were often small discrepancies between accounts from different villages or dialects. On a number of occasions I was assisted by someone who was able to explain the purpose of my visit in a lingua franca such as Kâte or in the local vernacular, and this was helpful in avoiding misunderstanding. However, in such cases there was also a tendency for the translator to suggest answers to informants and thus reduce the reliability of the data. Elicitation was normally carried out in Tok Pisin, but occasionally through an interpreter. On several occasions a Tok Pisin-speaking informant would begin and later refer to an older man for clarification. This usually involved discussion in the vernacular followed by a translation for the investigator in Tok Pisin. The majority of informants were male, although checks with female informants did not reveal any perceptible differences. The basic information elicited consisted of all the numeral words the informant could give, plus methods of counting or tallying. On brief visits it was difficult to obtain much in-depth information about the use of counting in a culture, but where any extra information was forthcoming, this was recorded.

### 3.3 RECORDING INFORMANTS' RESPONSES.

Information in a wide variety of languages was given by informants in verbal form, and this was transcribed by the investigator. This presented something of a problem, as not all languages in the province have been investigated or alphabets devised for them. Thus a broad phonetic transcription was adopted for the purpose of recording most vernacular responses. A more narrow phonetic transcription was not attempted as it was not considered essential for the purposes of this study. Checks were later made with available published material. There are a number of languages where the phonology has been investigated and orthographies and grammars devised. In such cases, use was made of the alphabets available. Checks were also made against survey word lists, which usually include some number terms, and help was elicited from linguists working on Morobe languages during the period of this study. In particular, linguists from the Summer Institute of Linguistics provided a great deal of assistance by obtaining or checking data and providing insights from their knowledge of the language and culture of their study area. Some question sheets were sent out to Siassi and Dregerhafen Provincial High Schools, and the students wrote responses on their own. In some cases, Kâte, Yabim or other established orthographies were evidently adopted. In other cases idiosyncratic spelling was used, and this was checked with other informants.

Translation of vernacular terms presented some difficulty. A direct translation could usually be made of lower numerals, although the number 'one' in particular could sometimes take a variety of forms. Where higher numbers were represented by more complex circumlocution, it was sometimes difficult to obtain a literal translation of individual terms rather than a general translation of the whole term. For example, on one occasion informants from the Mapos language translated the expression *miran dadu sti* as 'twenty'. It appeared that there was more to this term than a simple numeral equivalent, but repeated attempts to elicit a more specific meaning of the morphemes failed. In cases such as this, information from linguists working on Morobe languages and published grammars and word lists were used for clarification where possible.

## 4. COUNTING METHODS USED IN MOROBE PROVINCE

### 4.0 INTRODUCTION

Data have been obtained from field investigation or secondary sources for all 105 Morobe languages except the Lae language, which now appears to be extinct. These data are assembled in Appendix A, together with comments on each language and counting system. In this section, the data are examined to see the variety of counting methods employed. In particular, the extent of the series of distinct lexical items representing numbers is investigated for each language. As noted in section 2, several classifications of counting systems in Papua New Guinea have already been devised, and reference is made to these in the present analysis of data. Finally, some other types of counting in Morobe are described.

### 4.1 CLASSIFICATION OF COUNTING SYSTEMS IN MOROBE LANGUAGES

A number of different types of counting procedure can be extracted from the data, and these types are summarised below.

Type A	Use of the body as a tally	(4.1.1)
Type B	Two numerals only	(4.1.2)

Type C	Two numerals plus hands and feet	(4.1.3)
Type D	Three numerals only	(4.1.4)
Type E	Three numerals plus hands and feet	(4.1.5)
Type F	Four numerals plus hands and feet	(4.1.6)
Type G	Numeral for ten	(4.1.7)
Type H	Numerals for ten and twenty	(4.1.8)

#### 4.1.1 TYPE A - THE USE OF THE BODY AS A TALLY

Although many Morobe languages have only a few numeral words and rely on the fingers and toes to tally higher numbers, there were no examples found of extensive body counting series similar to those described for some Central Highlands areas (Franklin and Franklin 1962, Saxe 1981, Biersack 1982) or inland Madang (Aufenanger 1938). Nor could any examples of body counting in Morobe be found in the literature. The nearest reported body system in a coastal area is that reported by Ray (1907:364) from the Musa area of the Northern (Oro) Province to the south-east of Morobe. The only example in the present Morobe data of the use of body parts other than hands and feet for tallying was the inclusion of the two nostrils by informants from the Sakam language in the Uruwa Family, spoken in the Western Saruwageds. After tallying to ten on the hands, the thumbs were successively placed on the two nostrils before tallying continued on the toes to a total of 22. Since only this isolated example was encountered, it can be safely stated that tallying on parts of the body other than the hands and feet plays a negligible role in the counting methods of Morobe.

#### 4.1.2 TYPE B - TWO NUMERALS ONLY

In this type of system there are only two numeral words and the hands and feet do not appear to be used in tallying. An example is the Austronesian Adzera language of the Markham Valley, in which counting proceeds as follows:

1	<i>bits</i>	one
2	<i>iruc</i>	two
3	<i>iruc da bits</i>	two and one
4	<i>iruc da iruc</i>	two and two
5	<i>iruc da iruc da bits</i>	two and two and one
6	<i>iruc da iruc da iruc</i>	two and two and two
	etc.	

This procedure can continue in the same way as long as necessary, but it is clearly too cumbersome to be useful for anything but small numbers. However, other means of indicating number are available to Adzera speakers, such as the use of named terms for groups of a specific number of objects. The term *nam wan*, for example, refers to 'a group of three bunches of bananas to be presented on certain ceremonial occasions' (S. Holzkecht personal communication).

Other Morobe languages for which a system of this type was described by informants are Ngariawan, Sirasira, and Sukurum, all of the Markham sub-family of the Adzera Family, and Bam and Yagawak of the Wantoat Family. The former family is Austronesian and the latter non-Austronesian, but all are spoken in a continuous area in the Upper Markham-Wantoat region.

## 4.1.3 TYPE C - TWO NUMERALS PLUS HANDS AND FEET

Like type B, this type of system has numeral words only for one and two. The term for three is a combination of the words for one and two, while the term for four is two and two, or two two. However, higher numbers can be indicated by tallying on the hands and feet. An example is the Menya language, which proceeds as follows:

1	<i>hankwona</i>	one
2	<i>hankwakwu</i>	two
3	<i>hankwakwu hankwe</i>	two one
4	<i>hankwakwi hankwakwi</i>	two two
5	<i>hipa hankwona</i>	hand one
10	<i>hipa ekwana</i>	hand all
20	<i>hipa suka ekwana</i>	hand leg all

A clear advantage of this system over the previous one is the ease with which a tally total of 20 can be reached. This total can then be used as a base for higher numbers. Informants in some languages classified as this type only tallied as far as ten on the hands, or repeated four sets of five 'hands' to reach a total of 20. These cases are included with this type as being basically similar in pattern.

Systems belonging to type C are found in the following languages: Roinji and Nengaya (some informants) of the Siassi Family; Dangal, Maralango, Silisili, Wampar, Guwot, Musom, Sirac and Yalu (Adzera Family); Kâte and Mape (Eastern Huon Family); Nomu (Western Huon Family); Finungwa, Gusan, Mamaa, Munkip, Nek, Nimi, Nuk, Numanggang and Sauk (Erap Family); Irumu and Wantoat (Wantoat Family); Waffa (Eastern Family, East New Guinea Highlands Stock); Hamtai, Kamasa, Kawacha, Menya, Safeyoka, Yagwoia and Susuami (Angan Family); Biangai, Kunimaipa and Weri (Kunimaipan Family); and Suena, Yekora and Zia (Binanderean Family).

There is some pattern to the geographical distribution of this group of languages. Those in the South-Central Huon Peninsula area (Erap, Wantoat and Adzera Families) and Central Ranges (Angan and Kunimaipan Families) tend to be of this type, although there are exceptions. Other languages of type C appear occasionally throughout the province. Altogether just over one third of all Morobe languages are of this type.

## 4.1.4 TYPE D - THREE NUMERALS ONLY

The Som language of the Uruwa Family has three numeral words, but informants did not describe any tallying. Hence the system proceeds by addition, rather like type B:

1	<i>koweran</i>	one
2	<i>yarə</i>	two
3	<i>kabmə</i>	three
4	<i>oyarə oyarə</i>	two two
5	<i>oyarə oyarə kowe</i>	two two one
6	<i>okabmə okabmə</i>	three three
7	<i>okabmə okabmə kowe</i>	three three one
	etc.	

This was the only example of this type found in the Morobe Province. Like type B, this system is useful only for relatively small numbers.

## 4.1.5 TYPE E - THREE NUMERALS PLUS HANDS AND FEET

This type of system employs three numeral words and tallying on the hands and usually the feet also. An example is the Guhu-Samane language of the Binanderean Family, which proceeds as follows:

1	<i>tena</i>	one
2	<i>eseri</i>	two
3	<i>tapari</i>	three
4	<i>eseri sa eseri</i>	two and two
5	<i>boto tena</i>	hand one
6	<i>boto tena ma tena</i>	hand one and one
10	<i>boto eseri</i>	hands two
15	<i>boto eseri ma oko te</i>	hands two leg one
20	<i>boto eseri ma oko eseri</i>	hands two legs two

Languages using this type of system are Nengaya (some informants) of the Siassi Family; Manga, Mapos, Mumeng and Piu (Buang Family); Migabac (Eastern Huon Family); Kumukio, Nabak, Ono and Sialum (Western Huon Family); Nakama and Urie (Erap Family); Bonkiman, Yupna and Koripon (Yupna Family); Weliki, Komutu and Sakam (Uruwa Family); Wasembo (Pihom Stock); and Binandere, Guhu-Samane and Mawae (Binanderean Family). It can be seen that this system is most commonly found in the languages of the Western Saruwageds and Mumeng area, but examples are found in other families throughout the province. Nengaya is the only example from Austronesian languages other than those of the Buang Family.

It is not always clear whether a term used for three is a distinct numeral or a combination of the terms for one and two. For example, counting in the Sauk language of the Erap Family proceeds thus:

1	<i>ningit</i>
2	<i>yali</i>
3	<i>yalanang</i>

The term for three does not appear literally as 'two and one', although the words are sufficiently similar to suspect a relationship. This relationship might be seen clearly with greater familiarity with the language. Informants translated *yalanang* as 'two and one', and because of this, the term is considered to be derived from the two previous numerals and is included with type C.

In the case of the Nakama language, the derivation is not so clear. Counting proceeds thus:

1	<i>fikanggang</i>
2	<i>lupek</i>
3	<i>lufeten</i>

The term for three looks as though it could possibly be derived from a combination of terms for one and two, but this cannot be demonstrated with certainty, and so the system is included with type E, with three numerals.

## 4.1.6 TYPE F - FOUR NUMERALS AND HANDS AND FEET

A system of this type has separate numeral words for one to four. However, it is not a 'base-four' system where counting is carried out in groups of four. Instead, tallying proceeds on the fingers and toes to a total of 20, as previously described. An example is the Dedua language of the Eastern Huon Family:

1	<i>mocgu</i>	one
2	<i>jahockang</i>	two
3	<i>harebec</i>	three
4	<i>neakpac</i>	four
5	<i>mara mong</i>	hand one
6	<i>mara mong nga mocgu</i>	hand one and one
10	<i>mara johoc</i>	hand two
15	<i>mara johoc nga hani mong</i>	hand two leg one
20	<i>ngic mong</i>	person one

The range of this type of system within the province is mainly restricted to the Eastern Huon Peninsula and coastal Austronesian-speaking areas, with only a few examples from other areas. The languages of this type are: Kaiwa, Siboma, Yabim, Barim, Gitua and Tami (Siassi Family); Dedua, Kosorong, Kube, Momare and Sene (Eastern Huon Family); Burum, Komba, Mesem, Selepet, Timbe, Tobo and Yaknge (Western Huon Family); Ufim (Gusap-Mot Family); Yau (Uruwa Family); and possibly Agaataha.

In the last-mentioned case, Agaataha (Angan Family), the term for four involves reduplication, but it cannot be demonstrated that this means 'two two', and so it is provisionally regarded as a distinct numeral. Further investigation might indicate a derivation from 'two two', in which case Agaataha would be included in type E.

## 4.1.7 TYPE G - NUMERAL FOR TEN

In this type of system, there is less dependence on the fingers and toes for indicating number. There are separate numerals for the numbers one to four and also for ten. The word for five may also be a distinct numeral or may be the same as the term meaning hand. For example, in the Bukawac language, counting proceeds as follows:

1	<i>tigen</i>	one
2	<i>lu</i>	two
3	<i>to</i>	three
4	<i>hale</i>	four
5	<i>lim dang</i>	five one
6	<i>lim dang ngando tigen</i>	five one and one
7	<i>lim dang ngando lu</i>	five one and two
10	<i>sahuc</i>	ten
15	<i>sahuc nga lim</i>	ten and five
20	<i>nga sambuc</i>	man complete

This type of system is found in Morobe Province only among the Austronesian languages. They are Bukawac and Kela (Huon Gulf Group, Siassi Family); Lukep, Mangap, Mutu and Sio (Island Group, Siassi Family); Kapin (Buang Family); and Hote, Misim and Yamap (Hote Family). In all

the languages represented in this group, the numbers six to nine are indicated by the terms '5 + 1', '5 + 2', '5 + 3' and '5 + 4' respectively. In some cases, for example Kaiwa, the meaning is literally 'hand and one' and so on, while in others, for example, Bukawac, the term for five is not the same as the usual term for hand, but is still related to the Proto-Oceanic term for 'hand' \**lima*. Hence the relationship with finger counting can be seen, but the need for the physical presence of fingers is lessened due to the existence of the base of ten. This type is the first so far examined which can be considered to have a series of abstract numerals as far as ten. The term for twenty, however, is something like 'one man', 'complete person' or 'whole man finished', and refers to a physically present tally total.

#### 4.1.8 TYPE H - NUMERALS FOR TEN AND TWENTY

This type of system shows a greater independence of external tallying aids such as hands, feet or whole persons. There are numerals for ten and twenty, and only the term for five, which is usually the same as or cognate with the term for hand shows the historical connection with tallying. In the Morobe Province, only the Labu and Kovai languages are of this type. The former is an Austronesian language, while the latter is non-Austronesian, but in an area completely surrounded by Austronesian languages. Other languages which may be of this type are adjacent to the Kovai area: Lukep and Mangap of the Island Group of the Siassi Family. However, it is not quite clear whether the terms for twenty in these two languages are distinct numerals or not, and so they have been included with type G.

The Labu language has the following counting terms:

1	<i>tugwatu</i>	one
2	<i>salu</i>	two
3	<i>sidi</i>	three
4	<i>suha</i>	four
5	<i>maipi</i>	five
6	<i>maipi anendi tugwatu</i>	five and one
7	<i>maipi anendi salu</i>	five and two
10	<i>numusu</i>	ten
15	<i>numusu anendi maipi anendi</i>	ten and five and
20	<i>asamuni</i>	twenty

Higher numerals can readily be formed:

30	<i>asamuni numusu</i>	twenty ten
40	<i>asamu salu</i>	twenties two
60	<i>asamu sidi</i>	twenty, three times
	etc.	

Thus a considerable series of abstract numerals can be generated using these terms.

#### 4.2 THE RELATIONSHIP WITH OTHER CLASSIFICATIONS

The types of counting system A to H outlined above were distinguished by inspection of the data collected, and differ from classifications previously described in section 2. Ray's (1907) account of all Papuan (that is non-Austronesian) languages having terms for only two or rarely three numerals



followed by body-counting is clearly wrong, and in fact it was an unjustified conclusion even when based on data available at the time. Following Codrington (1885), Ray described four types of counting system for the Melanesian (that is Austronesian) languages: quinary, imperfect decimal, perfect decimal and vigesimal. The distinction between quinary and vigesimal, although stressed by Ray, does not seem to have been clear-cut or significant, as it was probably the process of elicitation which assigned a system to one or the other type. They are thus grouped together in the present study under types C, E or F depending on the number of numeral words. The presence of a word or base for ten is much more significant, and all those systems described here as type G or H belong to what Ray called the imperfect decimal type. There are no Morobe examples of complete series of ten numerals.

The classifications of Galis (1960) and Wolfers (1972) include types not encountered in Morobe, namely body counting systems and bases of six, eight, fifteen, sixty and possibly four. Similarly, the base-24 system described by Bowers and Lepi (1975) in the Upper Kaugel is not found. Seidenberg's (1960) classification and subsequent conjecture concerning the origin and diffusion of different types of counting systems are based on incomplete and superficial data, and his conclusions may safely be ignored.

Lancy (1977) distinguished four separate types of counting system. All the Morobe examples referred to as types B to H in this study are included in Lancy's types III and IV. His type III includes all systems employing tallying on the hands and feet, and Lancy claims it to be typical of Morobe and other mainland provinces. His type IV or base-ten systems are said to be typical of the New Guinea Islands and East Papuan Island Region. The distribution of base-ten systems in coastal Austronesian-speaking areas of Morobe Province and the implications of this for the culture history of the region will be discussed in section 6.

#### 4.3 OTHER TYPES OF RECKONING IN MOROBE

Lancy's type II is described as using named sets of objects of fixed size, or tallies of objects. These phenomena also occur in Morobe, but in no case is it the sole or dominant type of reckoning. It was quite common for informants from a variety of languages to mention that in former times important objects or events were tallied using bundles of sticks, a series of knots in a rope or a collection of stones. The use of named sets was also recorded from a variety of groups, especially when dealing with coconuts, yams, taro or other garden produce. Sometimes this was used in conjunction with the more usual counting system, for example in the Mutu language, where a standard size for a pile of taro for a feast was reached by counting out named bundles of five according to a base-20 system.

There is some evidence for the existence or former use of a base of four in Morobe. Some languages have an expression for 'four' which has the appearance of a base, but whose meaning is not clear, for example Kube, *kembon pa*, and Tobo *kembem bagap*. The meaning of these terms probably refers to the hand completed apart from the thumb. In Timbe, the word for 'four' is *imbot*, which could be related to the word for 'hand', *bot*. In Burum, an alternative form of 'four' was given as *birikun kwagep*. *biri* means 'hand', hence the possibility that the term for 'four' is a base or a subtractive expression such as 'hand minus one', or 'hand not complete'.

In some languages the term for 'four' refers to the name of one of the fingers or an action of the fingers, for example in Suena, *wana awa patitiro* means 'little finger bent', and in Weri, *kong nent* means 'one fourth finger'. In the latter expression it may be significant that the expression

*kong* is qualified by 'one', suggesting that it could be a base. Some languages have alternative terms for four, one a distinct numeral and the other formed by addition. For example, in Kosorong, four can be either *nemumgac* 'four' or *karong mong* 'three one', while in Nakama the alternatives are *diding* 'four' or *lupeleng lupeleng* 'two two'. However, in all cases where the existence of a base of four is suspected, the dominant type of reckoning is a tally total of 20 on fingers and toes, and evidence for the use of four as a base remains flimsy.

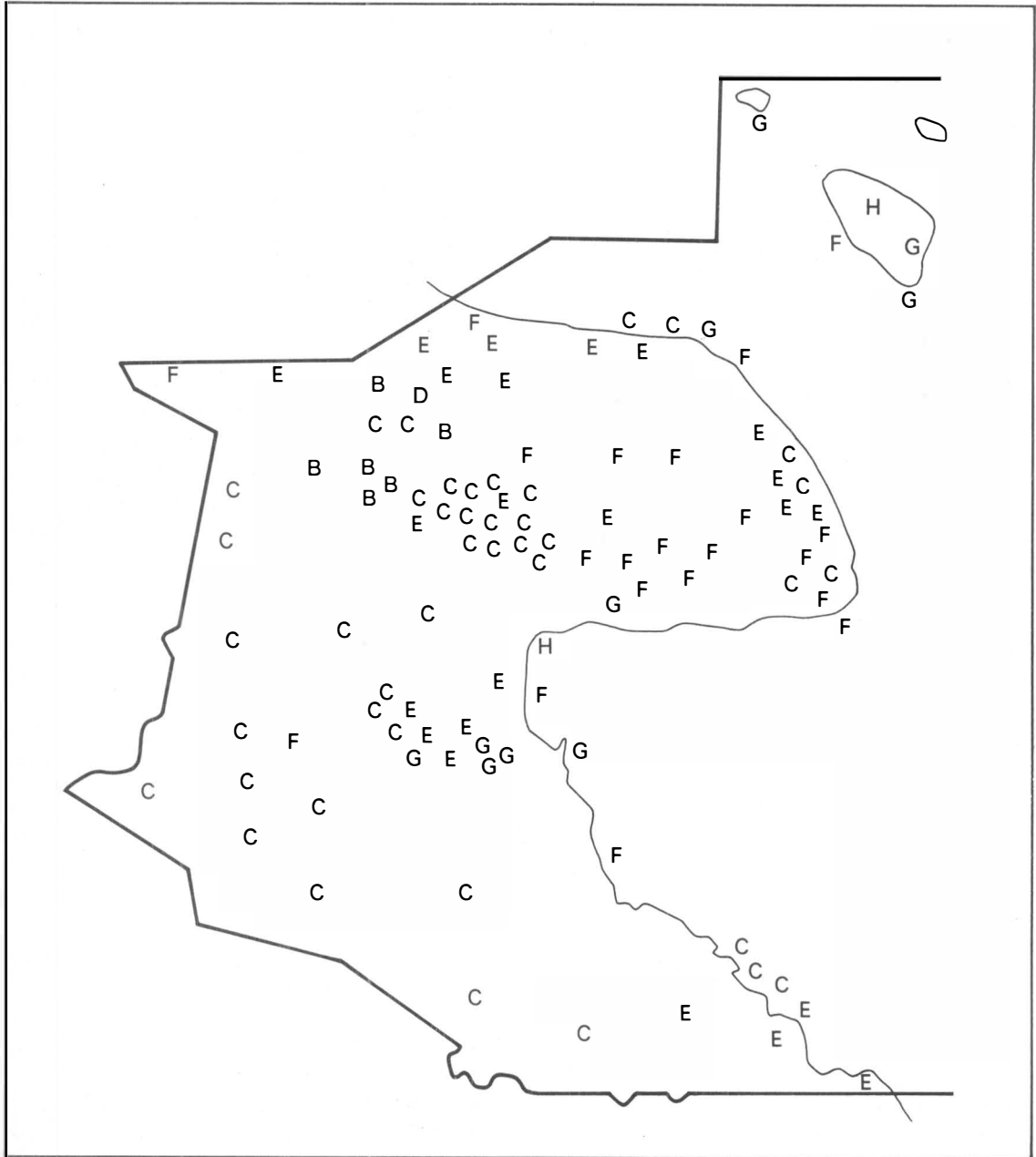
Outside influences over the past century have led to a widespread familiarity with decimal systems introduced by German and Australian educators and administrators. Robinson (1972) even reported that children in Butibum village near Lae could be heard reciting Japanese numerals (also decimal) during the short occupation period. Tok Pisin numerals, derived from English, are now well-known, and have probably replaced traditional systems when dealing with larger numbers for nearly all non-traditional purposes. In the Kosorong language, a system was described which appeared to be a vernacular adaptation of the English decimal system, based partly on Tok Pisin numerals, but this kind of adaptation does not appear to be common. A highly unusual and idiosyncratic system was described in the Urii language by one informant, but was not confirmed by other informants in the area.

The need to use money has necessitated familiarity with a succession of currencies: Deutschmarks and pfennigs (base-ten), pounds, shillings and pence (base-20 and base-12), dollars and cents (base-ten) and kina and toea (base-ten). The pound of 20 shillings was the first currency to be well-known by many Papua New Guineans, and was easily adaptable to finger and toe tallying systems. The change to dollars and cents, and shortly afterwards to kina and toea seems to have caused a certain amount of difficulty. Similarly, there is still confusion between ten-based and 20-based counting, as the following examples indicate. In the Mumeng area, some informants gave 'ten' as the total equivalent to 'one man' rather than the more usual 'twenty', while in Mutu, the number *ndingnding*, equivalent to 20 times 20, is commonly translated as 'one hundred' rather than 'four hundred'. Some Labu informants referred to the higher numerals above 20 *asamusalu* and *asamusidi* as 40 and 60 respectively, whereas others translated them as 30 and 40. This confusion is probably due to the introduced decimal series of numbers interfering with a traditional 20-based conception, and this may have been aggravated by changes in the money system.

