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COUNTING AT PULARUMPI

A SURVEY OF A TRADITIONAL MATHEMATICS AND ITS IMPLICATIONS FOR MODERN LEARNING

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The research on which this article is based was undertaken at Pularumpi, Melville Island, Northern Territory in 1984-85. At the time I was employed as the adult educator for Pularumpi, and was conducting courses and classes which involved mathematics at various levels - a course in metrication for the technical staff; mathematics for specific purposes for the health workers, police aides, Council and Housing Association bookkeepers, and for the Essential Services apprentices.

In all this I was never too sure of my methodology: what was the most effective way of helping these adults to learn? The basic problem was that I had no information of their pre-knowledge - the mathematical knowledge they possessed prior to their entry into the classes. Most had formal education to a secondary level, a few had completed secondary schooling in Darwin, Perth or Melbourne, with mixed results. Beyond that formal knowledge, however, I needed to know the students' mathematical preconceptions so that I could more effectively assist them to learn the specific purpose mathematics they needed for the jobs they held.

In 1984, the Northern Territory Education Department published a paper by Pam Harris, *Money in Aboriginal Communities*. This was the first academic work I had encountered which addressed my needs as an educator in this area. Harris examined modern shopping practices and posited a theory of attitudes to numeracy. This information was presented in a readable form and in an effort to assist educators of Aboriginals in mathematics.

Subsequently I decided to conduct my own primary research at Pularumpi to test Harris's theory of shopping behaviour. In the event, the information given went far beyond this basic premise, such that a rationale could be obtained for the teaching of numeracy and other mathematical skills at Pularumpi.

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Before presenting that evidence I should point out that, when I started gathering the evidence, I had already been resident at Pularumpi since the start of 1980: this influences perceptions of the veracity of the evidence presented. Of course, the further evidence of the veracity of the evidence presented will be affected by the degree of acceptance of me by the community and by the individual respondents: this is difficult to evaluate, but every attempt was made to check that evidence, in the first instance by using as wide a range as possible of members of the community, to whom my aim in the exercise was explained as my need to ensure my ability to teach properly those members of the community who held jobs, and in whose technical training I participated. The appeal was, then, not to academia but to the more effective performance of the community - and this remains my aim in writing this.

The evidence given is here organised in the following way:

1. Traditional numeracy
2. Modern numeracy
3. Measurement
4. Shopping

From these sections certain methodological principles and practices can be produced which may help other educators in Aboriginal mathematics.

Finally, an introduction is needed to the Pularumpi community in 1984-5. The population was usually in the range 320-350, the variation depending on transmigration at various seasonal times to other settlements or to camps in the Tiwi nation on Bathurst and Melville Islands. The community was almost equally divided between the Tiwi, and people of various admixtures of race, the "mixed race" people, some of whom had Tiwi ancestry, others of whom had none (their Aboriginal ancestry being from a variety of places on the mainland, as far away as "The Centre", the area around Alice Springs). The non-Aboriginal admixture in this part of the Pularumpi population included Japanese, Irish and other European. Evidence for sections 1 and 2 is exclusively from the Tiwi; other evidence is equally from both parts of the population.

Within the Tiwi people respondents are classified as "old" (adults over 50 years of age); "young" (adults from about 20 but under 35 years: these provided the vast majority of my students and, as the workers taking over administrative jobs, were an

identifiable group, with a community of interests different from that of the old people but similar to that of the younger members of the population, who were their children); "children" (at school); and infants (children not at school, that is, below about four years).

The entire community was based on these age divisions, rough as they may seem. The old people lived in "Old Camp", the young people lived in houses with their children. The old people were the Councillors. The young people played competitive sports. Old women hunted and gathered as a matter of course: the young women hunted or gathered occasionally. The young men fished and sometimes hunted: the old men hunted very rarely, usually only in the dry season camps, for about a month in June-July. The young men mostly worked. Few old men were healthy enough to continue work, though all were proud of the work they had done throughout their lives. The old people rarely went into Darwin; the youngest adults went into "town" several times per year, though less frequently after marriage.