## 5. VARIATIONS IN COUNTING TYPES WITHIN LANGUAGE FAMILIES

### 5.0 INTRODUCTION

In the previous section, several different types of counting system were distinguished. The purpose of this section is to see what kind of relationship exists between the distribution of the various types of counting system (see Map 3) and the distribution of the different language families in the province (see Map 4). As noted in the Introduction, an observation by Laycock (1977:219) indicates that in many parts of the New Guinea area, little correlation between languages and counting systems can be expected. Here, each language family in turn is examined to see how much variation in type there is between the different languages of the family.



MAP 3: DISTRIBUTION OF COUNTING TYPES IN MOROBE LANGUAGES

## 5.1 AUSTRONESIAN LANGUAGES

## 5.1.1 THE SIASSI FAMILY

Types of counting system employed in the languages of the Siassi Family are as follows:

HUON GULF GROUP		ISLAND GROUP	
Bukawac	G	Barim	F
Kaiwa	F	Gitua	F
Kela	G	Lukep	G (H?)
Labu	H	Mangap	G (H?)
Lae	No data	Mutu	G
Siboma	F	Nengaya	C or E
Yabim	F	Roinji	C
		Sio	G
		Tami	F

It is immediately apparent that there is a fairly wide range of types within this family. Included here are simple systems with only two numerals, and the most complex type found in Morobe, with numerals for one to five, ten, twenty and higher combinations. The Huon Gulf Group shows greater internal consistency, with three decimal systems and three with four numerals followed by hand and foot tallying. The Island Group shows a reasonable amount of internal consistency apart from two exceptional cases, Roinji and Nengaya. Of the others, there are four decimal systems, while three have four numerals followed by tallying.

## 5.1.2 THE ADZERA FAMILY

The following types of counting system occur in the languages of the Adzera Family:

LOWER WATUT SUB-FAMILY		MARKHAM SUB-FAMILY	
Dangal	C	Adzera	B
Maralango	C	Ngariawan	B
Silisili	C	Sirasira	B
		Sukurum	B
		Unank	C
		Wampar	C
		Wampur	C
BUSU SUB-FAMILY			
Guwot	C		
Musom	C		
Sirak	C		
Yalu	C		

There is considerable uniformity here. All languages have two numeral words, and the word for 'two' appears to be cognate for all the languages of the family (see Appendix B). In some Markham Sub-family languages, counting was described without the use of finger tallying. In the remainder of this sub-family and all the languages of the Lower Watut and Busu sub-families, two numerals and tallying on hands and feet were employed.





## 5.1.3 THE BUANG FAMILY

The following counting types are found in the Buang Family:

Kapin	G	Mumeng	E
Manga	E	Piu	E
Mapos	E	Vehes	E

All the languages except one employ three numerals and hand and foot tallying. Kapin is exceptional, with a decimal system, although possible reasons for this have not been identified.

## 5.1.4 THE HOTE FAMILY

The following counting types occur:

Hote	G
Misim	G
Yamap	G

All languages in this family have the same type of decimal system. The words used in these three languages are very similar, and this supports the idea that they may be better considered as dialects of a single language, as suggested by Marguerite Muzzey (personal communication), a linguist from the Summer Institute of Linguistics, who is working in the area.

## 5.2 NON-AUSTRONESIAN LANGUAGES

## 5.2.1 THE KOVAI ISOLATE

This language has a decimal system, and is the only non-Austronesian language in the Morobe Province to possess one. A reasonable explanation of this would be in terms of the geographical location of Kovai speakers on Umboi Island, surrounded by Siassi Family Austronesian languages which have decimal systems.

## 5.2.2 THE EASTERN HUON FAMILY

The following types of counting systems are found:

Dedua	F	Mape	C
Kâte	C	Migabac	E
Kosorong	F	Momare	F
Kube	F	Sene	F

Although all languages use systems depending for higher numbers on hand and foot tallying, there is considerable variation in the number of distinct numeral words employed. Five languages use four numerals, one language uses three numerals, and two languages have only two numerals.

## THE WESTERN HUON FAMILY

The following types of counting system are found:

Burum	F	Ono	E
Kinalakna	C	Selepet	F
Komba	F	Sialum	E
Kumukio	E	Timbe	F
Mesem	F	Tobo	F
Nabak	E	Yaknge	F
Nomu	C		

As with the Eastern Huon Family, all languages of the Western Huon Family employ hand and foot tallying to describe higher numbers, but there is variation in the number of distinct numeral terms employed. Two languages rely on two numerals only, while three languages have three numerals. The majority of the languages (seven) have four numeral terms.

## 5.2.4 THE ERAP FAMILY

The following types of counting system are found:

Finungwa	C	Nimi	C
Gusan	C	Nuk	C
Mamaa	C	Numanggang	C
Munkip	C	Sauk	C
Nakama	E	Urii	E
Nek	C		

There is much consistency here, with nine of the eleven languages using only two numerals followed by hand and foot tallying. The remaining two languages differ only in having a third numeral term.

## 5.2.5 THE WANTOAT FAMILY

The languages in this family have the following types of counting system:

Bam	B	Wantoat	C
Irumu	C	Yagawak	B

All four languages have only two numeral words. Informants in two of the languages described tallying on hands and feet, while those of the other two languages did not.

## 5.2.6 THE GUSAP-MOT FAMILY

The only representative of this family in the Morobe Province, Ufim, has a type F system with four numeral words and thence tallying on hands and feet. According to Claassen and McElhanon (1970:70), this is typical of the languages of the family, the remainder of which are spoken in the Madang Province.



## 5.2.7 THE YUPNA FAMILY

This family also straddles the border between the Madang and Morobe Provinces. The counting systems in the three Morobe representatives are as follows:

Bonkiman	E
Yupna	E
Koripon	E

All three are of a similar type with three numerals followed by hand and foot tallying.

## 5.2.8 THE URUWA FAMILY

The Uruwa Family languages have the following types of counting system:

Komutu	E	Weliki	E
Sakam	A, E	YHau	F
Som	D		

There is a variety of types here. Most have three numeral words, although no tallying on hands and feet was described by informants in the Som language. The Yau language had four numeral terms, and the Sakam language was the only one in Morobe where any form of body counting was encountered. Two nostrils were included in the tallying sequence to give a tally total of 22.

## 5.2.9 THE PIHOM STOCK

The Wasembo language, which apparently has no close relatives, has a counting system with three numerals and hand and foot tallying, that is it belongs to type E.

## 5.2.10 THE EASTERN FAMILY, EAST NEW GUINEA HIGHLANDS STOCK

The Waffa language is the only Morobe representative of this family, which is spoken mainly in the Eastern Highlands Province. The Waffa counting system is of type C, with two numerals and hand and foot tallying. Information on other languages in the family is incomplete. Bee (1973:727) notes that the Usarufa system has three numerals and then tallying. Word lists in McKaughan (1973) include numerals in several languages of this family. They list translations of 'four', 'five' and 'ten', but accounts of the systems are not provided, and these may be tallying terms rather than distinct numerals. According to Lancy (1978:7), hand and foot tallying is typical of the Eastern Highlands area.

## 5.2.11 THE ANGAN FAMILY

Languages of this family are spoken in the Morobe, Gulf and Eastern Highlands Provinces. The Morobe representatives have the following types of counting system:

Agaataha	F (E?)	Menya	C
Hamtai	C	Safeyoka	C
Kamasa	C	Yagwoia	C
Kawatsa	C	Susuami	C

All except the Agaataha language have only two numerals followed by tallying on the fingers and toes. Agaataha has either three or four numerals, depending on whether the expression for 'four' is considered to be a combination of 'two and two' or not. Languages belonging to this family spoken in the Gulf and Eastern Highlands Provinces appear to be similar to the majority (Lloyd 1973:87).

#### 5.2.12 THE KUNIMAIPAN FAMILY

The languages of this family spoken in the Morobe Province have the following types of counting system:

Biangai	C
Kunimaipa	C
Weri	C

All three types are similar, with two numeral terms followed by tallying on the hands and feet. Counting methods in other languages of this family spoken in Northern and Central Provinces appear to be similar (Dutton 1975:263).

#### 5.2.13 THE BINANDEREAN FAMILY

Languages of this family are spoken in the Morobe and Northern Provinces. The Morobe representative have the following types of system:

Binandere	E	Suena	C
Guhu-Samane	E	Yekora	C
Mawae	E	Zia	C

All use hand and foot tallying. Three languages employ three numeral words, while the other three have only two numerals.

### 5.3 CONSISTENCY AND VARIATION

There is evidence here to support Laycock's statement (1977:219) that closely related languages may show widely differing counting systems. However, counting types are not distributed randomly throughout the languages; there is also a good deal of consistency within certain families.

#### 5.3.1 NON-AUSTRONESIAN LANGUAGES

The non-Austronesian languages of Morobe show a reasonable degree of consistency in the counting methods employed, and this has been remarked upon by several linguists. Claassen and McElhanon's account of the Finisterre Stock language families includes the comment (1970:70):

Counting systems are uniform throughout the languages included in this survey. Counting begins with the small finger of one hand, progresses through the other hand, the toes of one foot and finally the toes of the other foot to a complete unit of twenty. Numerals one through four are expressed by separate terms...

This generalisation covers the languages of the Wantoat, Erap, Gusap-Mot, Western and Eastern Huon and Yupna Families. While the statement does not accurately reflect the variation in the number

of distinct numeral words, it does indicate the underlying similarity in the counting methods of the non-Austronesian languages of the Huon Peninsula.

Lloyd (1973:87) is likewise struck by the uniformity of Angan counting methods:

(Angan Family) counting systems are very similar...there are words for 'one' and 'two' and phrases, literally 'two one' for 'three' and 'two two' for 'four'. For higher numbers the nouns 'hand' and 'foot' are used.

Dutton, too, stresses similarities when commenting on the counting systems of the South-Eastern Trans-New Guinea Phylum languages, which include both the Binanderean and Kunimaipan families (1975:623):

Counting systems are based on two or three (e.g. 1, 2, 2 + 1, 2 + 2, 1 hand or 1, 2, 3, 2 + 2, 1 hand).

The major exception to this consistency is the Kovai language of Umboi Island. In this language there is a decimal system with words for ten and twenty, that is, a type H system according to the classification adopted in section 4. The occurrence of a decimal system here may be explained by the proximity of other similar systems: the Kovai language area is surrounded on all sides by Siassi Family languages of the Island Group, all of which have decimal systems. This situation is rather similar to that of the Yeletne language referred to in section 1. This non-Austronesian language has a complete decimal series and occurs in an area completely surrounded by Austronesian languages.

### 5.3.2 THE AUSTRONESIAN LANGUAGES

The Austronesian languages show a great deal of variation in the extent of their numerical resources. This is surprising, since reconstructions of a complete set of ten numerals are available for ancestral languages known as Proto-Austronesian and Proto-Oceanic. If these proto-languages are indeed the ancestors of today's Austronesian languages in Morobe, there has evidently been a loss of numerical resources in the descendant languages. A more detailed discussion of this situation is reserved for the following section.

## 6. COUNTING AND CULTURE HISTORY

### 6.0 INTRODUCTION

The nature and distribution of counting systems in Morobe Province pose some interesting problems with respect to the culture history of the area, in particular the interaction between groups speaking Austronesian languages and those speaking non-Austronesian languages. Before these problems are addressed, the general culture history of the region is considered in some detail, especially linguistic aspects. Some mechanisms of change in relation to language and counting are then discussed. Finally, an explanation is offered in terms of cultural and economic factors which could account for the present distribution of Morobe's counting systems.

## 6.1 CULTURE HISTORICAL FACTORS

## 6.1.1 LANGUAGE AND CULTURE

The island of New Guinea appears to have been inhabited for at least ten thousand years and possibly much longer, which indicates that the first inhabitants were almost certainly hunters and gatherers (Bulmer and Bulmer, 1964:41). When considering such enormous time spans, a certain amount of conjecture is involved in any reconstruction of events. However, a number of theories have been proposed which are of relevance to the Morobe situation. Schmitz (1960a) specifically considered past movements into the Huon Peninsula, and describes evidence for the existence of three basic culture types. What he refers to as culture A is described as consisting of 'proto-negroid' people of short stature who first entered the eastern half of New Guinea from the west across mountain valleys. Culture B, the 'neo-Melanesians', typified a planting culture and entered at a later date from the coast along river valleys. Finally, culture C, consisting of maritime Austronesian-speaking migrants, arrived relatively recently. Such a picture is somewhat simplistic and based on rather superficial evidence, but the idea of a relatively recent arrival of Austronesian-speaking migrants from the west to an island already inhabited meets with fairly widespread assent. Chowning, reviewing the situation notes (1973:8):

...it is generally accepted that the first inhabitants of the island of New Guinea itself spoke non-Austronesian languages. Their distribution alone is sufficient proof; Austronesian languages occur in New Guinea only in scattered and isolated spots along the coast, very rarely penetrating for any distance into the interior.

It is worth noting that the Morobe Province contains the area of greatest penetration of Austronesian languages into New Guinea, a fact to bear in mind when considering the extent of the influence of non-Austronesian languages on Morobe Austronesian languages.

The origin of Austronesian speakers, who occupy an enormous geographical range bounded by Madagascar, Formosa, New Zealand and Eastern Polynesia, has been the subject of a great deal of study and speculation, and no one theory is universally accepted. Dyen (1971:31) considers that the place of origin is likely to be the area of maximum diversity, which appears to exist in Western Melanesia. This region is therefore postulated as the homeland of the ancestral or proto-language of all the Austronesian languages (Proto-Austronesian).

A more generally held view approximates the position adopted by Grace (1961:367):

The linguistic data known to me suggest the following historical outline. The Proto-Austronesian language was probably spoken in or near South East Asia. At a considerably later date a language was spoken, most probably on or near the north coast of New Guinea, which became the proto-language of the Eastern Austronesian sub-group.

An Oceanic sub-group within the Austronesian languages has been identified mainly on the basis of a number of shared phonological innovations (Grace 1961:363). This sub-group is considered to consist of the Polynesian languages, nearly all Micronesian languages and most of the Austronesian languages of Melanesia. Attempts at the reconstruction of a proto-language ancestral to this group, called Proto-Oceanic, have also been made, but so far have concentrated mainly on phonological features. The possible existence of a 'New Guinea cluster' or New Guinea Oceanic group within Oceanic is still the subject of debate (Milke 1965, Capell 1969, 1971, 1976, Pawley 1978, Lynch and

Tryon 1983). Chowning argues against over-simplified explanations based on uni-directional movements of peoples, but considers it reasonable to assume (1973:8) that :

...some of the present 'Melanesian' languages, including most of those on the north coast of New Guinea...are the descendents of Austronesian languages that entered Melanesia early from the west and underwent a long local development, almost certainly influenced by the presence of non-Austronesian languages.

The possible influence of non-Austronesian languages on the numeral sets of Austronesian languages will be examined in more detail in later sections.

### 6.1.2 ANCESTRAL NUMBER SYSTEMS

A considerable amount of work has been done on reconstructing elements of Proto-Austronesian. Dahl (1976), drawing on the work of Dempwolff (1934-1938), Dyen (1962, 1965) and others, reconstructs grammatical features of Proto-Austronesian, as well as phonemic and vocabulary items. Of particular interest here is the reconstruction of numerals (Dahl 1976:122):

...cardinal numbers from 1 to 10 are considered : *\*ita*, *\*dzuSa*, *\*təlu*, *\*sə(N)pat*, *\*l(l)ima*, *\*uənəm*, *\*pit(l)u*, *\*uala*, *\*tiua*, *\*puluq*. From 20 to 90 the numerals are generally composed of *\*puluq* preceded by other numerals.

Thus it is assumed that the speakers of the ancestral language of all Austronesian languages, including those in Morobe, had a complete decimal series of numerals, possibly up to thirty thousand years ago.

As in Proto-Austronesian, there is reconstructed in Proto-Oceanic a complete decimal set of numerals (Grace 1969, Wurm and Wilson 1975):

1	<i>*nsa</i>
2	<i>*dua</i>
3	<i>*tolu</i>
4	<i>*pat</i> , <i>*pati</i>
5	<i>*lima</i>
6	<i>*onom</i>
7	<i>*pitu</i>
8	<i>*walu</i>
9	<i>*nsiwa</i>
10	<i>*ngapulu</i>

An alternative form of ten, *\*nsangapuluq* has been suggested by Ross (personal communication). The relationship of this series to some numerals of today's Morobe Austronesian languages can readily be seen, for example the first five numerals in the Mangap language of Siassi:

1	<i>ta</i>
2	<i>ru</i>
3	<i>tel</i>
4	<i>pang</i>
5	<i>lamata</i>

However, other Austronesian languages in the area have numeral words which cannot so easily be related to Proto-Oceanic, for example Barim *bayerta* 'five', Kapin *vei* 'four' and Yama *yi* 'two', although Siegel (personal communication) has suggested possible derivations for some of these. Although there are numerous cognates for the numerals one to five, there are no instances among the Morobe Austronesian languages of numerals between six and nine cognate with those reconstructed for Proto-Oceanic. Instead, additive expressions are used to represent these numbers.

The historical development of the non-Austronesian languages has not been researched in such detail. However, none of the available evidence (e.g. McElhanon 1973) indicates the existence of former extensive numeral series for any of the Morobe families.

## 6.2 MECHANISMS OF CHANGE

Complete decimal series of the kind described in Proto-Oceanic are by no means uncommon in the area. Laycock comments (1975:224):

Pure decimal systems characterise many Austronesian languages of Island Melanesia, Polynesia and Indonesia.

However, it has already been pointed out that not a single one of the 40 Austronesian languages of the Morobe Province has a complete decimal set. This at first sight is somewhat puzzling, and in considering possible explanations for this state of affairs it may be as well to look at the kinds of changes which can take place, first in counting systems and then in languages generally.

### 6.2.1 CHANGES IN COUNTING METHODS

The counting system or systems found in a community are not static, and a number of ways in which they could be modified are considered here. Firstly, development from a simpler to a more complex system could take place. Systems classified as type B, with two numerals and no tallying, could easily change to a system classified as type D, which involves tallying on the hands and feet to a total of 20. No new words would be needed for this. In fact some language groups showed a certain amount of variation, for example where some informants described a type B system and some described type D. If necessary, additional numeral words could be added to the counting repertoire by adapting words such as the names of fingers or body parts to serve the function of numerals, and there is some evidence that this has taken place in some languages (Cheatham 1978:17). In the Guwot language, only two numerals were described, but informants could readily provide a named series of five fingers. There is also evidence that the word for 'big toe' was adopted as the word for 'twenty' in the Yupna language of the Finisterre Mountains (see Appendix A). Hooley (1978:158) describes certain named sequences among the Buang, such as birth order names as far as eight, and similar series were described by informants in the Nabak and Labu languages. It seems, then, that there is no problem handling sequences of several terms, even when numeral words are limited in a language.

When tallying on hands and feet, many languages involve cumbersome circumlocutions which vary from speaker to speaker and cannot be regarded as numerals; they are merely the description of the tallying process which takes place as successive digits are marked off. These terms could become abbreviated and conventionalised to give a stereotyped numeral series in place of a variable repertoire of phrases describing the actions accompanying tallying. This may have taken place in the Komba

language of the Huon Peninsula, where, although a tallying procedure is used, descriptions of the system by different informants were unusually concise and consistent. Similarly, the words from six to nine in some Austronesian languages such as Tami and Mutu appeared to be abbreviated and stereotyped, although the process of addition to form these numerals still showed clearly.

Another process which could increase the numeral repertoire of a language is that of borrowing. This would present no great difficulty in an area such as New Guinea where multi-lingualism and dual-lingualism are widespread (Sankoff 1977, Lincoln 1975b, Laycock 1979). Additional numerals from neighbouring languages could be added to a series and in this case it would not always be easy to tell if the presence of a word was due to borrowing or not. Where the word for 'five' is also the word for 'hand', ambiguity could be reduced by adopting the word for 'hand' in a neighbouring language to represent the numeral.

Alternatively, the adoption of whole sets of numeral terms could take place. This seems to have occurred in some other areas of Papua New Guinea, for example on Rossel Island in the Milne Bay Province, where a decimal series has been adopted into the non-Austronesian Yeletne language from surrounding Austronesian languages, although some at least of the original Yeletne terms have been retained. The Kovai language of Umboi Island in the Morobe Province is in a somewhat similar position, being a non-Austronesian language completely surrounded by Austronesian languages of the Siassi Family. Indeed, the Kovai counting system appears to be more typical of the surrounding languages than of its closest non-Austronesian neighbours, but the words used are not apparently Austronesian in origin. The idea behind the counting system seems to have been adopted while retaining words from within the language to describe it. A similar situation obtains in the non-Austronesian Flores-Timor languages further west in Indonesia (Capell 1976b:539); decimal numeral series have been adopted from neighbouring Austronesian languages, but in some cases words or constructions from the original system have been retained for part of the series. Similarly, the influence of Tok Pisin numerals in recent decades appears to have been great. Laycock and Wurm (1979:202) note:

Particularly common is the use of *lingue franche* numerals in place of vernacular numerals, especially for numbers greater than 'two' in languages whose system is binary or binary/quinary only.

A third process which could affect a numeral series is that of reduction. In the Austronesian languages of Morobe, this seems to have been more common than expansion of a series. The Roinji language of the Rai Coast, for example, is an Austronesian language, descended from Proto-Oceanic, but unlike its ancestor it only has two numeral terms. Similarly, languages of the Adzera and Buang Families generally have only two or three numerals. Where decimal systems occur in Morobe Austronesian languages, they are all incomplete, involving simple addition from six to nine. Something has evidently happened to the remaining Proto-Oceanic numerals, and the most likely cause would appear to be interaction with neighbouring non-Austronesian languages. This is discussed in more detail below.

## 6.2.2 LANGUAGE CHANGE

It is widely acknowledged that the Austronesian languages in the New Guinea area have been 'influenced' by non-Austronesian languages (see e.g. Capell 1976b). However, the exact dynamics of the processes by which one language is influenced by another are complex, and difficult to

observe, let alone reconstruct. Nevertheless, a number of explanations have been postulated, and some of these may be relevant here.

There is some evidence that 'language mixture' has taken place where some Austronesian and non-Austronesian languages have come into contact. Although the existence of this process has been questioned, the concept is defended by Capell (1976:529):

...the idea of a language belonging simultaneously to two different language families is to be rejected. Even a so-called 'mixed language' has a single parent language. But such a language also has an *invader*, and when the balance of relationship to the original mother tongue – the true ancestor – is outweighed by the invader's contribution in lexicon *and* structure, it is right to speak of a mixed language.

Other languages for which a mixed status has been suggested are Magori in South-East Papua (Dutton 1976), the Reef-Santa Cruz Family in the Eastern Solomons (Wurm 1976), and in Morobe, Kube and Dedua (McElhanon 1970a:230).

Whatever the status of these languages, it is evident that certain features such as vocabulary items pass relatively easily from one language to another in multilingual Papua New Guinea. Bradshaw refers to the situation in Numbami, a Huon Gulf Austronesian language as follows (1978a:30):

As to how well they speak their own language, most Numbami will acknowledge somewhat self-deprecatingly that *i manggo binga miks*, 'we speak our language mixed', the form of the statement itself evincing the truth of its claim.

While vocabulary items pass fairly readily from one language to another, structural features appear to be more basic and not borrowed so easily. Hence in the case of one language being influenced by another, a 'substratum' of basic features may persist and give indications of its ancestry which are not immediately apparent from more superficial features. It is not always easy to sort out such features, especially when the languages involved have not been studied in any great depth, as is the case with many Morobe languages. As Bradshaw noted (1978b:54) when considering the Labu language:

It seems as likely to be a Siassified Azera language as an Azerified Siassi language.

The process of pidginisation may have been involved in the development of some Morobe languages. A pidgin language is based on a simplified lexicon and grammar and arises in situations where different language groups need to communicate for specific purposes. Such a situation can easily be imagined in the context of North-East New Guinea. Expansion and diversification occur if a pidgin language becomes creolised, that is, becomes the native language of a new generation of speakers. While the lexicon of a pidgin language may be derived largely from one language, the grammatical features of another may be retained. This process could account for the existence of a limited numeral series in Morobe Austronesian languages. For example, if a pidgin language relying on vocabulary items from an Austronesian language was used by a culture familiar with only two numeral words, the atrophy of the remainder of the decimal series could easily occur. If languages such as Roinji and Nengaya were descended from such a pidgin language, the existence of only two numeral terms in the language could be accounted for. A similar situation could be postulated for the Adzera Family languages. This, however, is pure conjecture, and such a development cannot be assumed without a good deal more evidence, no matter how convenient an explanation it may present. There are many objections to the 'pidginisation' hypothesis, and it is more likely that the effects of multilingualism bring about language changes of this kind.



### 6.3 COUNTING IN ITS CULTURAL CONTEXT

#### 6.3.1 COUNTING IN ACTION

Further clues to the causes of the apparent regression of numerical resources in the Morobe Austronesian languages lie in the cultural context of counting in the region. As noted by Bowers and Lepi (1975:309), a list of numeral terms and their translation gives little indication of the way reckoning is carried out in a society. As was seen in section 1, it is only since a number of ethnographic studies have been carried out, mostly in the Highlands, that we have got much closer to an understanding of how counting takes place in its cultural context in Papua New Guinea (e.g. Franklin and Franklin 1962, Bowers and Lepi 1975, Strathern 1977, Thune 1978, Cheetham 1978, Biersack 1982). Some of the cultural factors relevant to a consideration of counting in context are illustrated by the following examples.

Strathern (1977) describes the Melpa counting system in action during *moka* exchanges. Here, 'big men' aim at a 'grand set' of pigs for distribution at a small *moka* ceremony. Since the counting base may be eight or ten depending on whether or not the thumbs are used, the set may be 8 x 8, 8 x 10 or 10 x 10. The bamboo tallies worn around the neck by Melpa men are well known as records of the shells given away during *moka* ceremonies, each bamboo slat representing a set of eight or ten shells. However, Strathern points out that these tallies are not memory aids, and would be unnecessary as such, but function as a public display of *moka*-making activity. The prestations, or gift exchanges, are intimately concerned with inter-group relations and are events of great social significance.

Similarly, Bowers and Lepi (1975:322) make the following comment about counting as performed by the Kakoli of the Upper Kaugel Valley:

Kaugel counting does not exist in isolation. It quantifies and qualifies relations between people, objects and other entities.

The system described is based on four and 24, but formal counts involving higher numbers only take place in the context of the exchange of valuables. The system, with bases of four and 24, has a number of unusual features, and is particularly notable for the degree of abstraction ascribed to it by the authors (1975:316). It is postulated that the system may have developed due to the needs of an expanding prestige economy.

Biersack, on the other hand, comments on the degree of concreteness exhibited by the Paiela, another Highland group from the Enga Province in their counting behaviour. She argues that a tallying system tied to a concrete set of objects or body parts need not imply a deficient cognitive capability. Noting that Paiela counting exhibits what has been characterised (e.g. Hallpike 1979) as cognitive immaturity based on an incomplete logic, she states (1982:6):

Paiela counting is concrete in just those ways Hallpike claims to be characteristic of primitive counting systems. The Paiela always enumerate; they never compute. There are elaborate tallying procedures in the event that the items being counted are absent. Finally the words for numbers are also the names of body parts.

However, following a detailed and sensitive analysis of their counting behaviour as a semiotic system, she concludes that in this context, the concreteness ceases to be misplaced:

Underlying the semiotic logic of the Paiela counting system is an abstraction: the concept of information itself...the concept of information plays the same role that the concept of number plays in western counting systems: the role of governing abstraction.

Common to accounts of Biersack, Bowers and Lepi, and Strathern, is the importance of the idea of pattern in counting behaviour, especially at formal prestations. Biersack pays considerable attention to the concept; its importance in counting pairs, in variations in the body sequence, in the Paiela principle that 'relationship and heirarchy, not unit and iteration, are the sources of multiplicity' (1982:30). Strathern describes the public display which accompanies the counting of pigs and formerly shells prior to their distribution. The stakes to which pigs are to be tethered may be driven into place for everyone to see months before the actual distribution. Bowers and Lepi, while stressing the abstract nature of the Kaugel system, note that counting during formal distribution is also accompanied by an important public display consisting of lines or heaps of wealth objects.

Even though such distributions may involve accurate tallying of the number of valuables distributed, the primary objective appears to be to provide a relative rather than an absolute measure. Strathern comments (1977:19):

The final number is taken as a figure to be compared with previous occasions of a similar kind and as a standard for future returns from the recipients.

When complex series of debts and credits are to be remembered by organisers of such distributions, external calculating devices are seldom necessary. The fingers can be used to enumerate items or persons involved, but such is the cultural importance attached to the exchanges that the reality of each transaction is kept alive between formal ceremonies by constant references in conversation.

In Morobe societies for which ethnographic accounts are available, and in coastal societies of Papua New Guinea in general, prestations seem to take place on a smaller scale than in Highlands areas. Nevertheless, pattern and display are still important aspects of the gift-giving process, and a public distribution is likely to lay more stress on visual aspects than the enumeration of a total. As the writer has noted elsewhere (Smith 1981:7) prestations among the Adzera of the Markham Valley may involve an enormous number of bunches of bananas, but counting the exact number of bunches is not considered necessary, and other forms of visual display are employed, such as tying the bunches on to a framework reaching the top of a coconut tree. Read (1950:206) observed similarly impressive displays by the Adzera at *mugus* festivals where yams were displayed prior to distribution. Again, an important feature was the concept of relative rather than absolute quantity. It would appear, then, that tallying systems and limited numeral series are quite adequate for dealing with transactions of this kind.

Numbers may, in fact, sometimes appear to be redundant, and Thune (1977) observes that the numerical resources of the Loboda of Milne Bay are not fully utilised. While there is a counting system reaching into the hundreds, counting and enumeration of objects are unimportant in the culture and occur only rarely. Instead, a non-numerical way of looking at the world is described, emphasising relative rather than absolute measures. In such a situation, regression of numeral sets could easily be imagined.

### 6.3.2 TRADE AND EXCHANGE

In Morobe Province, more complex exchanges have traditionally taken place as part of extensive trading networks. Hogbin (1947b, 1951) gives an account of trade around the Huon Gulf, while details of a network centred on the Siassi Islands appear in Harding (1967, 1970), Freedman (1967, 1970), Allace (1976) and Pomponio (1983). This network linked communities as far apart as New Britain, the Huon Gulf, Madang and the Huon Peninsula hinterland, and it would seem reasonable to assume that the possession of a complete decimal set of numerals would be a useful resource for calculating beneficial trading terms. However, it is in just this type of cultural environment that the regression of decimal numerals appears to have taken place. A detailed examination of what took place during trading interactions may give some idea of the mathematical requirements of participation in trade of this type.

The importance of ceremonial exchange in inter-group rivalry and alliance, and as a stage for politically ambitious 'big men' is a well-documented feature of many Melanesian societies. Since Malinowski's pioneering work in the Trobriand Islands (1922), it has been acknowledged that trade in Melanesia involves a number of such ceremonial features. A great deal of energy is expended, for example, in *kula* expeditions in the Milne Bay waters, even though some of the exchanges appear to outside observers to have little intrinsic economic value. Thus it might be argued that such overseas expeditions should be thought of not so much as trading ventures as complex social rituals.

However, Harding considers that social, ritual and political aspects of trading have been over-emphasised in ethnographic accounts of Melanesian societies and maintains that the primary function is economic. The Siassi, for example, '...engaged in social rituals of exchange as a means of acquiring valued need-serving goods.' (1970:108). They acted as middlemen, exchanging goods at favourable rates by manipulating exchange ratios in the different Vitiaz Strait ports. A pig, for example, could be exchanged on Umboi for five to ten packets of sago, which in turn were exchanged at Sio or Gitua for 50 to 100 pots. These pots could then be transported to New Britain, where they yielded five to ten pigs (Harding 1970:139). Thus goods of little value in one community were transported to others where they were in short supply, or had high prestige, usually for ceremonial purposes, and thereby yielded a profit.

The *kula* of Milne Bay and the Siassi overseas expeditions, it must be stressed, are not identical systems, and it is pertinent to compare Morobe trading patterns with those elsewhere. Strathern (1983) draws comparisons between a number of exchange systems including Milne Bay, Siassi, Enga, Melpa and Tolai, especially with respect to rules governing exchanges and strategies adopted to exploit them. He indicates some points of similarity: the matching of return gifts, the introduction of new and unsolicited gifts into exchange partnerships, the 'two fundamental aims of demonstrating prestige and at the same time continuing friendly partnerships' (1983:87). On the other hand, there are considerable differences in detail, and the Highlands systems described appear to be less stable than the more conservative *kula*, due, in part, to sensitivity to changing economic conditions.

In these exchange systems, the concept of profit requires close examination. In the Melpa *moka* exchanges, for example, where a form of 'profit' appears to be built in to the system, material losses are nevertheless made up as gains in political prestige. Although surplus 'profits' of *tambu* shell may be acquired among the Tolai, they tend to be stored for subsequent redistribution. And in the *kula*, Strathern notes (1983:80):

The category of 'profit-making' tends, therefore to dissolve when considered more closely, into other categories. First, the 'profit' may have to be returned later. Second, it

is in any case a by-product of competitive giving, the aim of which is to acquire renown. Third, it may simply represent the wish by the donors to maintain the partnership... It is better, therefore, to refer to 'incremental giving' rather than to a 'principle of profit'.

In Morobe, too, the acquisition of profit was not the basic aim. Harding notes (1970:105):

Ultimately the concept of profit appeared irrelevant because the objectives of trade for any participant community were highly specific. The Siassis counted the returns of trade in pigs and vegetable food which could be reserved for the 'feasts of merit' staged by local leaders. The Komba mountaineers were drawn to Sio because 'they smelled the grease of our coconuts', 'they were hungry for fish and salt'. Because of these specific objectives, transactions that might be judged unprofitable as measured by comparative inputs of labour time were desirable nonetheless.

In Siassi, any 'profit' gained was essential both for subsistence needs in their over-populated communities and for the prestige of men sponsoring feasts celebrating various stages of the life-cycle. It was not merely an accumulation for private individual use, and Freedman notes (1970:318):

The promotion of private accumulation, in Siassi, is ultimately in the public interest...most private wealth is distributed in village-wide ceremonies.

Another aspect of trading in the Vitiaz network should be emphasised, and that is the role of trade partners. Although trading involved the manipulation of an awesome array of exchange ratios, it was not an impersonal affair designed to maximise acquisition at all cost, but involved a category of people who were regarded as kinsmen. Depending on relative age, trade partners would call one another 'brother', 'father' or 'son', and these relationships might be carried on in later generations until the distinction between 'real' and 'trade' kinship became blurred. Since transactions were carried out with a category of kin, exact computation of exchange rates or enumeration of totals may not have been as important as it otherwise would have been. Nevertheless, it does seem that there was general agreement about exchange ratios; discrepancies recorded probably reflected the wide range in size and quality of the various commodities (Freedman 1970:154). Close trade partnership was associated not so much with differences in rates of exchange as with a time delay between initial gift and return (Freedman 1970:165).

The establishment of trade partnerships had a number of important advantages. In an area where warfare was endemic, a trade partnership afforded protection in an otherwise hostile community. Since exchanges were of such economic importance to both parties, this temporary suspension of hostility appears to have been strictly observed. The 'credit' extended in delayed return has been mentioned above. Pomponio (1983) stresses the role of trade partnerships in the extension of a kin network by prospective big-men. The establishment of a new trade partnership eventually transformed strangers into brothers, and an exchange of women in marriage commonly followed, thus creating affines. An additional link could be established by the adoption of children. What Pomponio refers to as 'Mandok concepts of personal investments in people' (1983:181) were thus brought into operation as a means of acquiring a group of people on whom a man could rely for support in various prestige-enhancing enterprises.

The importance of these trade partnerships is illustrated by the strict etiquette observed by partners (Harding 1967:166). Haggling over prices was not acceptable, and gifts had to be accepted graciously. Stealing of trade partners or undercutting of prices were likewise serious offences, while an underlying general principle of reciprocity avoided undue advantage being taken of the situation. The observance of this code of ethics suggests that the maintenance of amicable trading relationships

was considerably more important than insisting on the most beneficial rates of exchange. It is thus postulated that after the Austronesian-speaking migrants arrived in North-East New Guinea, their complete decimal numeral set became redundant in the social and economic context in which they found themselves. This could account for the regression of numeral series which appears to have taken place in the Austronesian languages of Morobe investigated here.

## CONCLUSION

What began as data collection for the Indigenous Mathematics Project ended up as a historical linguistic conundrum : the reasons for the apparent regression of numeral series in the Morobe Austronesian languages.

The data presented here indicate that throughout the area under investigation, a system of counting involving tallying and the use of two, three or at most four numeral words was traditionally the predominant method of reckoning. Those languages which have a greater repertoire of numeral words tend to be coastal Austronesian languages of the Vitiazan sub-family, and the implication is that these languages are relatively recent arrivals in North-East New Guinea. However, the extent of the numeral series in these languages is small compared with series that have been reconstructed for the ancestral proto-Austronesian and proto-Oceanic languages.

A consideration of the social, cultural and economic context of counting in this area suggests that a complex abstract counting system was not needed for successful participation in most aspects of traditional life. Although formal ceremonies of exchange were significant cultural events, visual aspects of display were more important than abstract measures of quantity. Even in the more sophisticated trading systems of the Vitiaz Strait communities, computation of favourable exchange terms and exact enumeration of totals appeared to be secondary considerations. Social factors such as the maintenance of harmonious trade relationships were vital to ensure the supply of essential commodities and expand kin networks in the incessant pursuit of prestige.

It is therefore suggested that in this cultural milieu the means of computing exact totals and manipulating abstract amounts became redundant. Redundancy led to atrophy of the complete decimal series, and hence the counting systems of the Austronesian-speaking arrivals in North East New Guinea progressively came to resemble those of their non-Austronesian-speaking neighbours. The greater the penetration of Austronesian-speakers inland, the closer the resemblance became. More recently, the demands of a money-oriented economy have brought about the widespread adoption of Tok Pisin numerals for most non-traditional purposes.

## APPENDIX A

### COUNTING DATA FOR MOROBE LANGUAGES

Counting data are presented for the languages of Morobe in the order they appear in McElhanon's classification described in section 2.2.2. Thus the Austronesian languages are described first, followed by the non-Austronesian languages.

The data mostly consist of broad phonetic transcriptions of verbal responses. Since the primary purpose is to determine the kind of counting method employed, a narrower and more precise phonetic transcription was not considered to be essential. There will therefore be occasional deviations from the standard orthographies which may have been devised for some of the languages. Where data are

wholly based on written information from linguists, the orthography adopted by them has been used, and this has been indicated.

Two special symbols have been employed here. The symbol ə represents an unaccented neutral vowel, rather like the final sound in the English word 'teacher'. The symbol c is a glottal stop.

Translations of vernacular terms are only given where they mean something other than a numeral, such as a description of tallying. Where the meaning is considered to be obvious, such as reduplication of a previous term, the translation is omitted. In some cases, the exact meaning of terms could not be elicited, and this is indicated where it occurs.

## PART ONE: AUSTRONESIAN LANGUAGES

### 1. BUKAUAC

This Austronesian language is classified by McElhanon (1984) as belonging to the Huon Gulf group of the Vitiazan Sub-Family of the Siassi family. It is spoken in 32 villages in coastal areas on the south of the Huon Peninsula, and is one of the province's larger languages, with nearly 10,000 speakers. However, in spite of its size and the fact that it is spoken close to the provincial headquarters, Lae, very little linguistic research has been done on the language. Much more research has been carried out on the related Yabim language, although how closely the latter is related to Bukauac is not clear.

The following counting system was compiled from information from a number of informants.

1	<i>tigen</i>	
2	<i>lu</i>	
3	<i>to</i>	
4	<i>hale</i>	
5	<i>lim dang</i>	five one
6	<i>lim dang ngando tigen</i>	five one and one
7	<i>lim dang ngando lu</i>	
8	<i>lim dang ngando to</i>	
9	<i>lim dang ngando hale</i>	
10	<i>sahuc</i>	
11	<i>sahuc ngando tigen</i>	ten and one
12	<i>sahuc ngando lu</i>	
13	<i>sahuc ngando to</i>	
14	<i>sahuc ngando hale</i>	
15	<i>sahuc ngalim</i>	
16	<i>sahuc ngalim ngando tigeng</i>	
17	<i>sahuc ngalim ngando lu</i>	
18	<i>sahuc ngalim ngando to</i>	
19	<i>sahuc ngalim ngando hale</i>	
20	<i>ngac sambuc</i>	one man complete
21	<i>ngac sambuc ngando tigeng</i>	
30	<i>ngac sambuc ngac sahuc</i>	
31	<i>ngac sambuc ngando sahuc ngando tigeng</i>	
40	<i>ngac lu</i>	

50	<i>ngac lu ngasahuc</i>
100	<i>ngac lim dang</i>

There were some variations recorded for different informants in different villages. As well as some form of *tigeng* for 'one' (e.g. *tikeng*, *tigen*, *tegend*), the word *dang* was also used. *ulu* was a variant of *lu* for 'two', and 'three' was variously *to*, *tu*, *tur* and *tou*. The commonest expression for 'five' was some variation of *limdang*, but the word for 'hand' was given as *amang*. Some informants gave 'five' as *amang dang* or *emandang*. *sahuc* appears to be a distinct numeral word for 'ten' although other versions were given such as *amanglu* 'two hands' or *lambalu* 'fives two', and even as *amangdan* 'one hand' where 'five' had been given as *lemdan*. This confusion was also seen in words for '20', where *sahucdang* was sometimes used where 'ten' had been designated 'two fives' or 'two hands'. The commonest form of '20' was derived from 'one man' or 'whole man', *ngac sambuc* or *ngac dang*.

Thus the base of the system appears to be 20, with sub-bases of ten and five and separate numerals for one to four.

## 2. KAIWA

This is another Huon Gulf Group language spoken by just under 1,000 in five villages in the mountains behind the coast south of Lae. The language is sometimes known as Iwal. The following counting system was obtained from informants in Lae.

1	<i>dongke</i>	
2	<i>ailu</i>	
3	<i>aitol</i>	
4	<i>aivat</i>	
5	<i>bage tavlu</i>	hand half
6	<i>bage tavlu ano dongke</i>	hand half and one
7	<i>bage tavlu ano ailu</i>	
8	<i>bage tavlu ano aitol</i>	
9	<i>bage tavlu ano aivat</i>	
10	<i>bage isgabu</i>	hands full
15	<i>bage isgabu vatavlu</i>	hands full leg one
16	<i>bage isgabu vata lu ano dongke</i>	
20	<i>buni apmol til</i>	whole man one

An alternative for '20' was *bage isgabu be va isgabu*, that is 'hands complete, legs complete'. The system thus appears to be base 20 system based on a complete set of human digits with numerals for one to four. The word for five is the same as hand, and there is no separate word for ten. Numerals two to four appear to be cognate with the Proto-Oceanic terms.

## 3. KELA

This is another Huon Gulf Group Austronesian language spoken by nearly 3,000 people in ten coastal villages around Salamaua south of Lae.

The following counting system was obtained from informants in Lae.

1	<i>tunome</i>
2	<i>lua</i>
3	<i>tarawa</i>
4	<i>nga</i>
5	<i>lita</i>
6	<i>lita mangonua</i>
7	<i>lita mangolua</i>
8	<i>lita manga tarawa</i>
9	<i>lita mango nga</i>
10	<i>taomo</i>

Variations are *tamunua* for 'one' and *taumen* for 'ten'. The data are rather incomplete but suggest a system similar to the previous two languages with numerals for one to four, a base numeral five and another for ten. The word for 'hand' was given as *mange*, which is not the same as the word *lita* for 'five', but it is not clear if a form of *mange* is present in the expressions, for example *lita mango lua*. The word for 'and' was given as *mangi*. Hooley (1971) gives the word *taube* for 'ten', again a separate numeral term distinct from a tallying description.

#### 4. LABU

This is a Huon Gulf Group Austronesian language spoken in three villages to the south of the mouth of the Markham River near Lae. Neglected by linguists for many years, some grammar sketches have recently appeared (Siegel 1984, Siegel and Kamake n.d.).

A counting system assembled from data provided by a number of informants is as follows:

1	<i>tugwatu</i>	
2	<i>salu</i>	
3	<i>sidi</i>	
4	<i>suha</i>	
5	<i>maipi</i>	
6	<i>maipi anendi tugwatu</i>	five and one
7	<i>maipi anendi salu</i>	
10	<i>numusu</i>	
11	<i>numusu anendi tugwatu</i>	ten and one
15	<i>numusu anendi maipi anendi</i>	
16	<i>numusu anendi maipi anendi tugwatu</i>	
20	<i>asamuni</i>	
30	<i>asamuni numusu</i>	
40	<i>asamu salu</i>	
50	<i>asamu salu numusu</i>	
60	<i>asamu sidi</i>	

The system has separate numerals for one to four with five also a numeral distinct from the word hand, although *maipi* could be derived from *nama ipi* meaning 'hand half'. Whatever the derivation, it appears to be used as a numeral rather than a literal description of a tallying process. Similarly the word for 20 appears to be used as a numeral although it too could possibly be derived



from 'man whole one'. There is a distinct numeral for ten, and multiples of ten and 20 can be formed quite easily.

An alternative system described '30' as *asamusidi* and '40' as *asamusuha*. It is not clear if this is actually used or was described in error, but is similar to an alternative system described for Lukep where higher numbers proceed by tens instead of twenties.

## 5. LAE

This is an apparently dying language reported by McElhanon to be spoken by less than ten old people in Kamkumung and Butibam villages in Lae. No informants could be located, and, as a result, no data are available. It is possible that the language is already extinct.

## 6. NUMBAMI

This Huon Gulf Group language spoken in a single village, Sipoma, by about 300 people, has been investigated by Bradshaw (1978b). The counting system has been described by informants as follows:

1	<i>sesemi</i>	
2	<i>lua</i>	
3	<i>tori</i>	
4	<i>wata</i>	
5	<i>nima teula</i>	hand half
6	<i>nima teula ano sesemi</i>	
10	<i>nima besua</i>	hands together
11	<i>nima besua ano sesemi</i>	
15	<i>nima besua ae teula</i>	hands together, legs half
16	<i>nima besua ae teula ano sesemi</i>	hands together, legs half and one
20	<i>tamota te</i>	man one
21	<i>tamota te ano sesemi</i>	
30	<i>tamota te nima besua</i>	
35	<i>tamota te nima besua ae teula</i>	
40	<i>tamota lua</i>	
50	<i>tamota lua nima besua</i>	
60	<i>tamota tori</i>	
80	<i>tamota wata</i>	
100	<i>tamota nima teula</i>	

As in other languages in the Huon Gulf Group, there are separate numerals for one to four. The word for five appears to be the same as that for hand, and there is no word for ten, the expression meaning 'hands together' being used. Counting proceeds on the digits of the feet as far as 'one man' for 20. Higher numbers involve repetition of this on 'another man'.

## 7. YABIM

The last member of the Huon Gulf Group languages is spoken as a first language by about 2,000 people in seven villages close to Finschhafen. However, Yabim was adopted as a lingua franca by the Lutheran Church for use in coastal areas and is used actively by about 25,000 people, while there are probably somewhat more with a passive knowledge of the language (Renck 1977b:852). A Yabim-German dictionary was published in 1917 by Zahn, and the numerals one to five are contained in it, although the counting system is not described in detail. The counting system from a variety of informants is as follows.

1	<i>tageng</i>	one only
2	<i>luagic</i>	
3	<i>tiliac</i>	
4	<i>acle</i>	
5	<i>lemengteng</i>	one hand
6	<i>lemengteng ngano ta</i>	
7	<i>lemengteng ngano luagic</i>	
10	<i>lemenglu</i>	
11	<i>lemenglu ngano ta</i>	
15	<i>lemenglu ngano lemengteng</i>	
16	<i>lemenglu ngano lemengteng nganu ta</i>	
20	<i>ngacsamuc teng</i>	one man
30	<i>ngac samuc teng ma nga lemenglu</i>	whole one and hands two
40	<i>ngac samuc luagic</i>	
60	<i>ngac samuc tiliac</i>	

Separate numerals for one to four are found. The word for five appears to be the same as that for hand, with the suffix *teng*, which means 'one'. Ten is 'fives two', while 15 is 'fives two and five'. Twenty was either described as 'one man' or 'fives two and fives two'. Thus there are fewer numeral words than in some other languages of the Huon Gulf Group and counting seems more closely associated with the hands. The word *treia* was given by some informants for 'three', and at first sight this would appear to be a version of the English 'three' or Tok Pisin *tripela*. However, it could merely be an alternative pronunciation of *tiliac* and related to the Proto-Oceanic *\*tol*.

## 8. BARIM

This language belongs to the Island Group of the Vitiazan Sub-Family of the Siassi Family of Austronesian languages. It is spoken in three villages on the west coast of Umboi Island. The language spoken in some villages on the north coast of the Huon Peninsula was previously included with this language, but has since been distinguished as comprising the Malasanga language (McElhanon 1984).