It will be noticed that these divisions leave a gap between the young and the old, from roughly 35 years to roughly 50. This also reflects local realities, and can best be displayed in the use of Tiwi language. A quick example is in the use of refusal or imperative expressions. The old people used Tiwi as a matter of course; their expression for 'no' was the traditional *anungkwa* ('yes' is *kwa*). The young people's use of Tiwi has, for a variety of reasons mainly connected with the history in the Tiwi nation of formal education, largely been "corrupted" with accretions, some from the mainland, some from English. One reliable correspondent estimates that just under half of the words used in modern Tiwi are from Cape Don on the mainland, being especially prominent in descriptions of introduced things. Even these vary with the length of time they have been used in Tiwi: thus, *ketupu* (from "get up") is used by all age groups to mean "to jump"; while only the young people use the more literal "*getapi*" to mean "get out of bed". In any case, the expression used by the young people to express a negative is the Cape Don *kalo* (sometimes *galo* or, when being fanciful, *kalu*).

The people between the young and the old will use a mixture of the traditional Tiwi language and the modern, depending on their audience.

Further, traditional Tiwi had slight regional and familial variations, caused by the usual effect on language of isolation

TABLE 1: TRADITIONAL TIWI NUMBERS AND MODERN USAGE.

Number	Traditional Tiwi	Alternative traditional system ^a	Young people's system
1	yati	yoh	pronounced more as yeti
2	yirrarra	yirrarra	yirrarra
3	(i)yirratrima	(i)yirratrima	yirratrima or yirraratrima
4	yetaulugiri	yatapinti ^b	yatapinti or yukurri ^c
5	pinigignita	pinigignita	pinigignita ^d
6	kirrigarayati	kirrigarra	kirrigarra
7	kirrigarra yirrarra	kirrigarayati	ki.jigayarayati or ki.jigayirayati ^e
8	kirrigarra(i)yirratrima	kirrigarra yirrarra	punyipuniŋa ^f
9	kirrigarra yeta ulu	kirrigarra(i)yirratrima	- ^g
10	giri OR pinigignita yeta ulu giri		
11	womuturarra	womuturarra	womurrara ^h
12	womuturarra milaumparra yati		womurrara milaumparra yeti ⁱ
13	womuturarra milaumparra yirrarra		womurrara milaumparra yirrarra
14	womuturarra milaumparra yeta ulu giri		
15	womuturarra milaumparra pinigignita		
16	womuturarra milaumparra kirrigarayati	womuturarra milaumparra kirrigarra	
17	womuturarra milaumparra kirrigarra yirrarra	womuturarra milaumparra kirrigarra yati	
18	womuturarra milaumparra kirrigarra (i)yirratrima	womuturarra milaumparra kirrigarra yirrarra	
19	womuturarra milaumparra kirrigarra yetaulugiri	womuturarra milaumparra kirrigarra (i)yirratrima	

Table 1, contd..

Number	Traditional Tiwi	Alternative traditional system	Young people's system
20	milauparra yirrarra	milauparra yirrarra	milauparra yirrarra
21	milauparra yirrarra yati		
22	milauparra yirrarra yirrarra		
.....			
30	milauparra (i)yiratrira		
.....			
99	milauparra kirriqarra yeta ulu giri kirriqarra yeta ulu giri	milauparra kirriqarra yeta ulu giri kirriqarra (i)yiratrira	
100.....j			

Notes:

- a. All respondents who used this system (several women, and one man) were all from the eastern side of Melville Island.
- b. "Yetapinti" is used only by a few old people: most old people regard it as "a bit too rough".
- c. "yukurri" has been introduced from the mainland.
- d. Almost all young adults remember local words for 5 and 6, some only with prompting. Even with prompting, about half did not admit knowledge of such terms. Very few know of any terms beyond six.
- e. This is obviously a phonetic decline. "Kijini" means "small"; "kiji a" means "child".
- f. "punyipunyi" normally means something corresponding to "smarts" or "brains".
- g. No young adult could remember a term for nine.
- h. Most young adults knew this, many only after prompting.
- i. Only two young adults knew words for eleven and twelve and twenty. These two were a brother and sister, aged thirty-three and thirty-six respectively. Both belonged to the major branch of one of the two main Pularumpi families; both had been extensively educated, at Nguiu and off the island, to post-secondary level; both held positions of major responsibility in the community, and were employed, one as a teacher (not a teacher aide) and the other was in charge of the Health Department's Health Centre.
- j. No-one knew of any terms for one hundred or powers beyond . This was uniform for people of all ages, and from both eastern and western sides of Melville Island. It should be pointed out that, in the above table, the main difference between the two traditional systems is uniform for all numbers 6-9, 16-19, 26-29,