The following counting data were provided by an informant from Barim village:

1	<i>ta</i>
2	<i>ru</i>
3	<i>tol</i>
4	<i>pang</i>
5	<i>lim</i>

6	<i>lim be ta</i>	
7	<i>lim be ru</i>	
10	<i>sangul</i>	
11	<i>sangul be ta</i>	
12	<i>sangul be ru</i>	
13	<i>sangul be tol</i>	
14	<i>sangul be pang</i>	
15	<i>sangul be lim</i>	
20	<i>tamota</i>	man one
30	<i>tamota sangul</i>	
40	<i>tamotru</i>	
50	<i>tamotru sangul</i>	
60	<i>tamotol</i>	

One informant gave the word *dingding* for '100'. This system generally agrees with the data obtained by Chinnery on his 1926 patrol to Umboi, although his spelling differs.

#### 9. LOKEP

This is an Island Group Austronesian language spoken in the Morobe Province in four villages on Tolokiwa Island in the Vitiav Strait, and also in the Madang Province on Long Island. The counting system proceeds as follows:

1	<i>atul</i>	
2	<i>ru</i>	
3	<i>tol</i>	
4	<i>pai</i>	
5	<i>lim</i>	
6	<i>lim be atul</i>	
7	<i>lim be ru</i>	
10	<i>sangaul</i>	
11	<i>sangaul be atul</i>	
12	<i>sangaul be ru</i>	
15	<i>sangaul be lim</i>	
19	<i>sangaul be lim be pai</i>	
20	<i>tamod</i>	man
40	<i>tamod ru</i>	

Counting can proceed then by twenties. However, there also seems to be the influence of an underlying ten-base, as some informants described '30' as *tamod tol*, '40' as *tamod pai*, instead of '60' and '80' as would be expected. Other informants described '20' as *sangaul ru*, '30' as *sangaul tol* and '40' as *sangaul pai*. The word for 'hand' in Lukep is *bene*, not related to the word for five.

## 10. MALASANGA

This Island Group language is spoken in three villages on the north coast of the Huon Peninsula. It was formerly grouped with Barim (No.8), but it has since been recognised that it is a distinct language (McElhanon 1984).

Counting data from an informant in Kiara village are as follows:

1	<i>ta</i>	
2	<i>rua</i>	
3	<i>tol</i>	
4	<i>pange</i>	
5	<i>bayerta</i>	hand one
6	<i>bayerta takes</i>	hand one, one and
7	<i>bayerta rukes</i>	hand one, two and
10	<i>bayer rua</i>	hands two
11	<i>bayer rua takes</i>	hands two, one and
15	<i>bayer rua bayerta</i>	hands two, hand one
16	<i>bayer rua bayerta takes</i>	hands two, hand one, one and
20	<i>kurupta</i>	man one

Lincoln (1976) in his Rai Coast survey at Malasanga village records 'five' as *bagerda* and 'ten' as *baer rua*, but otherwise the terms are very similar.

In Singorokai village an informant used the following words, indicating a considerable dialect difference.

1	<i>tanuku</i>
2	<i>dua</i>
3	<i>ton</i>
4	<i>tantan</i>
5	<i>bagera ta</i>
20	<i>kurap ta</i>

This generally agrees with Lincoln's Singorokai data.

## 11. MANGAP

This is an Island Group language spoken in six villages on the eastern portion of Umboi Island and the only village on Sakar Island. Data from informants were virtually the same as those collected by the government anthropologist Chinnery on a patrol in 1926 and may be summarised as follows:

1	<i>ta</i>
2	<i>ru</i>
3	<i>tel</i>
4	<i>pang</i>
5	<i>lamata</i>
6	<i>lamata mi ta</i>
7	<i>lamata mi ru</i>
10	<i>lamuru</i>
11	<i>lamuru ta</i>

15	<i>lamuru mata</i>	
16	<i>lamuru mata ta</i>	
19	<i>lamuru mata pang</i>	
20	<i>tamota</i>	man one
21	<i>tamota ta</i>	
22	<i>tamota ru</i>	
40	<i>tomtoru</i>	two men

As with previously described systems, some informants gave 'ten' as *tamota* implying some confusion between bases of ten and 20. The word for 'hand' is *nomong*, different from the word for five.

## 12. NENGAYA

This is a small Island Group language spoken by about 300 people in Nineia, Buala and Boneia villages on the north coast of the Huon Peninsula. Data obtained is inconsistent, with three different systems described by two of my informants and Lincoln's (1976) Rai Coast data. One informant described counting as follows:

1	<i>taininau</i>	
2	<i>lua</i>	
3	<i>lua hilia</i>	
4	<i>lua di lua di</i>	
5	<i>lua di lua di hiliandina</i>	
6	<i>lua di lua di lua di</i>	
7	<i>lua hiliandi lua hiliandi taininau</i>	
10	<i>laingtela laingtela suplo</i>	half half finished (2 hands)

An alternative to six was given: *lua hilia lua hilia* 'two one two one'. In this system there are only two numeral words and all higher numbers are combinations of these with ten indicated as a complete number of fingers. Another informant described a system with three numeral words:

1	<i>tainina</i>	
2	<i>lua</i>	
3	<i>tua</i>	
4	<i>luang lua</i>	2 + 2
5	<i>luang lua hiliano</i>	2 + 2 + 1
6	<i>tuang tua</i>	3 + 3
7	<i>tuang tuang hiliano</i>	
8	<i>umana</i>	

Hands were not used here, higher numerals being combinations of the words for two and three. *umana* was repeated for numbers above seven and appeared to mean something like more or the rest.

Lincoln's data also give the word for three, but his informants used hands and feet in counting:

1	<i>utitidzi</i>
2	<i>lua</i>
3	<i>tuwa</i>
4	<i>lua lua</i>

5	<i>lua lua hilia</i>	2 + 2 + 1
6	<i>rimara tainina kisi haitaino</i>	
7	<i>kisi lua</i>	
10	<i>rimara lua</i>	
11	<i>kisi tainina</i>	leg one
20	<i>lipu tainina kisi rimana kina</i>	hands and legs of one man

This is somewhat confusing also. The word for hand is not given at five but ten is given as 'two hands'. A third word translated as 'one' is used. Also, the word for 'leg' appears at six, earlier than would appear reasonable. It seems from the contradictions and ambiguities that the traditional system is not well known or in use as a consistent system by speakers of the language.

### 13. ROINJI

This language is spoken by approximately 100 people in Roinji and Darronge villages on the north coast of the Huon Peninsula, and also in the Madang Province in Gali village. Like the previous language, informants were hesitant about the counting system and gave a variety of conflicting responses indicating that the traditional system is not in use very much. All informants agreed that there were only two numerals:

1	<i>tanina</i>	
2	<i>lua</i>	
3	<i>lua ma tenina</i>	2 + 1
4	<i>lua zua lua zua</i>	

After four, some informants continued to count in twos with no further modification while others gave *dimara patena* 'one hand' for five and *dimara paten lua* 'two hands' for 10. I was unable to elicit counting as far as 20 from a number of informants on different occasions, but Lincoln (1976) records 20 as *limu tenina dimana keena* 'hands and feet of one man'.

### 14. SIO

This Island Group language is spoken by approximately 2,000 people in three villages in the vicinity of Sio Island off the north coast of the Huon Peninsula. The counting system described by a number of informants is as follows:

1	<i>taitu</i>	
2	<i>rua</i>	
3	<i>ngato</i>	
4	<i>ngapa</i>	
5	<i>lima</i>	
6	<i>lima kanango taitu</i>	
7	<i>lima kanango rua</i>	
10	<i>sangao</i>	
11	<i>sangao kanango taitu</i>	
15	<i>sangao kanango lima</i>	
19	<i>sangao kanango lima kanango ngapa</i>	
20	<i>tamota taitu</i>	man one

21	<i>tamota taitu kanango taitu</i>
30	<i>tamota taitu kanango sangao</i>
40	<i>tamota rua</i>
60	<i>tamota ngato</i>

Two informants only gave an expression for 100 and in each case gave *tamota sangao* which is '20 x 10' rather than *tamota lima*, or '20 x 5'. This is another example of a confusion of ten and 20 as bases.

#### 15. TAMI

This Island Group language is spoken by about 1,000 people on the Tami Islands off the south-eastern tip of the Huon Peninsula and in Malasiga and Tamigedu villages on the mainland. The counting system obtained from a number of informants is as follows:

1	<i>te</i>
2	<i>lu</i>
3	<i>tol</i>
4	<i>pat</i>
5	<i>lim</i>
6	<i>lima timong</i>
7	<i>limalu</i>
8	<i>limatol</i>
9	<i>limapat</i>
10	<i>limandalu</i>
11	<i>limandalu ma timong</i>
15	<i>limanda lu ma lim</i>
17	<i>limandalu ma limalu</i>
20	<i>taumonde</i>
21	<i>taumonde ma timong</i>

There are separate numerals for one to five, but no word for ten. Twenty is based on the expression 'one man'.

#### 16. GITUA

This language has recently been reclassified (McElhanon 1984) as a member of the Bariai Sub-Family, and is spoken in a single village on the north-east coast of the Huon Peninsula. The counting system has been described as follows:

1	<i>eze</i>	
2	<i>rua</i>	
3	<i>tolu</i>	
4	<i>pange</i>	
5	<i>nimanda sirip</i>	hand half
6	<i>nimanda sirip wolo eze</i>	hand half and one
7	<i>nimanda sirip wolo rua</i>	
10	<i>nimanda rua</i>	hands two

11	<i>nimanda rua wolo eze</i>	hands two and one
15	<i>nimanda rua agenda sirip</i>	hands two, leg half
16	<i>nimanda rua agenda sirip wolo eze</i>	hands two, leg half and one
20	<i>ongere eze</i>	man one
30	<i>ngero eze nimanda rua</i>	man one, hands two
40	<i>ngero rua</i>	men two
60	<i>ngero tolu</i>	men three
80	<i>ngero pange</i>	men four
100	<i>ai eze</i>	

The use of a distinct word for 100 is a notable feature here. Some informants gave 20 as *nimanda rua agenda rua*, 'hands two, legs two', while an alternative to *nimanda sirip* for 'five' was *lima*. The tally total *nimanda rua agenda rua*, 'two hands two legs' was reported to be used to equal two kina when counting money. Lincoln's (1976) data from the Rai Coast survey are roughly the same as I have obtained, except that he records 'and' as *gole* in place of *wolo*, and uses a different expression for the numerals 11 to 19, e.g. '11' *gole agenda nggangga eze*. The meaning of *nggangga* here is 'finger/toe' (Lincoln personal communication).

## 17. MUTU

This Bariai Sub-Family language is spoken in the original Siassi Islands, a group of small islands off the south coast of Umboi Island. The name Siassi is now used to describe the whole area including Umboi Island. There are approximately 2,000 speakers on the islands of Mandok, Tuam, Aramot, Malai and Mutu-Malau. A counting system derived from a number of informants is as follows:

1	<i>es</i>	
2	<i>ru</i>	
3	<i>tol</i>	
4	<i>pang</i>	
5	<i>lim</i>	
6	<i>lim be es</i>	
7	<i>lim be ru</i>	
10	<i>sanggul</i>	
11	<i>sanggul be es</i>	
12	<i>sanggul be ru</i>	
15	<i>sanggul be lim</i>	
16	<i>sanggul be lim be es</i>	
19	<i>sanggul be lim be pang</i>	
20	<i>tamot es</i>	man one
21	<i>tamote be es</i>	
30	<i>tamote be sanggul</i>	
40	<i>tamotru</i>	
60	<i>tamotol</i>	
100	<i>tamot lim</i>	
200	<i>tamot sanggul</i>	
400	<i>ndingnding</i>	



Some informants omitted the conjunction *be*, for example expressing '11' as *sanggul es*. Others used *ve* in place of *be*, and *sanggavul* or *sanggawul* in place of *sanggul*.

A notable feature of this system is the existence of a named higher power, in this case twenty squared. The anthropologist Alice Pomponio notes (personal communication) that this is not a recent introduction and has a practical basis, the number 20 times 20 being an adequate quantity of vines to make a large dugong net. *ndingnding* is said to be translated by informants as '100' and may be used rather loosely to mean an indefinite large number. Father Anton Mulderink, a long time resident of Mandok Island observes (personal communication) that when counting taro for a feast the following system is used. Taros are first bunched together in fives, each group of five being known as *ndir*. These bunches are then counted up to 20 making a pile known as *ndingnding*, consisting of '20 x 5' or 100 taro. These *ndingnding* may also be counted up to 20, making a pile of '20 x 20 x 5' or 2,000 taro. This bunch is considered to be enough for a good feast or *singsing* and is also known as *ndingnding*. Presumably the distinction between large and small *ndingnding* becomes apparent from the context.

#### 18. DANGAL

This language is classified by McElhanon as belonging to the Lower Watut Sub-Family of the Adzera Family of Austronesian languages. It is spoken in three villages in the Lower Watut area. Information from a single informant in Lae is sketchy:

1	<i>takanan</i>	
2	<i>suruk</i>	
3	<i>suruk aru wangin</i>	
4	<i>suruk a suruk</i>	
5	<i>bangi takanan</i>	one hand
6	<i>bangi takanan ru wangin</i>	one hand and another
7	<i>bangi takanan ru suruk</i>	
8	<i>bangi takanan ru suruk aru wangin</i>	
9	<i>bangi takanan aru suruk a suruk</i>	
10	<i>bangi suruk</i>	

The informant could not proceed further. It appears that there are only two numerals, counting thence proceeding by addition and the use of hands. The word *wangin* seems to be a general term for 'other' rather than an alternative form of 'one'.

#### 19. MARALANGO

This language belongs to the Lower Watut Sub-Family and is spoken by about 200 people in two villages in the Lower Watut area. No informants were contacted, and the only information available is from Fischer's ethnographic account *Watut* (1963:225).

1	<i>taganangk</i>	
2	<i>serok</i>	
3	<i>serok a wangin</i>	
4	<i>serok a serok</i>	
5	<i>nga bangge</i>	one hand

As far as it goes, this system is almost identical to that described by the informant from Dangkal. There are two numerals and counting proceeds on the hands.

## 20. SILISILI

This language is the third member of the Lower Watut Sub-Family, spoken in seven villages in the Lower Watut area. The only information available is from Fischer (1963:225) taken from Uruf village.

1	<i>bicits</i>	
2	<i>siruc</i>	
3	<i>siruc a bicits</i>	
4	<i>siruc a siruc</i>	
5	<i>biangke haits</i>	one hand

This is similar to the other two Lower Watut languages, with two numerals and the use of hands. However, the words used for one and two more closely resemble those of Markham Sub-Family languages. Hooley's (1971) list gives the following forms:

4	<i>seroasero</i>	
5	<i>bangki 'fatse</i>	hand
10	<i>nga bangki sero</i>	hands two

## 21. ADZERA

The Adzera language belongs to the Markham Sub-Family of the Adzera Family according to McElhanon's classification. It is one of the larger language groups in the province, being spoken by over 20,000 people in the Upper Markham Valley around Kaiapit. The language is divided into six separate dialects, Adzrac, Amari, Guruf, Ongac, Tsumim and Yarus spread over about 70 villages.

The counting terms used by several informants from different dialects were fairly consistent:

1	<i>bitsinta</i>	
2	<i>iruc</i>	
3	<i>iruc da bits</i>	2 + 1
4	<i>iruc da iruc</i>	2 + 2
5	<i>iruc da iruc da bits</i>	2 + 2 + 1
6	<i>iruc da iruc da iruc</i>	2 + 2 + 2

Counting higher numbers proceeds in the same manner. Some small variations were recorded. One informant described 'two' as *bisi da bisi*, while others referred to two as *irurun* 'two only'. However, there was a uniform style employing only the two numerals and not using the hands for tallying. One informant said that counting on hands had been introduced and that five could be expressed as *bangi bitsinta* 'hand one', but that this was not common. It does appear, however, in Hooley (1971), where 'five' is translated as 'hand', but 'ten' is translated not as 'two hands', but as *ampi bingan* 'a real lot'.

The limitations of this system may be overcome to some extent for certain purposes. When counting pots, names groups of four or five may be treated as units, and bunches of bananas may likewise be grouped at food presentations.

## 22. NGARIAWAN

This is a language of the Markham Valley Sub-Family spoken in two villages in the Leron River area. Village informants provided the following counting system:

1	<i>bisinta</i>	1 only
2	<i>iru</i>	
3	<i>iru da bits</i>	2 + 1
4	<i>iru da iru</i>	2 + 2
5	<i>iru da bits da iru</i>	2 + 1 + 2
6	<i>iru da bits da iru da bits</i>	2 + 1 + 2 + 1
7	<i>iru da iru da iru da bits</i>	2 + 2 + 2 + 1

This was as far as the informants could go. The system is virtually identical with that for Adzera. The compounds for five and six, 'two and one and two' and 'two and one and two and one' respectively are rather unusual. Like in Adzera, it appears that there are only two numerals.

## 23. SIRASIRA

This is a Markham Sub-Family language spoken in four villages in the Leron River area. Informants from Som and Sirasira villages provided the following data:

1	<i>tangkua</i>	
2	<i>iruk</i>	
3	<i>irikiruk ena tango mangan</i>	two and another one
4	<i>iruk da iruk</i>	2 + 2
5	<i>iruk da iruk a mangan</i>	2 + 2 + 1
6	<i>iruk a mangan iruk a mangan</i>	2 + 1 + 2 + 1

Informants were hesitant and unsure of information, and there was some prompting by a Ngariawan-speaking informant who may have influenced the responses, for example the grouping of 'two and one, two and one' for six rather than 'two and two and two'. The meaning of the expression for three is not altogether clear, but seems to mean something like 'two and another one'. Like Adzera and Ngariawan, there are only two numerals in the system described, and hands were not used.

## 24. SUKURUM

This Markham Sub-Family language is spoken in five villages in the Leron River area. The counting system described by informants at Sukurum village is as follows:

1	<i>bisan</i>	
2	<i>leluk</i>	
3	<i>leluk anga bisan</i>	2 + 1
4	<i>leluk anga leluk</i>	2 + 2
5	<i>leluk anga leluk anga bisan</i>	2 + 2 + 1
6	<i>leluk anga leluk anga leluk</i>	2 + 2 + 2

Further counting was said to proceed in the same manner. Like other members of this family so far described, there are only two numeral words and the hands were not used.

## 25. UNANK

Described by McElhanon as being spoken at Unank village west of the Markham-Leron confluence and belonging to the Markham Sub-Family. Hooley (1971) gives the following word list for the village, here called Onank:

1	<i>bicits</i>	
2	<i>siruc</i>	
3	<i>siruabits</i>	
4	<i>siruasiru</i>	
5	<i>bangke haitsi</i>	hand
10	<i>bangke haitsi babu</i>	

Thus the system has only two numeral words, after which tallying on the hands is carried out.

## 26. WAMPAR

This Markham Sub-Family language is spoken by nearly 5,000 people in eight villages in the Lower Markham area. The following system was compiled from data obtained from a number of informants:

1	<i>oroz</i>	
2	<i>serok</i>	
3	<i>serok oroz</i>	
4	<i>serok a serok</i>	
5	<i>bangid oroz</i>	hand one
6	<i>bangid oroz da oroz</i>	
10	<i>bangid serok</i>	hands two
11	<i>bangid serok da oroz</i>	
15	<i>bangid serok da faud oroz</i>	hands two and feet one
16	<i>bangid serok da faud oroz da oroz</i>	
20	<i>bangid serok da faud serok</i>	hands two feet two

Some informants did not use the hands at five, but continued to count in twos and ones until ten or *bangid serok* 'two hands'. The system involves only two numerals, followed by tallying. Some informants gave *ongan* in place of *oroz*.

## 27. WAMPUR

This is a Markham Sub-Family language spoken by about 300 people in three villages to the west of the Upper Markham. The following data were recorded by S. Holzknecht in Wampur village:

1	<i>bisangcwa</i>	
2	<i>iriciru</i>	
3	<i>iruc a bits</i>	
4	<i>iruc a iruc</i>	
5	<i>bacin marahin sib</i>	hand half
6	<i>bacin marahin bisangcwa</i>	
7	<i>bacin a iriciru</i>	

10	<i>bangcian ditir</i>	hands altogether
11	<i>bacin ditir hagan bisangcwa</i>	hands together leg one
20	<i>garam mangan hagan a bangcian ditir</i>	man one hands and legs together

There are two alternative forms of the word for 'hand'; *bacin* and *bangcian*. The system is similar to others in the Adzera Family languages, with only two numeral words. Tallying on hands and feet takes place after four.

## 28. DUWET

This language, also known as Guwot, belongs to the Busu Sub-Family of the Adzera Family of Austronesian languages. It is spoken in three villages near the headwaters of the Busu River north of Lae. Informants at Lambaip village provided the following counting data:

1	<i>taginei</i>	
2	<i>seik</i>	
3	<i>seik ba ta</i>	two and one
4	<i>seik ba seik</i>	two and two
5	<i>limangga arinang</i>	hand half
6	<i>limangga arinang anau na ta</i>	hand half, another one
7	<i>limangga arinang anau na seik</i>	
10	<i>limang seik</i>	hands two
11	<i>limang seik anau na ta</i>	hands two, another one
15	<i>limang seik ambengga arinang</i>	hands two, leg half
16	<i>limang seik ambengga arinang ta</i>	
20	<i>ambeng seik limang seik</i>	hands two legs two

Thus the system involves only two numeral words and uses hands and feet to tally up to 20.

It is worth noting that informants provided a separate name for the five fingers of the hand. The names were:

<i>linan</i>	thumb
<i>geie</i>	first finger
<i>won</i>	second finger
<i>wirie</i>	third finger
<i>gan</i>	fourth finger

It is interesting to conjecture that this series could have provided the basis for a series of numerals up to five, but these words are not in fact used in counting.

## 29. MUSOM

This language belongs to the Busu Sub-Family and is spoken by about 300 people in two villages east of the Busu River. Village informants provided the following system:

1	<i>munuts</i>
2	<i>siluk</i>
3	<i>siluk da wen</i>
4	<i>siluk da siluk</i>

5	<i>baing lehem</i>	hand half
6	<i>baing lehem da munuts</i>	
8	<i>baing lehem da siluk da wen</i>	
10	<i>baing siluk</i>	two hands
11	<i>baing siluk da munuts</i>	
15	<i>baing siluk da hong lehem</i>	hands two and legs half
20	<i>baing siluk da hong siluk</i>	hands two legs two

The counting system has only two numeral words and uses the hands and feet to tally to 20.

### 30. SIRAK

This language, which belongs to the Busu Sub-Family is spoken in a single village, Banzain, which is a short distance from Boana. The language was named Nambom or Nafi by village informants who provided the following counting data:

1	<i>urus</i>	
2	<i>siruk</i>	
3	<i>siruk awen</i>	
4	<i>siruk de siruk</i>	
5	<i>baing lafen</i>	hand half
6	<i>baing lafen urus</i>	
10	<i>baing suruk</i>	hands two
11	<i>baing siruk urus</i>	
14	<i>baing siruk siruk da siruk</i>	
15	<i>baing siruk siruk da siruk da urus</i>	

Informants did not proceed to the legs, although this may take place. There are only two numerals with tallying on the hands.

### 31. YALU

This language is spoken only at Yalu village and is the last member of the Busu Sub-Family. I was told by a number of informants in different villages that Yalu, Musom and Sirak constitute a single language and that the dialects are mutually intelligible, but this has not been confirmed with any independent evidence. Village informants provided the following counting data:

1	<i>uruts</i>	
2	<i>siruc</i>	
3	<i>siruc aruts</i>	
4	<i>siruc siruc</i>	
5	<i>pangging lefen</i>	hand half
6	<i>pangging lefen nitsin uruts</i>	hand half and one
7	<i>pangging lefen nitsin siruc</i>	
10	<i>pangging siruc</i>	
15	<i>pangging siruc ofong menen</i>	hands two foot one
20	<i>pangging siruc ofong siruc</i>	hands two feet two

This is very similar to the previous system (Sirak) with two numeral words and using the hands for tallying. In addition the feet are used to reach 20.

### 32. KAPIN

This language belongs to the Buang Family of Austronesian languages. It is spoken in five villages in the Mumeng area. Village informants provided the following data:

1	<i>ti</i>	
2	<i>yu</i>	
3	<i>yal</i>	
4	<i>vei</i>	
5	<i>lim</i>	
6	<i>lima sakti</i>	
7	<i>lima sakayu</i>	
10	<i>omin</i>	
11	<i>ome tentem ti</i>	ten and one
12	<i>ome tentem yu</i>	
16	<i>ome tentem ti</i>	
20	<i>mepie ti</i>	

The information above is a little confusing. It is not clear if the word *omin* is unequivocally the numeral 'ten' or if it means something else. The linguist Linda Lauck (personal communication) considers that *gomeng pu*, alternatively used for ten means 'person above', that is the upper part of the body indicating hands complete. Likewise the meaning of the expression for '11' *onme tentem ti* is not completely clear, and although it seems to mean 'ten and one', the term for '16' is identical. While iterating the words from 11 to 15 the informants counted on the toes of the right leg, and changed to the left leg for 16 to 19, the terms for which are identical. *mepie ti* appears to mean 'one something' but the informant would only give the meaning 'hands and legs'. *kiramong* was given as an alternative to *ti* for 'one'. Lauck (personal communication) records a different system where four is given as *ba lu* or 'half', with five as *ba lu ma sek ti* or 'half and cross to one'. This appears to use the fingers of the hands without the thumbs, but the informant using this system still gave the completed hands as ten. *ba lu* is rather similar to the Mapos *lumbalu* for four meaning 'two and two'.

In summary, the system appears to have distinct numerals for one to five with the status of ten unclear. Higher numbers involve tallying on the hands and legs. There is some evidence for the alternative use of a base of four. In Hooley's (1971) lists, 'ten' is translated as *yu ming*, which seems to be two of something, possibly halves of the hands.

### 33. MANGA

This language of the Buang Family is spoken in eight villages in the Mumeng area. The following data were provided by village informants, and meanings and orthography checked by the linguists Joan Healy and Roma Harwick of the Summer Institute of Linguistics, who were working in the area.

1	<i>ti</i>	
2	<i>yuuh</i>	
3	<i>yaar</i>	
4	<i>yumbeyuuh</i>	two and two
5	<i>nama vaalu</i>	hand one side
6	<i>nama vaaluh windak ti</i>	hand one side and one
10	<i>nama yuuh</i>	hands two
11	<i>nama yuuh ambe windak ti</i>	hands two add and one
15	<i>name yuuh ambe windak nama vaalu</i>	hands two add hand one
20	<i>doti</i>	whole person one

Here it can be seen that there are numerals for one to three. Four is not a separate word but the expression 'two and two' is used. The expression for five means 'one hand' and hands are used thereafter to tally 'one whole person' or 20.

### 34. MAPOS

This is a relatively large language belonging to the Buang Family spoken by about 7,000 people in 21 villages around the Buang River area east of Mumeng. There are two dialects, Mapos and Mambump. The following data were assembled from information provided by Mapos speakers in Lae.

1	<i>ti</i>	
2	<i>lu</i>	
3	<i>lal</i>	
4	<i>lumbalu</i>	two and two
5	<i>orund vandu</i>	hand half
6	<i>orund vandu mbti</i>	hand half and one
10	<i>orundluo</i>	hands two
11	<i>orundluo mbti</i>	
15	<i>orundluo mb varang dwadu</i>	hands two, foot half
20	<i>miran dadu sti</i>	complete person one

There were considerable variations from different informants. An alternative for five was *n'madvai*, apparently meaning 'hand half', or *oronvalu*. Ten was also expressed as *orondroho* or *n'madluho*, apparently meaning something like 'hand complete'. Alternatives for 20 were *orondroho vahandroho* 'hands and legs complete' and *mahoda histi*, whose meaning is obscure.

Common to the above variations is a system with three numeral words and using the hands or hands and feet for tallying up to 20. Hooley's account of counting among the Central Buang (1978) describes a similar system proceeding as far as *mehodahis nemadvahi*, equivalent to 'five complete people' or '100'. In the same account, it is noted that a birth order series for both male and female children as far as eight is in use.



## 35. MUMENG

This is another large language in the Buang Family consisting of a chain of six dialects spoken by about 7,000 people in 25 villages in the Mumeng area. Counting data were provided by village informants and further information from the linguists Linda Lauck and Karen Adams has been used.

1	<i>ti</i>	
2	<i>yuu</i>	
3	<i>yon</i>	
4	<i>yuudiyuuu</i>	two and two
5	<i>vige vilu</i>	hands half
6	<i>vige bilu di sec ti</i>	hands half and cross over one
10	<i>vige yuu</i>	hands two
11	<i>vige yuu vaga yuu</i>	hands two foot one
15	<i>vige yuu vaga vilu</i>	hands two feet half
20	<i>vige yuu vaga yuu</i>	hands two feet two

Lauck states (personal communication) that there is a word for 'four' in some dialects which is *mentenau* or *mendeng*. 'Two hands' or 'ten' may be expressed *nema lu* in dialects where the word for 'hand' is *nema*. Some informants are said to give the total *gomeng* or 'one man' at ten rather than 20, and the usual expression for '20' is *kehe ti* meaning 'one base or source'. Hence '40' is expressed *kehe yuu* and there is also an expression for '100', *yul ti*, which means literally 'one bag or sack'. Lauck comments (personal communication) that for the Patep dialect, numbers one to ten and round numbers are frequently expressed in the vernacular, especially by older people, whereas Tok Pisin may be used especially by younger people and for the more cumbersome expressions.

## 36. PIU

This is a small Buang Family language spoken in a single village, Piu, west of Mumeng. The following counting data were provided by informants in Bulolo:

1	<i>tika</i>	
2	<i>lu</i>	
3	<i>yan</i>	
4	<i>ndalu</i>	
5	<i>vate</i>	hand one
6	<i>serkti</i>	and one
7	<i>serkalu</i>	
10	<i>serkvate</i>	and hand
11	<i>vanggilu da serkti</i>	hands two and one
15	<i>vanggilu da vate</i>	hands two and hand one
16	<i>vanggilu vangavatei tisuk</i>	
20	<i>yuka ti</i>	

At 11 the informant pointed to the toes of one leg and at 16 changed to the other leg. *yuka ti* appears to mean 'one whole man or set of digits'. Hence the system described has words for one to three, thereafter using hands and feet to tally to 20. It is not clear whether the expression for four is a distinct numeral. It is similar to the Kapin *balu* described as 'half' but could also be derived from an

expression meaning 'two and two', *lu nda lu*. Hooley's (1971) data give the expression *banggi lu* 'hands two' for ten.

## 37. VEHES

The last of the Buang Family languages is a small language spoken by about 100 people in a single village, Buissi, on the Buissi River south of Lae. Data from Hooley's (1971) wordlists are as follows:

1	<i>timu</i>
2	<i>uy</i>
3	<i>yar</i>
4	<i>nyekuy</i>
5	<i>nəma baru</i>
10	<i>nəma yin</i>

There are thus either three or four distinct numerals depending on whether the term for four is considered to be formed from 'two and two' or not. Words for five and ten appear to be related to hand tallying.

## 38. HOTE

This language belongs to the Hote Family of Austronesian languages. It is the largest of the three languages in the family, being spoken by about 1,500 people in seven villages in the mountains west of Salamaua. The other two languages in this family, Misim and Yamap, may possibly be dialects of Hote. The following information was provided by Hote speakers in Lae and supplemented by explanations by Marguerite Muzzey, a linguist working in the area.

1	<i>tom</i>	
2	<i>lokuangyu</i>	
3	<i>lokuanglu</i>	
4	<i>lokuangva</i>	
5	<i>bahengvi</i>	hand half
6	<i>bahengvi lahavu te</i>	hand half including one
7	<i>bahengvi lahavu yu</i>	
10	<i>lauming</i>	
11	<i>lauming ba lahavu te</i>	
15	<i>lauming ba lahavu bahengvi</i>	
20	<i>bungte</i>	

An alternative for one is *dongtom* meaning 'a single one' and the word *te* is used in compounds. In the expression for two to four, *lokuang* which may be omitted, appears to mean 'bone (of the finger)'. *lahavu* means 'and' or 'including'. *bungte* refers to 'one whole (person)' although the word for man is not the same. Higher numbers can be obtained from this base, for example *bungyu* for '40' or *bunglu* for '60'. It is interesting to note that the word for 'three' is *lu*. *lu* means 'two' in many Austronesian languages. The system, then, has separate numerals for one to four with a word for five meaning 'hand'. There is a separate numeral word for ten. Twenty is a completed

whole representing the tally of digits on a body. Fingers were used in counting even when distinct numerals were used which did not refer to tallying on the hands.

### 39. MISIM

This is a language of the Hote Family spoken by about 250 people in two villages on the north-eastern slopes of Mount Misim. The following data were collected in Lae from informants from Selebop village.

1	<i>tom</i>	
2	<i>zu</i>	
3	<i>lu</i>	
4	<i>va</i>	
5	<i>bahemvi</i>	whole hand
6	<i>bahemvi balahava tom</i>	hand whole and one
10	<i>laumin</i>	
11	<i>laumin balahava tom</i>	
12	<i>laumin balahava zu</i>	
15	<i>laumin bala bahemvi</i>	
20	<i>bongte</i>	

This is very similar to the system described for the previous language Hote. Again the expression *lokuan* may appear as a prefix in the numbers two to four, and similarly there is a separate numeral for ten and a base of 20 meaning 'one whole person'.

### 40. YAMAP

This Hote Family language is spoken by about 1,300 people in four villages in the mountains behind Salamaua. The following incomplete information was provided by an informant in Lae originally from Bodadum village in the Yamap area.

1	<i>tom</i>	
2	<i>yi</i>	
3	<i>lu</i>	
4	<i>va</i>	
5	<i>vagem vi</i>	one hand
6	<i>vagem vi balahava tom</i>	
10	<i>lauming</i>	
15	<i>lauming vagen vi</i>	

The informant used *vagem* for five, which means 'hand' in some of the Buang languages although he gave a different word *bahem* for 'hand' in his own language. The system is almost identical to those of Hote and Misim, with separate numerals for one to four, tallying on the hands and a separate word for ten. As with Hote, the word for 'three' is *lu*, which is more commonly found as the word for 'two' in Austronesian languages.

## PART TWO: NON-AUSTRONESIAN LANGUAGES

## 41. KOVAI

This non-Austronesian language isolate is spoken in 13 villages on Umboi Island. Its exact taxonomic position is not clear, although McElhanon (personal communication) considers the language to be related to Huon Peninsula languages although strongly influenced by neighbouring Austronesian languages. The following counting data were provided by informants on Umboi and in Lae:

1	<i>munugon</i>	
2	<i>lolon</i>	
3	<i>albon</i>	
4	<i>ilon</i>	
5	<i>mili munugon</i>	hand one
6	<i>mili munugon manan munugon</i>	hand one and one
7	<i>mili munugon manan lolon</i>	
8	<i>mili munugon manan albon</i>	
9	<i>mili munugon manan ilon</i>	
10	<i>melalin</i>	
11	<i>melalin manan munugon</i>	
12	<i>melalin manan lolon</i>	
13	<i>melalin manan albon</i>	
14	<i>melalin manan ilon</i>	
15	<i>bab</i>	
16	<i>bab manan munugon</i>	
17	<i>bab manan lolon</i>	
18	<i>bab manan albon</i>	
19	<i>bab manan ilon</i>	
20	<i>riring</i>	
21	<i>riring manan munugon</i>	

An unusual feature here is the word *bab* for '15'. The term for five, *mili munugon* means 'one hand', but there is a separate word for ten not meaning 'two hands'. The word for 20 does not mean 'man' and appears to be a true numeral.

The word for '40' was given by some informants as *riring ilon*, whereas this would be expected to represent 80 or 20 x 4. This confusion between the bases of ten and 20 is similar to that found with many of the Island Group Austronesian languages.

## 42. DEDUA

This language belongs to the Eastern Huon Family, and consists of northern and southern dialects spoken by about 5,000 people in 17 villages in the mountains behind the eastern coast of the Huon Peninsula. The following data are from a speaker of the South Duedua dialect:

1	<i>macgu</i>	
2	<i>jahoc kang</i>	two only
3	<i>harebec</i>	
4	<i>neakpac</i>	

5	<i>mara mong</i>	hand one
6	<i>mara mong nga mocgu</i>	hand one and one
10	<i>mara johoc</i>	hands two
11	<i>mara johoc nga mocgu</i>	
15	<i>mara johoc nga hani mong</i>	hands two and leg one
20	<i>ngic mong</i>	man one

The system thus has separate numerals for one to four, and five is expressed 'one hand'. Hands and feet are used to tally to 20. Twenty may also be expressed *ngi moc* or 'man one'.

#### 43. KÂTE

This language of the Eastern Huon Family was chosen by the Lutheran Mission to be the lingua franca among speakers of non-Austronesian languages. It is spoken by about 25,000 people as a first language in about 30 villages north of Finschhafen. Of the five dialects listed by McElhanon (1984), all except Wemo are virtually extinct. Renck (1977a:844) notes that at the time of its adoption, the Wemo dialect had only 600 speakers, but is now used actively by about 75,000 people, with another 40,000 or so with a passive knowledge.

The following data from the main dialect were assembled from information provided by a number of informants.

1	<i>moc</i>	
2	<i>yayahec</i>	
3	<i>yaheamoc</i>	two and one
4	<i>yahec a yahec</i>	two and two
5	<i>memoc</i>	hand one
6	<i>memoc a moc</i>	hand one and one
10	<i>me yayahec</i>	hands two
15	<i>me yaheamoc</i>	
20	<i>me yahe a yahec</i>	

Alternatively, 15 was expressed *me yayahec a kike moc* or 'hands two and leg one'. The system has only two numeral words, and thereafter uses simple addition of these and tallying on the hands and feet.

#### 44. KOSORONG

This Eastern Huon language is spoken in five villages in the Rawlinson Range south of Pindiu. The traditional system was described by a number of informants:

1	<i>motongo</i>	
2	<i>woic</i>	
3	<i>karong</i>	
4	<i>nemumgac</i>	
5	<i>boromong</i>	hand one
6	<i>boromong ano motongo</i>	hand one and one
7	<i>boromong ano woic</i>	
10	<i>borowoic</i>	hands two

15	<i>borowoic ano kanamong</i>	hands two foot one
20	<i>ezamong</i>	man one

Higher numbers can be expressed as multiples of the tally total, for example 80 is expressed *eza nemungac iyonoc kana boro* or 'four men's hands and feet'. The word *mera* meaning 'side' or 'half' is sometimes added, for example 11 is *boro woic ano kana mera mong* or 'hands two and leg one'. An alternative form of *karong* was given as *karowong*. Some informants did not use a distinct numeral for four, but expressed it *karong mong*, that is 'three one'. One informant expressed four *kembong pa*, meaning 'thumb without', which appears to have been borrowed from the Kube or Yaknge language. Thus there are three or four numeral words and tallying on the hands and feet.

An interesting alternative system was described which seems to be an adaptation of the introduced decimal system:

1	<i>wankembing</i>
2	<i>tukembing</i>
3	<i>tirikembing</i>
4	<i>fololo</i>
5	<i>faingambe</i>
6	<i>sapsap</i>
7	<i>tepelonga</i>
8	<i>hetewe</i>
9	<i>heneroka</i>
10	<i>hetening</i>
11	<i>henareka</i>
12	<i>henembing</i>
13	<i>nemungawong</i>
14	<i>henaru</i>

The earlier numerals are clearly related to the English words, while for others derivations are obscure, especially above ten. This is one of the few examples of vernacular adaptations of English-based numerals encountered.

#### 45. KUBE

This language, also known as Hube, belongs to the Eastern Huon Family and consists of two dialects spoken by about 6,000 people in 25 villages in the Pindiu area. The following counting data were obtained from village informants speaking the Yoanggeng dialect:

1	<i>mocmagu</i>	
2	<i>erehec</i>	
3	<i>harewec</i>	
4	<i>kembong kpac</i>	thumb without
5	<i>meramong</i>	one hand
6	<i>meramong zema mocmagu</i>	one hand and one
10	<i>mera erehec</i>	
15	<i>mera harewec</i>	
20	<i>mera kembong kpac</i>	

Slight variations were recorded for the Kurungtufu dialect. Instead of *erehec*, two was given as the cognate *uluhu* and five or 'one hand' as *mulamung*. Six was expressed as *nuwu ema momago* which appears to mean something like 'one on the other side', and 20 was expressed *imang susu*, or 'one man complete'. Forty was expressed *uluhu iora hana mula* or 'hands and feet of two men'.

Both dialects show a similar system with numerals for one to four and tallying on the hands. The words for two, *erehec* and three, *harewec* are cognate with the Selepet *yogop* and *kalimbu* respectively. Some informants used *gehec nga mong* 'two and one' for three and *gehec nga gehec* 'two and two' for four.

#### 46. MAPE

This language belongs to the Eastern Huon Family and is spoken by about 5,000 people in about 20 villages west of Finschhafen. There are two main dialects. The following counting data were from informants from the Fukac dialect:

1	<i>moketong</i>	
2	<i>yoyoka</i>	
3	<i>yokaomo</i>	two and one
4	<i>yokaoyoka</i>	two and two
5	<i>memoketong</i>	one hand
6	<i>memo a mo</i>	hand one and one
10	<i>meyoyoka</i>	hands two
11	<i>me yoyoka a mo</i>	
15	<i>me yoka a mo</i>	
20	<i>me yoka o yoka</i>	

Alternatives were as follows:

15	<i>meyoyka kifuo mobu</i>	hands two leg one whole
20	<i>ngi mobu</i>	man whole

Both systems involve only two distinct numerals and use the hands for tallying to 20.

#### 47. MIGABAC

The two dialects of this Eastern Huon Family language are spoken in six villages between the Tewae and Masaweng rivers north of Finschhafen. The following information appears to be from the northern dialect:

1	<i>moniang</i>	one only
2	<i>yaekang</i>	two only
3	<i>habakang</i>	three only
4	<i>yahe nga yahe</i>	two and two
5	<i>molemoni</i>	hand one
10	<i>mole yaekang</i>	hands two
15	<i>mole yahe hige moni</i>	hands two leg one
20	<i>ngi mone buc</i>	man whole one

Alternatives for 20 were *mole yae na yae* 'hands four' or *hige mole* 'hands and feet'. There are three numeral words, and hands and feet are used in tallying.

## 48. MOMARE

This is an Eastern Huon Family language spoken in only two villages in the Masaweng River area north of Finschhafen. Village informants provided the following counting data:

1	<i>mongkeangka</i>	one only
2	<i>yaekang</i>	two only
3	<i>araboa</i>	
4	<i>iforec</i>	
5	<i>me mo</i>	one hand
6	<i>icne mo</i>	more of it, one
10	<i>me yahe</i>	two hands
20	<i>nyi mabu</i>	one man

The information given contained some gaps, but it can be seen that there are four distinct numerals, and tallying on the hands takes place, with a total of 20 at 'one man'.

## 49. SENE

Fewer than ten people are thought to speak this language of the Eastern Huon Family. They live at Lakona village north of Finschhafen, which is now almost entirely Kâte-speaking. An old man in the village gave the following counting data:

1	<i>moko</i>	
2	<i>yakeko</i>	
3	<i>korobo</i>	
4	<i>kiwele</i>	
5	<i>memo</i>	hand one
6	<i>memo o mo</i>	hand one and one
10	<i>meyake</i>	hands two

The informants gave *yakeo yake* as an alternative for four, meaning 'two and two'. Although the information is not complete, it can be seen that there are three or four distinct numerals with tallying on the hands.

## 50. BURUM

This language belongs to the Western Huon Family and is spoken by about 3,000 people in 16 villages in the Upper Mongi area of the Rawlinson Mountains near Ogeranang. The following counting data were assembled from information provided by a number of informants:

1	<i>mohot</i>	
2	<i>yahat</i>	
3	<i>karambut</i>	
4	<i>kihiwet</i>	
5	<i>boro mohot</i>	hand one



10	<i>boro yahat</i>	hands two
15	<i>boro yahat kana mohot</i>	hands two leg one
20	<i>azi mohot</i>	

There was considerable variation in the information provided by different informants. Instead of the distinct numeral *kihiwet* for four, some informants gave *yahat aka yahat* or 'two and two', while one gave *birikun kwagep*. The meaning of the latter expression is not clear, but *biri* means 'hand', and it seems to be a subtractive expression like 'hand minus one'. Some informants gave five as *burukun*, and 20 as *azi ipen mohot* 'one man finished' or *biri yahat aka kana yahat* 'hands two and legs two'. In summary, there are either three or four distinct numerals, followed by tallying on the hands and feet. The word *kihiwet* 'four' is cognate with expressions for 'four' in other Western Huon languages, for example Komba *kimembut*, Timbe *imbot*.

### 51. KINALAKNA

This Western Huon Family language is spoken only at Kinalakna village in the mountains behind the Sialum coast. Village informants provided the following counting data:

1	<i>kutam</i>	
2	<i>ikop</i>	
3	<i>ikop so ngolo</i>	two and one?
4	<i>ikop so ikop</i>	two and two
5	<i>holi nembat</i>	hand half
6	<i>holi nembat kutam</i>	
10	<i>holi nembat nembat</i>	hand half half
11	<i>kea kutam</i>	leg one
15	<i>kea kutam</i>	leg half
16	<i>kea nembat kutam</i>	leg half one
20	<i>kea nembat nembat</i>	leg half half

The meaning of the expression for three is not altogether clear, but it seems to be composed of two and something else, presumably another one. If so, there are only two distinct numerals, with the use of the hands and legs for tallying to 20.

### 52. KOMBA

Five dialects of this Western Huon language are spoken by about 12,000 people on the northern slopes of the Cromwell Mountains in the Huon Peninsula. Information was collected from a number of informants, and proved to be unusually consistent. Informants in different areas could write the complete system using a standard orthography and almost identical spelling. This is unlike many other areas visited. Data were checked and further explanations of the derivation of some terms were given by the linguist N. Southwell who was working in the area. The counting systems emerge as follows:

1	<i>kanok</i>
2	<i>zogat</i>
3	<i>karambut</i>
4	<i>kimembut</i>

5	<i>betnambut</i>	hand half or side
6	<i>namburan kanok</i>	at the other side one
9	<i>namburan kimembut</i>	
10	<i>bazagat</i>	two hands
11	<i>kin kanok</i>	
15	<i>kin nambut</i>	leg half
16	<i>kin nambut kanok</i>	
20	<i>a kanok</i>	man one

In place of the shortened form *bazagat* for ten some informants used *bet zagat* 'hands two' or *bet nambut nambut* 'hand side side'. Southwell (personal communication) reports the use of the word *mamim*, meaning 'thumb' for five. The system thus involves four distinct numerals with tallying to 20 on the hands and feet.

## 53. KUMUKIO

This language belongs to the Western Huon Family and is spoken in two villages in the mountains behind the Sialum coast on the north-east of the Huon Peninsula. An informant in Lae provided the following data:

1	<i>tauc</i>	
2	<i>kosop</i>	
3	<i>karembot</i>	
4	<i>ikosop so ikosop</i>	2 + 2
5	<i>suli nembat</i>	hand half
10	<i>suli nembat nembat</i>	hand half half
11	<i>suli nembat nembat kea tauc</i>	hand half half leg one
20	<i>ke suli pisuk</i>	legs hands together
40	<i>azap ikosop</i>	men two

Thus the system employs three numerals and hands and feet to tally to a total of 20 or one man.

## 54. MESEM

This language of the Western Huon Family is also known as Momolili, and is spoken in nine villages in the western portion of the Rawlinson Mountains north-east of Lae. A village group provided the following counting data:

1	<i>kweji</i>	
2	<i>jeba</i>	
3	<i>tuba</i>	
4	<i>babumba</i>	
5	<i>bainimbeke</i>	hand half
6	<i>bainimbeke kwe</i>	
10	<i>bainimbegere baje dalang</i>	hands finished
11	<i>bainimbegere baje dalang kagara kweji</i>	hands finished, foot one
20	<i>amorat kweji</i>	man one

There were some gaps between ten and 20, but the system appears to be one with four distinct numerals and using hands and feet to tally to 20.

### 55. NABAK

This language belongs to the Western Huon Family and is spoken by nearly 10,000 people in villages on the southern slopes of the Saruwaged Mountains north of Lae. The following counting data were provided by village informants and checked by the Summer Institute of Linguistics linguist E. Fabian, who was working in the area.

1	<i>kwep</i>	
2	<i>zut</i>	
3	<i>tuk</i>	
4	<i>zulazulak</i>	two and two
5	<i>bet nambet delang</i>	hand half finished
6	<i>bet nambet dalang nembet galen kwep</i>	hand half finished, this one, one
10	<i>bet duk delang</i>	hands fingers finished
11	<i>bet duk delang set galen kwep</i>	hands fingers finished, foot this one, one
15	<i>set nambet delang</i>	foot half finished
20	<i>set bet duk delang</i>	feet hands digits finished

There are three distinct numerals only, and tallying on hands and feet gives a base of 20. In addition, there is a series of birth order names, similar to that described for the Mapos language (No.33).

### 56. NOMU

This language belongs to the Western Huon Family. It is spoken in five villages around the Suparo River in the north-east of the Huon Peninsula. The following counting data were provided by a high school student:

1	<i>wetku</i>	
2	<i>okop</i>	
3	<i>okop so wetku</i>	two and one
4	<i>okop so okop</i>	two and two
5	<i>mete wetku</i>	hand one
10	<i>mete okop</i>	
15	<i>mete karebot</i>	
20	<i>mete okop so okop</i>	

The meaning of the expression for 15 is not entirely clear, but appears to mean 'three hands'. Although three was translated as *okop so wetku* 'two and one', the word *karebot* used in the expression for 15 is very similar to the word for 'three' in other Western Huon Family languages, for example Burum, Komba and Yaknge (*karambut*) and Sialum (*karamba*). The informant did not seem to have a clear idea of the system, as for example the expression for 20 *mete okop so okop* was identical with that given for 12. However, it appears that the system has only two numerals and tallies on the hands to reach 20.

## 57. ONO

Two dialects of this Western Huon Family language are spoken by nearly 5,000 people in 28 villages in the north-eastern region of the Huon Peninsula. The following data were provided by high school students, and additional information is from the Summer Institute of Linguistics linguist Tom Phinnemore who was working in the Ono area.

1	<i>weku</i>	
2	<i>etke</i>	
3	<i>karewe</i>	
4	<i>etke so etke</i>	
5	<i>mete mane</i>	hand one
6	<i>mete mane so weku</i>	
10	<i>mete etka</i>	hands two
11	<i>mete etke so kie maneo weku</i>	
15	<i>mete etke so kie maneo korop</i>	hands two foot one finish
20	<i>ngei mane korop</i>	man one finished

An alternative for 20 is *ngei mane kie mete korop* 'man one feet and hands finished'. There are three distinct numerals, and a base of 20 is achieved by tallying on the fingers and toes.

## 58. SELEPET

This language belongs to the Western Huon Family and is spoken in 17 villages in the Kabwum area on the northern slopes of the Huon Peninsula. The following counting data were provided by village informants:

1	<i>konok</i>	
2	<i>yogop</i>	
3	<i>maik</i>	
4	<i>imbot</i>	
5	<i>botnombot</i>	hand side or half
6	<i>botnombot lon konok</i>	
10	<i>botnombot nombot nierek</i>	hand half half finished
11	<i>koi yon konok</i>	one on the foot
15	<i>koi yon nombot</i>	foot half
20	<i>lok konok kerek</i>	one whole man

The meanings of the expression were not clearly stated and the translations given here are tentative only. There were some variations from different informants. In the North Selepet dialect *kalambu* was used for three. Other informants used *bot numburok harok* for ten, which seems to mean 'hands together'. In spite of different tallying circumlocutions, the systems all involved the use of four distinct numerals and the use of hands and feet to make a base of 20. *numburok* was also used for five, while in the northern dialect, *mome* 'thumb' may be used.

## 59. SIALUM

This Western Huon Family language is spoken by about 600 people in three villages on the north-eastern coast of the Huon Peninsula. The following counting data were provided by a high school student.

1	<i>wengetene</i>	
2	<i>etka</i>	
3	<i>karamba</i>	
4	<i>etka ko etka</i>	two and two
5	<i>metamu</i>	hand
6	<i>metamu ko wengetene</i>	hand and one
10	<i>meta etka</i>	hands two
15	<i>meta karamba</i>	
20	<i>kenga etka</i>	feet two

The system described has three distinct numerals and uses hands and feet to tally up to 20.

## 60. TIMBE

The Timbe language belongs to the Western Huon Family and is spoken by about 11,000 people in 35 villages on the northern slopes of the Saruwaged Ranges west of Kabwum. There are four recognised dialects. A number of informants contributed information and this was supplemented by observations from the Summer Institute of Linguistics linguist M. Foster who was working in the Central dialect area. The following is a typical counting system:

1	<i>konok</i>	
2	<i>lauwo</i>	
3	<i>olowu</i>	
4	<i>imbot</i>	
5	<i>momerok</i>	thumb only
6	<i>bot biken konok</i>	hand one side one
10	<i>bot bip bip harok</i>	hand side side all
11	<i>keion konok</i>	one on the foot
15	<i>keion momerok</i>	foot five
20	<i>luak konok harok</i>	man one whole

Hands and feet are used to tally to 20 and there are four distinct numerals at least. For five, the word *momerok* is used, which is not the same as the word used for 'hand', *bot*, but means 'thumb only'. The word for four, *imbot* shows some similarity to the word for 'hand', *bot*, possibly indicating that it is derived from a subtractive term such as 'hand minus', or indicating the existence of a base of four at some time. It is noted in passing that the terms for two and three appear to bear some similarity to those words in some Austronesian languages, for example in Gitua, 'three' is *tolu*, while in Siboma 'two' is *lua*.

## 61. TOBO

The Tobo language belongs to the Western Huon Family. It is spoken by about 3,000 people in eight villages in the Upper Mongi area on the southern slopes of the Cromwell Range. The following counting data summarise information from a number of sources:

1	<i>mogok</i>	
2	<i>reget</i>	
3	<i>karewet</i>	
4	<i>kembem kpagap</i>	thumb without
5	<i>maraman</i>	hand one
6	<i>maraman mogok</i>	
10	<i>mara reget</i>	hands two
15	<i>mara reget kana mogok</i>	hands two feet one
20	<i>kana yagat zama mara yagat</i>	feet two hands two

An alternative for 20 was *mera kembem bagap* or 'hands four'. One informant gave five as *kembo ma*, whose meaning is not clear, but may refer to the thumb as a tally total for one hand.

## 62. YAKNGE

This Western Huon language is spoken in 11 villages close to Pindiu. Village informants provided the following counting data:

1	<i>mohokung</i>	
2	<i>weit</i>	
3	<i>karambut</i>	
4	<i>kimbam parup</i>	
5	<i>birikun</i>	hand half
	or <i>naman</i>	
6	<i>biri bara mohokung</i>	
10	<i>biri weit</i>	
11	<i>gem kana mohokung</i>	
15	<i>gem kana naman</i>	
20	<i>kana biri yomu</i>	

Alternate expressions were recorded, for example for 16 expressions given were *angam nambat ni biri kun* or *gem kana angam likep kup weit*. These appeared to be alternative ways of expressing the addition of the digits of the fingers and toes. The base here is a tally total of 20 derived from fingers and toes, as with other members of the language family. There appears to be a word for 'five', *naman*, but it is not clear if this is a true numeral or an expression indicating that half a hand is finished. Again the expression for four suggests that a base of four could have been in existence, but it is likely to be an expression meaning 'without the thumb'. Informants noted that in former times tallies of bundles of sticks or dogs teeth were kept as a record of important numbers.

## 63. FINUNGWA

This language belongs to the Erap Family, and is spoken in two villages in the Lowai area west of Boana. The following counting data were obtained from village informants:

1	<i>kobelak</i>	
2	<i>yalambok</i>	
3	<i>yala kobok</i>	two one
4	<i>yale yale</i>	two two
5	<i>yale yale kobok</i> or <i>mem gonggom</i>	half finished
6	<i>kai kusani kobelak</i>	hand half one
7	<i>kai kusani yalambok</i>	
10	<i>kai kusani fengec</i>	hand halves together

There are only two numeral words, and tallying proceeds on the hands.

#### 64. GUSAN

This language belongs to the Erap Family, and is spoken in five villages on the southern slopes of the Saruwaged Range west of Boana. The following counting data were obtained from village informants:

1	<i>kobogen</i>	
2	<i>yare</i>	
3	<i>yare kuboc</i>	two one
4	<i>yarewə yarewə</i> or <i>imaninamo</i>	two two
5	<i>iman</i>	
6	<i>kaiwi kuboc</i>	(other) hand one
10	<i>kuman ta</i>	together

The word *iman* for five appears to mean 'hand', although *kairi* was given for 'hand'. The alternative form for four *imaninamo* may mean something like 'hand nearly complete', although the meaning is not clear, and this is another example of a special term for four. Apart from this, there are only two numeral words and hands are used as tallies. The resemblance between *iman* and the word for 'hand' in certain Austronesian languages is striking, for example Siboma *nima*, Bukaua *lim*, Sio *lima*.

#### 65. MAMAA

This language of the Erap Family is only spoken at Mamaa village west of Boana. The following counting data were obtained from village informants:

1	<i>ningalac</i>	
2	<i>yalambok</i>	
3	<i>yalining</i>	
4	<i>yali yali</i>	2 + 2
5	<i>yali yali ning</i>	2 + 2 + 1

The informants did not proceed further, although it is likely that traditionally hands would be used as tallies. In the system described there are only two numeral words.

## 66. MUNKIP

This language belongs to the Erap Family and is spoken only at Munkip village in the Erap Valley. Informants in the village stated that their language and that of Gain village in the Numanggang area were mutually comprehensible. The following counting data were obtained from village informants:

1	<i>kubugang</i>	
2	<i>lifet</i>	
3	<i>lifet kubugang</i> or <i>lifetning</i>	
4	<i>lifet yang lifet yang</i>	two and two
5	<i>lifet lifet kubugang</i>	
6	<i>kafongfa kubugang</i>	other hand one
10	<i>wa tarerak</i>	both (hands) together
11	<i>kafong wa tarerak kadak kubugang</i>	hands together, foot one
20	<i>kadak watarerak</i>	legs finished

There are only two numeral words, unless the expression for three *lifetning* is seen as a distinct numeral in its own right. It certainly appears to be derived from 'two one'. Tallying proceeds on the hands and feet to make a total of 20.

## 67. NAKAMA

Two dialects of Nakama are spoken in six villages in the Boana area by about 1,000 people. The language belongs to the Erap Family. The following counting data were obtained from village informants. Two versions are presented as there seem to be considerable variations.

(a)	Northern Dialect	
1	<i>fikanggang</i>	
2	<i>lupek</i>	
3	<i>lufeten</i>	
4	<i>lupeleng lupeleng</i>	two and two
5	<i>kafo kung</i>	hand
6	<i>kafo fa fikanggang</i>	hand and one
10	<i>kafo kunukang</i>	hands together
11	<i>kada fikanggang</i>	foot one
15	<i>kadak fagang</i>	
19	<i>kadak diding</i>	
20	<i>kadak kunulkang</i>	feet finished

This is a base 20 system using hands and legs for tallying. There are three numerals, the word for three possibly being derived from 'two and one'. An alternative for four, *diding* was used in higher combinations. Hence there are either three or four distinct numerals.

(b)	Southern Dialect	
1	<i>kubugang</i>	
2	<i>lifet</i>	
3	<i>difetening</i>	
4	<i>lifet e lifet</i>	two and two



	or <i>didim</i>	
5	<i>ko fagang</i>	hand half
6	<i>kofa kubugang</i>	
10	<i>ko kunukang</i>	
11	<i>ko bina kadak kubugang</i>	hands finished, leg one
12	<i>kadak lifet</i>	leg two
15	<i>kadak fagang</i>	foot half
20	<i>kadak ko nukang</i>	legs hands finished

Although the words are slightly different, the system here is identical with hand and foot tallying to 20 and either three or four distinct numerals. It is not known if the alternative word for four is a borrowing or has some other meaning. The word for three again could be derived from 'two and one'. The words used here are so similar to those used by informants from Munkip (No.65) that the possibility that these are two dialects of the same language is worth exploring.

#### 68. NEK

This is an Erap Family language spoken as two dialects in six villages north of Boana. The following data were given by high school students in Lae.

1	<i>nogan</i>	
2	<i>tipet</i>	
3	<i>tipetkutno</i>	two and one?
4	<i>tipet tipet</i>	two and two
5	<i>kitombo</i>	hand
6	<i>kitombo nogan</i>	
10	<i>kit tombon tombon</i>	hand half half?
11	<i>kit tombon tombon t'm kesit tombo nogan</i>	hand half half and leg side one
15	<i>kit tipet t'm kesit tombon</i>	hands two and leg one

Informants were hesitant and could not provide complete data, but the system evidently involves tallying on the hands and legs, and appears to have only two numerals. The expression for three appears to be derived from 'two and one'.

#### 69. NIMI

This Erap Family language is spoken in seven villages in the Lowai area west of Boana. The following counting data were obtained from informants in Lae.

1	<i>ningit</i>	
2	<i>yaru</i>	
3	<i>yarukuba</i>	two and one?
4	<i>yaru yaru</i>	
5	<i>kit kusang</i>	hand?, side
10	<i>kit kusang kusang</i>	hand? side side
11	<i>kit kusan kusan kayona ningit</i>	hand sides foot one

- 15 *kit kusang kusang kayyona kusangit*  
 20 *kit kusan kusan kayona kusan kusan*

Like other members of the family, this system involves tallying to 20 on the hands and feet and has two distinct numerals. The word for three appears to be composed of 'two and one'.

## 70. NUK

Two dialects of Nuk, an Erap Family language, are spoken in eight villages east of Boana. Data provided by village informants and students in Lae are still incomplete:

- |    |                          |               |
|----|--------------------------|---------------|
| 1  | <i>ningeni</i>           |               |
| 2  | <i>tupet</i>             |               |
| 3  | <i>tupetni</i>           | two and one?  |
| 4  | <i>tupet tupet</i>       |               |
| 5  | <i>tupet tupetni</i>     | two and three |
| 6  | <i>tupet tupet tupet</i> |               |
| 10 | <i>singen</i>            |               |
| 20 | <i>kikeset</i>           |               |

There were some gaps between six and ten and ten and 20. The expression for ten appeared to refer to the fingers of the hands and meant something like 'all'. Similarly *kikeset* referred to the 'toes being finished'. Hence, although data are not complete, the system is seen to tally to 20 using fingers and toes, with only two distinct numeral words. *tupetni* for three appears to be a compound of 'one' and 'two'. The term *singen* for ten may mean something like 'finished', as it is unlikely that such a system would have a separate numeral for ten, although informants could not give a definite meaning for this term.

## 71. NUMANGGANG

This is an Erap Family language spoken in ten villages west of Boana. There are two dialects, East and West. The following counting data come from information provided by several village informants:

- |    |                          |          |
|----|--------------------------|----------|
| 1  | <i>kutnung</i>           |          |
| 2  | <i>lufom</i>             |          |
| 3  | <i>lufom kutnung</i>     | two one  |
| 4  | <i>lufom lufom</i>       | two two  |
| 5  | <i>kafong ko</i>         | hand     |
| 6  | <i>kafong ko kutnung</i> |          |
| 10 | <i>kafong lufom</i>      |          |
| 15 | <i>kayong ko</i>         | feet two |
| 20 | <i>kayong lufom</i>      | feet two |

Alternative tallying expressions were given, for example for five *hafokong* 'half?' and six *deak kutnung*, which seemed to mean something like 'other side one'. Twenty can also be expressed *kayong hafokong hafokong* or 'feet half half'. There are only two numerals, three being expressed 'two one'. A base of 20 is reached by tallying on the hands and feet. A variation from Kasin village was as follows:

1	<i>kubegang</i>	
2	<i>lipet</i>	
3	<i>lipet ning ding</i>	
4	<i>lipet lipet</i>	
5	<i>kohong kubugang</i>	hand one
10	<i>kohong lipet</i>	hands two
15	<i>kohong kubugang kayang fokoning</i>	hands two feet half
20	<i>mac kubugang</i>	man one

Some words here are very similar to the Nakama language, while others are similar to the other Numanggang data. It is possible that the two languages are related by dialect chaining.

## 72. SAUK

This Erap Family language is spoken in two villages on the southern slopes of the Saruwageds north-west of Boana. Village informants provided the following data:

1	<i>ningit</i>	
2	<i>yali</i>	
3	<i>yalanang</i>	
4	<i>yaliya yaliya</i>	two two
5	<i>niya</i>	
6	<i>kosan ingningit</i>	half one
10	<i>kekokeko</i>	half half

The informants used hands and feet when explaining the system but the words for these do not appear. The meaning of *niya* for five is not clear. Since there are only two distinct numeral words (the expression for three appears to be a compound of two and one) it is not likely that *niya* is a true numeral but probably a term assisting in tallying. Numbers above 15 were given as 'many'.

## 73. URUI

This Erap Family language is spoken in 13 villages between Boana and the Leron River. Data from Lae informants are as follows. One system described was:

1	<i>kubini</i>	
2	<i>fama</i>	
3	<i>famagong kubinigong</i>	two and one
4	<i>famagong famagong</i>	two and two
5	<i>famagong famagong kubinigong</i>	
6	<i>famagong famagong famagong</i>	
10	<i>kafini trasona</i>	hands finished?
11	<i>kafini fama tanga kubini</i>	hands two and one
15	<i>kafini fama tanga kubini</i>	hands two and one
18	<i>wusap</i>	
19	<i>wasapking</i>	
20	<i>samo</i>	
21	<i>samosini</i>	

It is difficult to make much sense of these data. Counting proceeded by twos as far as ten when the hands were brought in. There were certain inconsistencies, for example the expression for 11 was identical with the expression for 15, suggesting that the data are unreliable. The expressions given for 18, 19, 20 and 21 were completely unexpected and no explanation could be elicited.

Another Urii-speaking informant provided the following data:

- |    |                                      |
|----|--------------------------------------|
| 1  | <i>kubunik</i>                       |
| 2  | <i>kubuniksak</i><br>or <i>famak</i> |
| 3  | <i>fimeneng</i>                      |
| 4  | <i>fimenengging</i>                  |
| 5  | <i>fimenengsinik</i>                 |
| 6  | <i>siamoging</i>                     |
| 7  | <i>siamogingsinik</i>                |
| 8  | <i>memeng</i>                        |
| 9  | <i>memengging</i>                    |
| 10 | <i>memenggingsini</i>                |
| 11 | <i>memenggingsinik</i>               |
| 12 | <i>kubunikingsini</i>                |
| 13 | <i>femengsini</i>                    |
| 14 | <i>fimenengnisini</i>                |
| 15 | <i>fimenengsini</i>                  |
| 16 | <i>amongingsini</i>                  |
| 17 | <i>siamongingsini</i>                |
| 18 | <i>memengmemengingsini</i>           |
| 19 | <i>memenginmemengini</i>             |
| 20 | <i>memenging memenging</i>           |
| 21 | <i>memengbunik</i>                   |

This unusual system is quite unlike anything else encountered in the Morobe Province, and needs further investigation. It is possibly an adapted version of introduced English or Tok Pisin numerals using an indigenous counting method and phonology, but the full explanation remains a mystery at present. The informant who provided the system would not elaborate.

The normal traditional system appears to be the following, obtained from Siara village:

- |   |                                  |             |
|---|----------------------------------|-------------|
| 1 | <i>kubinik</i>                   |             |
| 2 | <i>famac</i>                     |             |
| 3 | <i>fimeneng</i>                  |             |
| 4 | <i>famagong famagong</i>         | two and two |
| 5 | <i>famagong famagong kubinik</i> |             |

There appear to be three distinct numerals here, although the expression for three could be a compound of 'two' and 'one'. Tallying was said to proceed on the hands and feet.

## 74. BAM

This language is a member of the Wantoat Family and is spoken by about 400 people in four villages south-east of Wantoat. The following incomplete data were obtained from a high school student at Kaiapit:

1	<i>bat</i>	
2	<i>yara</i>	
3	<i>yara bat</i>	2 + 1
4	<i>yara yara</i>	2 + 2
5	<i>yara yara bat</i>	2 + 2 + 1
6	<i>yara yara yara</i>	2 + 2 + 2

The only numerals were for one and two and no further variation was given. Although no mention was made of tallying on the digits, this may occur.

## 75. IRUMU

This Wantoat Family language is spoken in 11 villages in the Upper Irumu River area south-east of Wantoat. Village informants provided the following data:

1	<i>kumbagangan</i>	
2	<i>yara</i>	
3	<i>yara kumba</i>	two one
4	<i>yarambok yarambok</i>	two two
5	<i>iman</i>	
6	<i>ket kutni kumbang</i>	hand? other one
10	<i>ket ketni kutni siang</i>	
11	<i>kurong ken kumbong</i>	leg one
15	<i>kuron ken iman</i>	
20	<i>ken kuron kunduk</i>	hands legs together

Unlike other members of the Wantoat Family, this system involves the use of hands and feet in tallying. The meaning of the word *iman* for five is not clear, and it may be a tallying aid, but its similarity to words for 'five' in the Austronesian languages should be noted, for example Lukep *lim*, Sio *lima*, Siboma *nima* and Gitua *nimanda* (see Gusan No.63). However, there are numeral words for only two and one apart from this.

## 76. WANTOAT

This is by far the largest language in the Wantoat Family. Three separate dialects are spoken by over 7,000 people in the Wantoat area. The following data were collected from village informants and high school students.

1	<i>tapatu</i>	
2	<i>tapaya</i>	
3	<i>tapaya tapatu</i>	2 + 1
4	<i>tapaya tapaya</i>	2 + 2
5	<i>tapaya tapaya tapatu</i>	2 + 2 + 1

6	<i>tapaya tapaya tapaya</i>	2 + 2 + 2
10	<i>katakut musayat</i>	hands together
20	<i>katahune ta kuku bengahune</i>	hands and feet together

There are only two numerals. Hands and feet are used in tallying but informants did not count five as one hand, but continued marking off twos until ten was reached.

## 77. YAGAWAK

This language belongs to the Wantoat Family and is spoken in two villages south-east of Wantoat. The following incomplete data were obtained from a high school student at Kaiapit:

1	<i>kumbagan</i>	
2	<i>yala</i>	
3	<i>yalakumba</i>	2 + 1
4	<i>yalakumba kumba</i>	2 + 1 + 1
5	<i>yalakumba yala</i>	2 + 1 + 2
6	<i>yalakumba yalakumba</i>	2 + 1 + 2 + 1
7	<i>yalakumba yalakumba kumba</i>	2 + 1 + 2 + 1 + 1
10	<i>yala yala yala yala yala</i>	2 + 2 + 2 + 2 + 2

The informant made no attempt to tally, even though asked for the words for hand and foot. The numbers were grouped in twos and ones except for ten, where only twos were used. This is rather similar to the previous language Wantoat, where fingers were marked off in twos until two hands were recorded.

## 78. UFIM

The Ufim language is the only member of the Gusap-Mot Family in the Morobe Province, the remainder being spoken in the Madang Province. Ufim is spoken by about 500 people in five villages in the Upper Umi and Ufim River areas north of Kaiapit. The following counting data are from informants in Lae:

1	<i>kwana</i>	
2	<i>irisa</i>	
3	<i>kapusa</i>	
4	<i>niming kining</i>	
5	<i>kande kwa</i>	hand one
10	<i>kande irisa</i>	hands two
15	<i>kande kapusa</i>	hands three
20	<i>kande niming kining</i>	hands four

There are distinct numerals for the numbers one to four, while five is expressed 'one hand'. The use of feet may have taken place traditionally, but only hands were mentioned by these informants.

## 79. BONKIMAN

This language belongs to the Yupna Family, which is spoken mainly in the Madang Province. In the Morobe Province, Bonkiman is only spoken in the village of Yuwong on the north coast of the Huon Peninsula near the Madang border. The following data were obtained from a village informant:

1	<i>isan</i>	
2	<i>bronge</i>	
3	<i>kabe</i>	
4	<i>mbrong mbrong</i>	two and two
5	<i>mbrong mbrong kagne</i>	
6	<i>kolom kuwo isan</i>	hand another? one
7	<i>am brong</i>	and two
8	<i>kabe na</i>	three more
9	<i>tauam kuwok kamkam</i>	

The meaning of the expression for nine is not clear, but is probably an expression for the coming together of the fingers of two hands which should have appeared at ten. The informant was very hesitant and needed a great deal of prompting to obtain the above information. There appear to be three distinct numerals with the use of hands to tally further.

## 80. ISAN

This is the second language of the Yupna Family to be spoken in the Morobe Province, and it is sometimes known as Yupna. Within the Province it is spoken at two villages in the mountains just east of the Madang Province border. Information was obtained from informants in both villages to give the following data:

1	<i>esal</i>	
2	<i>brong</i>	
3	<i>kape</i>	
4	<i>brongə brongə</i>	
5	<i>kodom kanda</i>	hand half
6	<i>kodom kanda kopok brong</i>	hand half side one
10	<i>kodom brong</i>	
15	<i>kodom brong kaipe kopok konda</i>	hands two leg one side
20	<i>kaipe brong kodom brong</i>	feet two hands two

One informant gave the word *upu* meaning 'big toe' when 20 was reached, but it is not clear if this is a commonly understood expression for 20. The system has three distinct numerals and tallying on hands and feet gives a base of 20.

## 80A. KORIPON

McElhanon (1984) includes the village of Koripon in the Yupna language area but notes that its status is not confirmed. Informants at Koripon stated that their language is not the same as that of neighbouring Bungavot (Yupna language) but is similar to Darronge, the language of a group living with Roinji speakers at the coast in Roinji village. I could not confirm this with lexicostatistical evidence, but the counting data provided by Koripon informants is quite different from both Yupna

and Roinji, and the language is thus given a separate status here. The Koripon word for three appears to be cognate with that of the Yupna, Bonkiman and Som languages. The following counting data were provided by informants in the village:

1	<i>duwit</i>	
2	<i>kumjat</i>	
3	<i>kapu</i>	
4	<i>kumnaket kumnaket</i>	two two
5	<i>korundo</i>	hand
6	<i>kutet duwit</i>	half one
10	<i>korun kumjat</i>	
11	<i>kai kutet duwit</i>	leg half one
15	<i>kai kutet du</i>	leg half finished
20	<i>kai orun kumgum</i>	hands legs together

There are three numeral words. Tallying on the hands and feet gives a base of 20.

### 81. KOMUTU

This language belongs to the Uruwa Family and is spoken in six villages on the north coast of the Huon Peninsula west of Wasu. Village informants provided the following data:

1	<i>kamantewe</i>	
2	<i>yarə</i>	
3	<i>kaləhu</i>	
4	<i>yarənə yarənə</i> or <i>yarə nuknuk</i>	
5	<i>get kamandauk</i>	hand one half
6	<i>get num kaman</i>	hand half and one
10	<i>get numnum</i>	hands together
11	<i>halambeng kamang</i>	leg one on
15	<i>halambeng daup</i>	leg half
20	<i>amna kaman dauk</i>	man one altogether

An alternative for five was *kawan tabi*, whose meaning is not known. The two meanings for four are probably similar, meaning 'two and two' or 'twice two'. An alternative for six was *kaləhu* or 'three three'. In summary the system has three distinct numerals and uses the hands and feet to tally to 20.

### 82. SAKAM

This language belongs to the Uruwa Family and is spoken by about 500 people in the Upper Uruwa area of the Huon Peninsula. The following data were obtained from informants at Makua village:

1	<i>kuwaran</i>	
2	<i>danggan</i>	
3	<i>kailpu</i>	
4	<i>danggan danggan</i>	two two



5	<i>kaibue kuwoku</i>	hand side
6	<i>paijang kuwe</i>	?other side one
10	<i>kaibukuo kumen kaibukuo kumen</i>	hand finished hand finished
11	<i>tailma kuwe</i>	nose one
12	<i>tailma dangge</i>	nose two
13	<i>koljang kuwoku kuwe</i>	leg on one
17	<i>koljang kuwoku kumen</i>	leg side finished
22	<i>koljang kulmen</i>	legs finished

A most unusual feature of this system is the incorporation of the nostrils for tallying. The informant first counted on the fingers of the left hand which was clenched with the thumb up. This was repeated with the right hand. The left thumb was then placed on the left nostril followed by the right thumb on the right nostril. This is the only case so far encountered in the Morobe Province of the use of any parts of the body apart from the hands and feet as counting aids. Informants at Dinanggat did not use this but could only provide a tally up to ten on two hands when asked. There thus appears to be tallying on the hands, nose and feet, and there are three distinct numeral words.

### 83. SOM

This member of the Uruwa Family is spoken only at Gorgiok village in a remote area of the Upper Som Valley. The following counting data were obtained from informants in the village:

1	<i>koweran</i>	
2	<i>yarə</i>	
3	<i>kabmə</i>	
4	<i>oyarə oyarə</i>	two two
5	<i>oyarə oyarə kowe</i>	two two one
6	<i>okabmə okabmə</i>	three three
7	<i>okabmə okabmə kowe</i>	

Counting proceeded in a similar fashion, adding further numbers in threes. There was no attempt made to use either the hands or feet to tally. There are three distinct numeral words.

### 84. WELIKI

This language is a member of the Uruwa Family and is spoken by about 200 people living near the north coast of the Huon Peninsula west of Wasu. The following counting data were recorded from Hiom village:

1	<i>kongotai</i>	
2	<i>eleko</i>	
3	<i>olowu</i>	
4	<i>eleko ngomba eleko</i>	two and two
5	<i>meme bisuk</i>	hand finished
6	<i>isin biknganggin kongotai</i>	side half one
10	<i>isin birim birim bisuk</i>	both hands finished
11	<i>aputen kongotai</i>	leg one

15	<i>aput biknge bisuk</i>	leg half
20	<i>aput birim birim bisuk</i>	legs together

This system employs tallying to a base of 20 and has three distinct numerals. There appears to have been some influence from the Timbe language, for example the use of *olowu* for 'three' and *biknge* for 'half'. The word *meme* appears to mean 'hand', while the expressions used from six to ten describe the tallying process.

## 85. YAU

The largest of the Uruwa Family languages in the Morobe Province, Yau is spoken in 11 villages on the northern slopes of the Saruwaged Ranges in the Sapmanga area. The following counting data were obtained from village informants:

1	<i>ongkogon</i>	
2	<i>yait</i>	
3	<i>atvi</i>	
4	<i>anumuno</i>	
5	<i>obu kaimang</i>	hand ?side
6	<i>obu hong ohe bigu</i>	hand ?half and one
7	<i>obu ohe yait</i>	hand and two
10	<i>obu yait yait</i>	hand two two (together)
11	<i>obu yait yait botengga orun bigu</i>	hands together leg one
15	<i>obu yait yait botengga orun ohema</i>	hands together, leg half
20	<i>orun obu yait yait boteca</i>	two hands legs finished

This is a straightforward system of tallying on the hands and feet to make a total of 20. There are four distinct numeral words.

## 86. WASEMBO

This language belongs to the Pihom Stock of the Madang and Adelbert Range Sub-Phylum, which is spoken mainly in the Madang Province. In the Morobe Province it is spoken in five villages in the Upper Ramu area near the border with the Madang Province. The following incomplete data were obtained from a high school student at Kaiapit:

1	<i>harawo</i>	
2	<i>abugi</i>	
3	<i>abono</i>	
4	<i>abugi abugi</i>	two two
5	<i>abugi abono</i>	three two
6	<i>abono abono</i>	three three
7	<i>abono abono harawo</i>	three three one

There was no attempt to use the hands to tally, and there are three distinct numerals.

## 87. WAFFA

This language is the only Morobe representative of the East New Guinea Highlands Stock, and belongs to the Eastern Family. It is spoken in five villages in the mountains to the west of the Markham River close to the border with the Eastern Highlands Province. The following data were provided by the Summer Institute of Linguistics linguist, Mary Stringer who has lived and worked in the area for many years. They are presented in the orthography she has devised for the language:

1	<i>mmuaa-vai</i>	
2	<i>taara-vaitana</i>	
3	<i>taara-vooma</i>	
4	<i>taara-ma taara-ma</i>	two two
5	<i>yaaku sai-vai</i>	hand half
6	<i>yaaku sai-vai sai-nai-diri mmuaa-vai</i>	hand half, new half one
10	<i>yaaku-u-raitanya</i>	hands two
11	<i>yaaku-u-raitanya yuku-ki-diri mmuaa-vai</i>	hands two foot one
15	<i>yuku sai-vai</i>	feet half
20	<i>yuku yaaku taika kioo or mmuaa vaidi-vai</i>	feet hands finished

An alternative form for five is *eera-ivo* which is the name for the 'little finger'. The system uses tallying on the hands and feet to make a base of 20, and there are two distinct numerals. The expression for three appears to be derived from 'two and one'.

## 88. AGAATAHA

This language belongs to the Angan Family and is also known as Langimar. It is spoken in the Langimar River area west of Bulolo. A village informant provided the following data:

1	<i>nanso</i>	
2	<i>yokwu</i>	
3	<i>mulumo</i>	
4	<i>mulə mulə</i>	
5	<i>ikwi kwandere</i>	hand
6	<i>ikwi kwandere mo nanso</i>	hand and one
10	<i>ikwu maindumwu</i>	hands ?finished
15	<i>ikwu maindumu ikwi kwandere</i>	hands two and half
20	<i>ikwu aukwuru</i>	hands and feet

There are three distinct numerals and the hands and feet are used to tally a total of 20.

## 89. HAMTAI

This language, also known as Kapau is spoken by over 60,000 people and is thus a very large language group by Papua New Guinean standards. About 20,000 of these live in the Morobe Province in the Aseki area, while the remainder live in the Gulf Province in the Kaintiba area. Village informants provided the following data:

1	<i>fati</i>	
2	<i>hivacu</i>	
3	<i>hivacu fati</i>	two one
4	<i>hivacu hivacu</i>	two two
5	<i>hivacu hivacu fati</i> or <i>feca akapu</i>	two two one fingers all
6	<i>feca hatuanga akapu hatuanga fati</i>	hand side all side one
10	<i>feca hatuanga hatuanga</i>	hand side side
11	<i>feca akapu ianga hatuanga fatina</i>	hands finished foot side one
15	<i>feca akapu ianga hatuanga akapu</i>	foot side finished
20	<i>feca akapua nica ade ianga akapu</i>	hands and feet finished

This system is similar to the preceding one except that there are only two numerals. Some informants did not use the hands, but counted by adding ones and twos. Others used hands and feet to tally to 20.

#### 90. KAMASA

This is an apparently dying language of the Angan Family spoken by about 20 people, mainly at Katsiong refugee village north-east of Menyamya. No field data were collected, but the following numbers were taken from word lists prepared by Lloyd (1973:548).

1	<i>hunankoko</i>
2	<i>hukwego</i>

Referring to common features of Anga languages, Lloyd notes (1973:87):

Counting systems are very similar...there are words for *one*, *two* and phrases literally *two one* for three and *two two* for *four*. For higher numbers the nouns *hands* and *foot* are used.

The Kamasa counting system thus has two numeral words and appears to use the hands and feet to tally to 20.

#### 91. KAWATSA

This is another very small Angan Family language, being spoken by about 20 people, mainly at Katsiong refugee village. A Kawatsa-speaking informant in Lae provided the following data:

1	<i>tona</i>	
2	<i>tavau</i>	
3	<i>tavau to</i>	2 + 1
4	<i>tavau tavau</i>	2 + 2
5	<i>tavau tavau to</i>	2 + 2 + 1
6	<i>tavau to tavau to</i>	2 + 1 + 2 + 1

Counting continued using only combinations of one and two. There was no attempt to tally on the hands. Lloyd (1973:549) gives the words for 'one' and 'two' as *uwa'na* and *huvaa'u* respectively.

## 92. MENYA

This Angan Family language is spoken by about 12,000 people in a large number of small settlements in the Menyama area. The following counting data were collected from a variety of informants, and were supplemented by comments from Summer Institute of Linguistics linguists A. Chipping and C. Whitehead who have worked in the area:

1	<i>hankwona</i>	
2	<i>hankwakwu</i>	
3	<i>hankwakwu hankwe</i>	two one
4	<i>hankwakwi hankwakwi</i>	two two
5	<i>hankwakwi hankwakwi hankwe</i> or <i>hipa hankwona</i>	hand one
10	<i>hipa ekwana</i>	hand all
20	<i>hipa suka ekwana</i>	hands legs all

Different informants gave quite a variety of pronunciation and orthography, but the systems were basically the same, with two numerals and the use of hands and feet to tally to 20. Some informants did not tally but only used the two numerals to build higher numbers.

## 93. SAFEYOKA

Four dialects of this Angan family language are spoken by about 3,000 people in an area north of Menyama close to the border with the Eastern Highlands Province. A variety of informants were contacted. The following data in the Ampeeli-Wojokeso dialect were provided by the Summer Institute of Linguistics linguists, D. and E. West who were working in the area:

1	<i>anga'no</i>	
2	<i>hufa'u</i>	
3	<i>hufa'u sihune</i>	
4	<i>osofo fo fa'u'no</i>	
5	<i>aho fehonjo hopi'nono</i>	hand half all
10	<i>aho hopi'nono</i>	hands all
15	<i>aho hopi'nono sife fehohnta'ni</i> <i>hopi'nono</i>	hands all foot half
20	<i>sife aho hopi'nono</i>	feet hands all

The phrases are not stereotyped, and data provided by other informants show that numbers above five were expressed quite differently by different individuals. Multiples of 20 can be expressed using this system. There appear to be only two numerals. The meaning of the expressions for three and four, are not clear, but appear to be compounds of one and two.

## 94. YAGWOIA

This Angan language is spoken by about 6,000 people in the Menyama area. A number of informants gave differing information, but the systems described were similar. The following data are typical and were provided by the linguists, M.R. and H. Bowling who were working in the area. The system is presented in their orthography:

1	<i>'kwənənoi</i>	
2	<i>u'laako</i>	
3	<i>u'laangwa</i>	
4	<i>'yaako 'yaako</i>	two two
5	<i>wəlyəmpu</i>	hand
10	<i>'wəlyə'mplaako</i>	two hands
15	<i>hyulə wəlyəmpu</i>	hands and foot
20	<i>apni</i>	man

Variations for 'one' were *hekwe* or *gonangi* and for 'two' *huluwaku* or *hoku*. Some informants did not tally on hands but used combinations of the numerals one and two only. The expression for three appears to be a combination of one and two.

#### 94A. SUSUAMI

Informants in Mangki village in the Upper Watut area described a language which they called Susuami, which did not appear to be the same as any so far described. A comparison of word lists suggests that this is an Angan Family language most closely related to Kamasa and Kawatsa (Smith forthcoming). A minority of the inhabitants of Mangki speak Susuami, the remainder speaking Agaataha. The following counting data were provided by village informants:

1	<i>pono</i>	
2	<i>penkwai</i>	
3	<i>penkwai nyi ponyi</i>	two and one
4	<i>penkwai nyi penkwai nyi</i>	two and two
5	<i>ha pesu</i>	hand half
10	<i>ayemu kwao</i>	
15	<i>ayemu kwao ha pesu</i>	
20	<i>ukwamu hamo kwekwa</i>	feet hands together

The meanings of the expressions for ten and 15 are not clear, but they appear to be phrases describing tallying. There are two numerals.

#### 95. BIANGAI

This language belongs to the Kunimaipan or Goilalan Family and is spoken in seven villages in the Wau area. The following data were compiled from information received from informants in the villages and in Lae, and from the Summer Institute of Linguistics linguist, R. Dubert:

1	<i>nak</i>	
2	<i>nayau</i>	
3	<i>nayak keya nak</i>	two and one
4	<i>mango bek tau ono</i>	
5	<i>mere nasik</i>	hand one
6	<i>mere nasik keya nasika nak</i>	
10	<i>mere yau</i>	hands two
11	<i>mere yau keya ingi nasika nak</i>	hands two, foot one

15	<i>mere yau ingi nasik</i>	hands two leg one
20	<i>yombu nak</i>	

Information from different informants was quite constant, that is there seems to be a standard or conventional form, unlike, for example Safeyoka where there was considerable variation in the phrases used. The expression for three means 'two and one' and it would seem that there are only two numerals, but the meaning of the expression for four is not clear. This could represent the vestiges of a base four system, or it may have a meaning related to hand tallying. Otherwise this is a normal hand and foot tallying system.

#### 96. KUNIMAIPA

This language, a member of the Kunimaipan Family, is spoken in an area straddling the border between Morobe and Central Provinces west of Garaina. There are about 1,500 Kunimaipa speakers in the Morobe Province, and somewhat more in the Central Province. The following data were provided by the Summer Institute of Linguistics linguists, J. Coleman and E. Geary:

1	<i>nap</i>	
2	<i>houlounariv</i>	
3	<i>nanariv nap</i>	two one
4	<i>nanariv nanariv</i>	two two
5	<i>maranas</i>	hand
6	<i>maranas sitihanan nap</i>	hand and one
10	<i>mar houlousikaro</i>	hands two
15	<i>marasikaro met en nas</i>	hands and foot
20	<i>abanap mumug</i>	

Coleman and Geary (personal communication) note that this system is not used very much beyond three. The suffixes appended to the numerals given in this list refer to people, but there are 17 other suffixes used as noun qualifiers. The system has two numerals and uses hands and feet to tally to 20.

#### 97. WERI

This Kunimaipan Family language is spoken exclusively within the Morobe Province. There are about 4,000 speakers in the mountains between Wau and Garaina. The following data were compiled from information received by village informants, two dwellers and the Summer Institute of Linguistics linguist, M. Boxwell:

1	<i>nent</i>	
2	<i>nentepar</i>	
3	<i>nentepar nent</i>	two one
4	<i>kong nent</i>	fourth finger
	or <i>nentepar nentepar</i>	two two
5	<i>mor nas</i>	
6	<i>mor has nasiaan nent</i>	hand one from hand one
10	<i>moraar</i>	
	or <i>moresiar</i>	hands two
11	<i>moresiar ingesiaan nent</i>	hands two from foot one

15	<i>moresiar ing nas</i>	hands two foot one
20	<i>omenamp ulpen</i>	man whole

In this system, tallying on hands and feet achieves a total of 20. There are two numerals but an alternative name for four is used also. In place of *nent* and *nentepar* for 'one' and 'two', some informants used *nao* and *naorar*.

## 98. BINANDERE

This language of the Binanderean Family is spoken mainly in the Northern Province, but also in two villages on the southern coast of the Morobe Province close to the border with the Northern Province. The following incomplete data were collected from an informant at high school in Lae:

1	<i>da</i>	
2	<i>tote</i>	
3	<i>tamode</i>	
4	<i>tamode da gagani</i>	
5	<i>ingo da</i>	hand one
6	<i>ingo neida gisi</i>	
7	<i>gisida gagani</i>	
8	<i>toro nei</i>	
9	<i>ingo da paside</i>	
10	<i>aobe ao</i>	

The meanings of these expressions are not clear. Five appears to mean 'one hand', but there seem to be other words for six to ten. Clarification is needed here.

## 99. GUHU-SAMANE

This language is a member of the Binanderean Family and is spoken in the mountainous Upper Waria area of the Morobe Province south of Garaina. A number of informants contributed to the following data:

1	<i>tena</i>	
2	<i>eseri</i>	
3	<i>tapari</i>	
4	<i>eseri sa eseri</i>	two and two
5	<i>boto tena</i>	hand one
6	<i>boto tena ma tena</i>	hand one and one
10	<i>boto eseri</i>	hands two
15	<i>boto tapari</i>	hands three
	or <i>boto eseri ma oko te</i>	hands two leg one
20	<i>boto eseri ma oko eseri</i>	hands two feet two

There are three numerals and tallying to a base of 20 takes place on the hands and feet.



## 100. MAWAE

This language belongs to the Binanderean Family and is spoken by about 1,000 people in the mid-Waria region in the south of the Morobe Province. The following counting data were provided by informants in Lae:

1	<i>dekako</i>	
2	<i>eto</i>	
3	<i>etama</i>	
4	<i>etama dekaka</i>	three one
5	<i>nago dekaka</i>	hand one
6	<i>nago zora dekako</i>	hand another one
10	<i>nago eto</i>	hands two
15	<i>nago eto nago zo</i>	hands two hand another
20	<i>nago eto te eto</i>	hands two and two

The feet were not used here to tally, but a total of 20 was achieved by using four hands. There are three numerals.

## 101. SUENA

This is a Binanderean Family language spoken by about 2,000 people around the Morobe District headquarters. Counting data from Suena-speaking informants were supplemented by comments from the Summer Institute of Linguistics linguist, D. Wilson who was working in the area:

1	<i>da</i>	
2	<i>eta</i>	
3	<i>etorobara</i>	
4	<i>zoeto zoeto</i>	two two
	or <i>wana awa patitiro</i>	little finger bent
5	<i>wana da</i>	hand one
6	<i>wana zore wana zora gitire</i>	hand one hand one's thumb
10	<i>wana eto darapotiro</i>	hands two?
15	<i>wana etore te zore</i>	hands two foot one
20	<i>wana etore te atore</i>	hands two feet two

Wilson (personal communication) considers that *etorobara* meaning 'three' is probably derived from *eta-roba-da* or 'two plus one'. The expression for four meaning 'little finger bent' indicates that four fingers are left upright. There are two numerals, and tallying on hands and feet gives a base of 20.

## 102. YEKORA

This language belongs to the Binanderean Family, and is spoken in three villages close to the Morobe District headquarters. Informants in Lae provided the following counting data:

1	<i>dembaka</i>
2	<i>eto</i>
3	<i>etoremba</i>

4	<i>ikapatige</i>	
5	<i>umazo</i>	hand
6	<i>umazo ika dembaka</i>	hand and one
10	<i>uma eto</i>	hands two
15	<i>uma eto wegiti dembaka</i>	hands two and foot one
20	<i>emba zo</i>	man one

Tallying on the hands and feet gives a base of 20. There are two distinct numerals and the expression for three appears to mean 'two and one'.

## 103. ZIA

This language belongs to the Binanderean Family and is spoken by about 3,000 people in the Lower Waria area south of the Morobe District headquarters. The following data were provided by an informant in Lae:

1	<i>dengkaka</i>	
2	<i>eta</i>	
3	<i>etama</i>	
4	<i>singwopatige</i>	
5	<i>wangwozo</i>	hand one
10	<i>wanwo eto</i>	hands two
15	<i>wangwo eto tezo</i>	hands two foot one
20	<i>emozo</i>	man one

This is similar to other systems in the family. There are two distinct numerals and three appears to have been derived from 'two and one' but is not identical. There is a term for four which seems to be related to the Suená term meaning 'the little finger bent'. Tallying on the hands and feet gives a total of 20.

## APPENDIX B

## NUMERAL WORDS IN MOROBE LANGUAGES

The words used for numerals in Morobe languages are presented here for ease of comparison. It will be recalled that languages represented by numbers 1-40 are Austronesian, while 41-103 are non-Austronesian (see Appendix A). For numerals above two, expressions consisting of combinations of others words are shown by the mathematical symbols, for example '2 + 1' or '5 x 2'. When considering the number five, the words for both five and hand are compared where this information is available. If five is represented by a hand tally, this is indicated. Few languages have a distinct numeral for ten; for the others, a variety of tallying expressions may be used, indicated in the lists by 'tally total'. None of the languages have distinct terms for the numerals six to nine.

## WORDS FOR 'ONE' IN MOROBE LANGUAGES

1.	<i>tigen, tikeng, tegeng</i>	5.	(no data)
2.	<i>dongke</i>	6.	<i>sesemi</i>
3.	<i>tunome</i>	7.	<i>tageng</i>
4.	<i>tugwatu</i>	8.	<i>ta</i>

- |     |                            |     |  |
|-----|----------------------------|-----|--|
| 9.  | <i>atul</i>                | 56. | <i>wetku</i>                               |
| 10. | <i>ta, tanuku</i>          | 57. | <i>weku</i>                                |
| 11. | <i>ta</i>                  | 58. | <i>konok</i>                               |
| 12. | <i>tainina, utitidzi</i>   | 59. | <i>wengetene</i>                           |
| 13. | <i>tanina</i>              | 60. | <i>konok</i>                               |
| 14. | <i>taitu</i>               | 61. | <i>mogok</i>                               |
| 15. | <i>te</i>                  | 62. | <i>mohokung</i>                            |
| 16. | <i>eze</i>                 | 63. | <i>kobelak</i>                             |
| 17. | <i>es</i>                  | 64. | <i>kubogen</i>                             |
| 18. | <i>takanan</i>             | 65. | <i>ningalac</i>                            |
| 19. | <i>takanangk</i>           | 66. | <i>kubugang</i>                            |
| 20. | <i>bicits</i>              | 67. | <i>fikanggang, kubugang</i>                |
| 21. | <i>bisinta</i>             | 68. | <i>nogan</i>                               |
| 22. | <i>bisinta</i>             | 69. | <i>ningit</i>                              |
| 23. | <i>tangkua</i>             | 70. | <i>ninggeni</i>                            |
| 24. | <i>bisan</i>               | 71. | <i>kutnung, kubegang</i>                   |
| 25. | <i>bicits</i>              | 72. | <i>ningit</i>                              |
| 26. | <i>oroz</i>                | 73. | <i>kubini</i>                              |
| 27. | <i>bisangcwa</i>           | 74. | <i>bat</i>                                 |
| 28. | <i>taginei</i>             | 75. | <i>kumbangan</i>                           |
| 29. | <i>munuts</i>              | 76. | <i>tapatu</i>                              |
| 30. | <i>urus</i>                | 77. | <i>kumbagan</i>                            |
| 31. | <i>uruts</i>               | 78. | <i>kwana</i>                               |
| 32. | <i>ti, kiramong</i>        | 79. | <i>isan</i>                                |
| 33. | <i>ti</i>                  | 80. | <i>esal</i>                                |
| 34. | <i>ti</i>                  | 80a | <i>duwit</i>                               |
| 35. | <i>ti</i>                  | 81. | <i>kamantewe</i>                           |
| 36. | <i>tika</i>                | 82. | <i>kuwaran</i>                             |
| 37. | <i>timu</i>                | 83. | <i>koweran</i>                             |
| 38. | <i>tom</i>                 | 84. | <i>kongotai</i>                            |
| 39. | <i>tom</i>                 | 85. | <i>ongkogon</i>                            |
| 40. | <i>tom</i>                 | 86. | <i>harawo</i>                              |
| 41. | <i>munugon</i>             | 87. | <i>mmuaa-vai</i>                           |
| 42. | <i>macgu</i>               | 88. | <i>nanso</i>                               |
| 43. | <i>moc</i>                 | 89. | <i>fati</i>                                |
| 44. | <i>motongo, wankembing</i> | 90. | <i>hunaninko</i>                           |
| 45. | <i>momagu</i>              | 91. | <i>tona, uwa'na</i>                        |
| 46. | <i>moketong</i>            | 92. | <i>hankwona</i>                            |
| 47. | <i>moniang</i>             | 93. | <i>anga'no, ananoi, hekwe,<br/>gonangi</i> |
| 48. | <i>mongkeangka</i>         | 94. | <i>'kwənənoi</i>                           |
| 49. | <i>moko</i>                | 94a | <i>pono</i>                                |
| 50. | <i>mohot</i>               | 95. | <i>nak</i>                                 |
| 51. | <i>kutam</i>               | 96. | <i>nap</i>                                 |
| 52. | <i>kanok</i>               | 97. | <i>nent, nao</i>                           |
| 53. | <i>tauc</i>                | 98. | <i>da</i>                                  |
| 54. | <i>kweji</i>               | 99. | <i>tena</i>                                |
| 55. | <i>kwep</i>                |     |  |

100. *dekako*  
101. *da*

102. *dembaka*  
103. *dengkaka*

## WORDS FOR 'TWO' IN MOROBE LANGUAGES

- |                                       |                                    |
|---------------------------------------|------------------------------------|
| 1. <i>lu, ulu</i>                     | 44. <i>woic, tukembing</i>         |
| 2. <i>ailu</i>                        | 45. <i>erehec, uluhu</i>           |
| 3. <i>lua</i>                         | 46. <i>yoyoka</i>                  |
| 4. <i>salu</i>                        | 47. <i>yaekang</i>                 |
| 5. (no data)                          | 48. <i>yaekang</i>                 |
| 6. <i>lua</i>                         | 49. <i>yakeko</i>                  |
| 7. <i>luagic</i>                      | 50. <i>yahat</i>                   |
| 8. <i>ru</i>                          | 51. <i>ikop</i>                    |
| 9. <i>ru</i>                          | 52. <i>zagat</i>                   |
| 10. <i>rua, dua</i>                   | 53. <i>kosop</i>                   |
| 11. <i>ru</i>                         | 54. <i>jeba</i>                    |
| 12. <i>lua</i>                        | 55. <i>zut</i>                     |
| 13. <i>lua</i>                        | 56. <i>okop</i>                    |
| 14. <i>rua</i>                        | 57. <i>etke</i>                    |
| 15. <i>lu</i>                         | 58. <i>yogop</i>                   |
| 16. <i>rua</i>                        | 59. <i>etka</i>                    |
| 17. <i>ru</i>                         | 60. <i>lauwo</i>                   |
| 18. <i>suruk</i>                      | 61. <i>reget</i>                   |
| 19. <i>serok</i>                      | 62. <i>weit</i>                    |
| 20. <i>siruc</i>                      | 63. <i>yalambok</i>                |
| 21. <i>iruc, irurun, bisi da bisi</i> | 64. <i>yare</i>                    |
| 22. <i>iru</i>                        | 65. <i>yalambok</i>                |
| 23. <i>iruk</i>                       | 66. <i>lifet</i>                   |
| 24. <i>leluk</i>                      | 67. <i>lupek, lifet</i>            |
| 25. <i>siruc</i>                      | 68. <i>tipet</i>                   |
| 26. <i>serok</i>                      | 69. <i>yaru</i>                    |
| 27. <i>iriciru</i>                    | 70. <i>tupet</i>                   |
| 28. <i>seik</i>                       | 71. <i>lufom, lipet</i>            |
| 29. <i>siluk</i>                      | 72. <i>yali</i>                    |
| 30. <i>siruk</i>                      | 73. <i>fama, famak, kubiniksak</i> |
| 31. <i>siruc</i>                      | 74. <i>yara</i>                    |
| 32. <i>yu</i>                         | 75. <i>yara</i>                    |
| 33. <i>yuuh</i>                       | 76. <i>tapaya</i>                  |
| 34. <i>lu</i>                         | 77. <i>yala</i>                    |
| 35. <i>yu</i>                         | 78. <i>irisa</i>                   |
| 36. <i>lu</i>                         | 79. <i>bronge</i>                  |
| 37. <i>uy</i>                         | 80. <i>brong</i>                   |
| 38. <i>(lokuang) yu</i>               | 80a <i>kumjat</i>                  |
| 39. <i>zu</i>                         | 81. <i>yara</i>                    |
| 40. <i>yi</i>                         | 82. <i>danggan</i>                 |
| 41. <i>lolon</i>                      | 83. <i>yara</i>                    |
| 42. <i>jahockang</i>                  | 84. <i>eleko</i>                   |
| 43. <i>yayahec</i>                    | 85. <i>yait</i>                    |

86.	<i>abugi</i>	95.	<i>nayau</i>
87.	<i>taara-vaitana</i>	96.	<i>houlounariv</i>
88.	<i>yakwu</i>	97.	<i>nentepar, naorar</i>
89.	<i>hivacu</i>	98.	<i>tote</i>
90.	<i>hukwego</i>	99.	<i>eseri</i>
91.	<i>tavau, huvaa'u</i>	100.	<i>eto</i>
92.	<i>hankwakwu</i>	101.	<i>eto</i>
93.	<i>hufa'u</i>	102.	<i>eto</i>
94.	<i>u'laako, huluwaku, hoku</i>	103.	<i>eta</i>
94a	<i>penkwai</i>		

## WORDS FOR 'THREE' IN MOROBE LANGUAGES

1.	<i>to, tu, tur</i>	36.	<i>yan</i>
2.	<i>aitol</i>	37.	<i>yar</i>
3.	<i>tarawa</i>	38.	<i>(lokuang) lu</i>
4.	<i>sidi</i>	39.	<i>lu</i>
5.	(no data)	40.	<i>lu</i>
6.	<i>tori</i>	41.	<i>albon</i>
7.	<i>tiliac, treia</i>	42.	<i>harebec</i>
8.	<i>tol</i>	43.	2 + 1
9.	<i>tol</i>	44.	<i>karong, karowong, tirikeming</i>
10.	<i>tol, ton</i>	45.	<i>harewec</i>
11.	<i>tel</i>	46.	2 + 1
12.	<i>tua, 2 + 1</i>	47.	<i>habakang</i>
13.	2 + 1	48.	<i>araboa</i>
14.	<i>ngato</i>	49.	<i>korobo</i>
15.	<i>tol</i>	50.	<i>karambut</i>
16.	<i>tolu</i>	51.	2 + 1
17.	<i>tol</i>	52.	<i>karambut</i>
18.	2 + 1	53.	<i>karembot</i>
19.	2 + 1	54.	<i>tuba</i>
20.	2 + 1	55.	<i>tuk</i>
21.	2 + 1	56.	2 + 1, <i>karebot</i>
22.	2 + 1	57.	<i>karewe</i>
23.	2 + 1	58.	<i>maik, kalambu</i>
24.	2 + 1	59.	<i>karamba</i>
25.	2 + 1	60.	<i>olowu</i>
26.	2 + 1	61.	<i>karewet</i>
27.	2 + 1	62.	<i>karambut</i>
28.	2 + 1	63.	2 + 1
29.	2 + 1	64.	2 + 1
30.	2 + 1	65.	2 + 1
31.	2 + 1	66.	2 + 1
32.	<i>yal</i>	67.	<i>lufeten, difetening, 2 + 1?</i>
33.	<i>yaar</i>	68.	2 + 1
34.	<i>lal</i>	69.	2 + 1
35.	<i>yon</i>	70.	2 + 1

71.	2 + 1	88.	<i>mulumo</i>
72.	2 + 1	89.	2 + 1
73.	2 + 1, <i>fimeneng</i>	90.	2 + 1
74.	2 + 1	91.	2 + 1
75.	2 + 1	92.	2 + 1
76.	2 + 1	93.	2 + 1
77.	2 + 1	94.	2 + 1
78.	<i>kapusa</i>	94a.	2 + 1
79.	<i>kabe</i>	95.	2 + 1
80.	<i>kape</i>	96.	2 + 1
80a.	<i>kapu</i>	97.	2 + 1
81.	<i>kalahu</i>	98.	<i>tamode</i>
82.	<i>kailpu</i>	99.	<i>tapari</i>
83.	<i>kabma</i>	100.	<i>etama</i> (2 + 1?)
84.	<i>olowu</i>	101.	2 + 1?
85.	<i>atvi</i>	102.	2 + 1?
86.	<i>abono</i>	103.	2 + 1?
87.	2 + 1		

## WORDS FOR 'FOUR' IN MOROBE LANGUAGES

1.	<i>hale</i>	28.	2 + 2
2.	<i>aivat</i>	29.	2 + 2
3.	<i>nga</i>	30.	2 + 2
4.	<i>suha</i>	31.	2 + 2
5.	(no data)	32.	<i>vei, ba lu</i>
6.	<i>wata</i>	33.	2 + 2
7.	<i>acle</i>	34.	2 + 2
8.	<i>pang</i>	35.	2 + 2
9.	<i>pai</i>	36.	2 + 2?
10.	<i>pange, tantan</i>	37.	<i>nyekuy</i>
11.	<i>pang</i>	38.	<i>(lokuang) va</i>
12.	2 + 2	39.	<i>va</i>
13.	2 + 2	40.	<i>va</i>
14.	<i>ngapa</i>	41.	<i>ilon</i>
15.	<i>pat</i>	42.	<i>neaqac</i>
16.	<i>pange</i>	43.	2 + 2
17.	<i>pang</i>	44.	<i>nemungac, fololo</i>
18.	2 + 2	45.	<i>kembong pa</i>
19.	2 + 2	46.	2 + 2
20.	2 + 2	47.	2 + 2
21.	2 + 2	48.	<i>iforec</i>
22.	2 + 2	49.	<i>kiwele</i>
23.	2 + 2	50.	<i>kihiwet</i>
24.	2 + 2	51.	2 + 2
25.	2 + 2	52.	<i>kimembut</i>
26.	2 + 2	53.	2 + 2
27.	2 + 2	54.	<i>babumba</i>

55.	2 + 2	80a.	2 + 2
56.	2 + 2	81.	2 + 2
57.	2 + 2	82.	2 + 2
58.	<i>imbot</i>	83.	2 + 2
59.	2 + 2	84.	2 + 2
60.	<i>imbot</i>	85.	<i>anumuno</i>
61.	<i>kembem kpagap</i>	86.	2 + 2
62.	<i>kimbam parup</i>	87.	2 + 2
63.	2 + 2	88.	<i>mulamula</i>
64.	2 + 2, <i>imaninamo</i>	89.	2 + 2
65.	2 + 2	90.	2 + 2
66.	2 + 2	91.	2 + 2
67.	2 + 2, <i>didim, diding</i>	92.	2 + 2
68.	2 + 2	93.	<i>osofo fo fa'u'no</i>
69.	2 + 2	94.	2 + 2
70.	2 + 2	94a.	2 + 2
71.	2 + 2	95.	<i>mango bek tau ono</i>
72.	2 + 2	96.	2 + 2
73.	2 + 2, <i>fimenengging</i>	97.	<i>kong nent, 2 + 2</i>
74.	2 + 2	98.	<i>tamode da gagani (3 + 1?)</i>
75.	2 + 2	99.	2 + 2
76.	2 + 2	100.	3 + 1
77.	2 + 1 + 1	101.	2 + 2, <i>wana awa patitiro</i>
78.	<i>niming kining</i>	102.	<i>ikapatige</i>
79.	2 + 2	103.	<i>singwopatige</i>
80.	2 + 2		

## WORDS FOR 'FIVE' AND 'HAND' IN MOROBE LANGUAGES

	FIVE	HAND			
			16.	(hand)	<i>nimanda</i>
1.	<i>lim (dang)</i>	<i>amang</i>		<i>lima</i>	
2.	(= hand)	<i>bage</i>	17.	<i>lim</i>	<i>ima</i>
3.	<i>lita</i>	<i>mange</i>			<i>niman</i>
4.	<i>maipi</i>	<i>nama</i>	18.	(= hand)	<i>bangi</i>
5.	(no data)	(no data)	19.	(= hand)	<i>bangge</i>
6.	(= hand)	<i>nima</i>	20.	(= hand)	<i>biangke</i>
7.	(= hand)	<i>lemeng</i>	21.	2 + 2 + 1	<i>bangi</i>
8.	<i>lim</i>	<i>bagek</i>	22.	2 + 1 + 2	?
9.	<i>lim</i>	<i>baene</i>	23.	2 + 2 + 1	?
10.	(= hand)	<i>bayer</i>	24.	2 + 2 + 1	?
	(= hand)	<i>bager</i>	25.	(= hand)	<i>bangke</i>
11.	<i>lama(ta)</i>	<i>nomong</i>	26.	(= hand)	<i>bangid</i>
12.	2 + 2 + 1	<i>rimana</i>	27.	(= hand)	<i>bacin</i>
13.	2 + 2 + 1	<i>dimara</i>	28.	(= hand)	<i>limangga</i>
14.	<i>lima</i>	<i>mbao</i>	29.	(= hand)	<i>baing</i>
15.	<i>lim</i>	<i>lima</i>	30.	(= hand)	<i>baing</i>
		<i>lemang</i>	31.	(= hand)	<i>pangging</i>

32.	<i>lim</i>	<i>memang</i>	69.	(= hand)	<i>kit</i>
33.	(= hand)	<i>nama</i>	70.	2 + 2 + 1	<i>kudne</i>
34.	(= hand)	<i>orund</i>	71.	(= hand)	<i>kafong</i>
35.	(= hand)	<i>vige</i>			<i>kohong</i>
		<i>nema</i>	72.	<i>niya</i>	<i>keli</i>
36.	(= hand)	<i>banggi</i>	73.	2 + 2 + 1	<i>kafini</i>
		<i>vanggi</i>		<i>fimenengsinik</i>	
37.	(= hand)	<i>nəma</i>	74.	2 + 2 + 1	<i>kesit</i>
38.	(= hand)	<i>baheng</i>	75.	<i>iman</i>	<i>ket</i>
39.	(= hand)	<i>bahem</i>	76.	2 + 2 + 1	<i>kata</i>
40.	(= hand)	<i>vagem</i>	77.	2 + 1 + 2	<i>ket</i>
41.	(= hand)	<i>mili</i>	78.	(= hand)	<i>kande</i>
42.	(= hand)	<i>mara</i>	79.	2 + 2 + 1	<i>kolom</i>
43.	(= hand)	<i>memoc</i>	80.	(= hand)	<i>kodom</i>
44.	(hand)	<i>boro</i>	80a.	(= hand)	<i>korun</i>
	<i>faingambe</i>		81.	(= hand)	<i>get</i>
45.	(= hand)	<i>mera</i>	82.	(= hand)	<i>kaibue</i>
46.	(= hand)	<i>mə</i>	83.	2 + 2 + 1	?
47.	(= hand)	<i>mole</i>	84.	(= hand)	<i>meme</i>
48.	(= hand)	<i>mə</i>	85.	(= hand)	<i>obu</i>
49.	(= hand)	<i>mə</i>	86.	3 + 2	<i>omaido</i>
50.	(= hand)	<i>boro</i>	87.	(= hand)	<i>yaaku</i>
51.	(= hand)	<i>holi</i>	88.	(= hand)	<i>ikwi</i>
52.	(= hand)	<i>bet</i>	89.	2 + 2 + 1	<i>feca</i>
53.	(= hand)	<i>suli</i>		(= hand)	
54.	(= hand)	<i>bainim</i>	90.	(= hand)	?
55.	(= hand)	<i>bet</i>	91.	2 + 2 + 1	<i>vaeya</i>
56.	(= hand)	<i>mete</i>	92.	(= hand)	<i>hipa</i>
57.	(= hand)	<i>mete</i>		2 + 2 + 1	
58.	(= hand)	<i>bot</i>	93.	(= hand)	<i>aho</i>
59.	(= hand)	<i>meta</i>	94.	(= hand)	<i>wəlyəmpu</i>
60.	<i>momerok</i>	<i>bot</i>	94a.	(= hand)	<i>ha</i>
61.	(= hand)	<i>mara</i>	95.	(= hand)	<i>mere</i>
62.	(hand)	<i>biri</i>	96.	(= hand)	<i>mar</i>
	<i>naman</i>		97.	(= hand)	<i>mor</i>
63.	2 + 2 + 1	<i>mem</i>	98.	(= hand)	<i>ingo</i>
64.	<i>iman</i>	<i>kairi</i>	99.	(= hand)	<i>boto</i>
65.	2 + 2 + 1	?	100.	(= hand)	<i>nago</i>
66.	2 + 2 + 1	<i>kafong</i>	101.	(= hand)	<i>wana</i>
67.	(= hand)	<i>ko</i>	102.	(= hand)	<i>uma</i>
		<i>kafo</i>	103.	(= hand)	<i>wangwo</i>
68.	(= hand)	<i>kit</i>			

## WORDS FOR 'TEN' IN MOROBE LANGUAGES

- |    |               |    |               |
|----|---------------|----|---------------|
| 1. | <i>sahuc</i>  | 2. | (tally total) |
|    | (tally total) | 3. | <i>taomo</i>  |



- |     |                 |      |                       |
|-----|-----------------|------|-----------------------|
| 4.  | <i>numusu</i>   | 48.  | (tally total)         |
| 5.  | (no data)       | 49.  | (tally total)         |
| 6.  | (tally total)   | 50.  | (tally total)         |
| 7.  | (tally total)   | 51.  | (tally total)         |
| 8.  | <i>sangul</i>   | 52.  | (tally total)         |
| 9.  | <i>sangaul</i>  | 53.  | (tally total)         |
| 10. | (tally total)   | 54.  | (tally total)         |
| 11. | 5 x 2           | 55.  | (tally total)         |
| 12. | (tally total)   | 56.  | (tally total)         |
| 13. | (tally total)   | 57.  | (tally total)         |
| 14. | <i>sangao</i>   | 58.  | (tally total)         |
| 15. | 5 x 2           | 59.  | (tally total)         |
| 16. | (tally total)   | 60.  | (tally total)         |
| 17. | <i>sanggul</i>  | 61.  | (tally total)         |
| 18. | (tally total)   | 62.  | (tally total)         |
| 19. | (tally total)   | 63.  | (tally total)         |
| 20. | (tally total)   | 64.  | (tally total)         |
| 21. | (tally total)   | 65.  | (tally total)         |
| 22. | (tally total)   | 66.  | (tally total)         |
| 23. | (tally total)   | 67.  | (tally total)         |
| 24. | (tally total)   | 68.  | (tally total)         |
| 25. | (tally total)   | 69.  | (tally total)         |
| 26. | (tally total)   | 70.  | (tally total)         |
| 27. | (tally total)   |      | <i>singen?</i>        |
| 28. | (tally total)   | 71.  | (tally total)         |
| 29. | (tally total)   | 72.  | (tally total)         |
| 30. | (tally total)   | 73.  | (tally total)         |
| 31. | (tally total)   |      | <i>memenggingsini</i> |
| 32. | <i>omin</i>     | 74.  | (tally total)         |
|     | (tally total)?  | 75.  | (tally total)         |
| 33. | (tally total)   | 76.  | (tally total)         |
| 34. | (tally total)   | 77.  | (tally total)         |
| 35. | (tally total)   | 78.  | (tally total)         |
| 36. | (tally total)   | 79.  | (tally total)         |
| 37. | (tally total)   | 80.  | (tally total)         |
| 38. | <i>lauming</i>  | 80a. | (tally total)         |
| 39. | <i>laumin</i>   | 81.  | (tally total)         |
| 40. | <i>lauming</i>  | 82.  | (tally total)         |
| 41. | <i>melalin</i>  | 83.  | 3 + 3 + 3 + 1         |
| 42. | (tally total)   | 84.  | (tally total)         |
| 43. | (tally total)   | 85.  | (tally total)         |
| 44. | (tally total)   | 86.  | 3 + 3 + 3 + 1         |
|     | <i>hetening</i> | 87.  | (tally total)         |
| 45. | (tally total)   | 88.  | (tally total)         |
| 46. | (tally total)   | 89.  | (tally total)         |
| 47. | (tally total)   | 90.  | (tally total)         |

91.	(tally total)	98.	(tally total)
92.	(tally total)		<i>aobe ao?</i>
93.	(tally total)	99.	(tally total)
94.	(tally total)	100.	(tally total)
94a.	(tally total)	101.	(tally total)
95.	(tally total)	102.	(tally total)
96.	(tally total)	103.	(tally total)
97.	(tally total)		

## APPENDIX C

## ALPHABETICAL LIST OF MOROBE LANGUAGES

Each Morobe language is given a number according to the classification adopted in section 2.2.2. These numbers are used for ordering the languages when presenting data in Appendices A and B. The following alphabetical listing is to facilitate location of a particular language.

LANGUAGE NAME	LANGUAGE NUMBER	Jabim	see Yabim
Adzera	21	Kaiwa	2
Agaataha	88	Kamasa	90
Ampeeli	see Safeyoka	Kapau	see Hamtai
Bam	74	Kapin	32
Barim	8	Kâte	43
Biangai	95	Kawatsa	91
Binandere	98	Kela	3
Bonkiman	79	Kinalakna	51
Bukauac	1	Komba	52
Bukawa	see Bukauac	Komutu	81
Burum	50	Koripon	80a
Dangal	18	Kosorong	44
Dedua	42	Kotte	see Kâte
Duwet	28	Kovai	41
Finungwa	63	Kube	45
Gitua	16	Kumukio	53
Guhu-Samane	99	Kunimaipa	96
Gusan	64	Labu	4
Guwot	see Duwet	Lae	5
Hamtai	89	Langimar	see Agaataha
Hote	38	Lokep	9
Hube	see Kube	Lukep	see Lokep
Irumu	75	Malasanga	10
Isan	80	Mamaa	65
Iwal	see Kaiwa	Manga	33
Jabem	see Yabim	Mangap	11
		Mape	46
		Mapos	34

Maralango	19	Siboma	see Numbami
Mawae	100	Silisili	20
Menya	92	Sio	14
Mesem	54	Sipoma	see Numbami
Migabac	47	Sirak	30
Misim	39	Sirasira	23
Momolili	see Mesem	Som	83
Munkip	66	Suena	101
Musom	29	Sukurum	24
Mutu	17	Susuami	94a
Nabak	55	Tami	15
Nafi	see Sirak	Unank	25
Nakama	67	Urii	73
Nambom	see Sirak	Vehes	37
Nek	68	Waffa	87
Nenaya	12	Wampar	26
Nengaya	see Nenaya	Wampur	27
Ngariawan	22	Wantoat	76
Nimi	69	Wasembo	86
Nomu	56	Weri	97
Nuk	70	Wojokeso	see Safeyoka
Numanggang	71	Yabim	7
Numbami	6	Yabem	see Yabim
Onank	see Unank	Yagawak	77
Ono	57	Yagwoia	94
Piu	36	Yaknge	62
Roinji	13	Yalu	31
Safeyoka	93	Yamap	40
Sakam	82	Yau	85
Sauk	72	Yekora	102
Selepet	58	Yupna	see Isan
Sene	49	Zia	103
Sialum	59		

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