and distance. In this respect, Milikapiti retains a more traditional form of Tiwi (as reflected in Table I, p.22) and Nguuu, where outside influence has been longest and remains strongest, has the least traditional form of Tiwi: Pularumpi is in between these two extremes, but the process of replacement cannot be reversed. For example, family relationships are now almost exclusively described in English-influenced terms; traditionally, full brothers could not speak to each other, and no man could talk to a sister or sister-in-law. At Pularumpi, the women, always important in traditional Tiwi society, retain most of the taboos, but even the old men will talk to their brothers - and all the old people who knew all the old terms for family relationships (as well as the family land boundaries) are dead. Change has happened and, despite recent attempts to pass on as much of tradition as remains, cannot be reversed. This is the reason for my including sections on both the traditional and the modern numeracies.

The final breakdown from traditional Tiwi is in the loss of imperative terms corresponding to "must", "should", "may". The old people retain such expressions; the young people have no terms to cover these concepts, though it is largely assumed that, in time, a mainland expression or something borrowed from English, will gain currency and acceptance and be used to convey these ideas. In the meantime, the young people and their children do not convey such information.

The issues raised here affect the whole gamut of education (for example, in bilingual education, which language should be used?): their implications will be considered in Section 5: "A Suggested Methodology".

1. TRADITIONAL NUMERACY

The information for this and the second section is contained in Table 1. From there, several factors can be determined as follows:

- a) The Tiwi, whether from east or west, used a decimal system of counting, based on a one-hand base system (see also below, counting on the fingers).
- b) The system was capable of extension to ninety-nine, at which level several old men are able to operate. That is, this was not merely a theoretical extension, but one which was used.

- c) There may well have been terms for numbers of one hundred and more, but these are not remembered or known, nor was there anyone who knew if such terms had ever existed.

Other points which demand attention are as follows:

- d) The word-ending "a" usually indicates feminine associations and gender, as in *kijina* ("children"). In adjectival words the ending "-i" usually indicates a male form, and the ending "-a" indicates a female form. Thus *pumpunni* is the male gender "good" and *pumbukka* the female gender "good". However, this does not apply to noun forms: thus *yurrula* means "old man"; *pijarra* is "eye" in any activity; *yoi'i* is used to describe dance by either gender; *tana* is "sickness"; *chikapruti* is "phlegm"; and *b'luti* means "breast" and "milk".

The question then is the degree of importance to be attached to the use of "-i" and "-a" endings in numbers. 1, 4, 6 and 9 in the western Tiwi system have the male ending (1, 4 and 7 in the eastern system), and 2, 3, 5, 7, 8 and 10 in the western system have female endings (2, 3, 5, 6, 8, 9 and 10 in the eastern system). If any importance can be attached to this gender distribution, then the common factor seems to be 1+3 (1+3 on each hand in the western system; 1+3+3 in the eastern system). There is no definite evidence that this was intentional: the corollary is that there is no evidence of the existence of a distinction between "odd" and "even" numbers, even in a gender form. Such a concept used in a classroom may then be an intrusion to the student's most effective learning.

- e) Tiwi is a language system which employs body and facial language widely, to reinforce meaning and sub-meaning, as well as intent. There is a widely-used sign language, with standardised signs for a wide variety of terms. This language is used daily, not just in hunting and the other situations requiring silence (death and mourning) and not just across distance. The sign language is used by people communicating over short distances as well, and to convey prosaic information. While such messages and body language are not usually used between the sexes, they are occasionally so used.

It is then important that the Tiwi, like all language systems, used a system of counting on the hands. This system is

used by both eastern and western Tiwi, and by both young and old adults. Teachers must then ensure that they know the system and do not introduce unnecessary confusion in the students by using either inappropriate body language, hand signals or hand counting systems. The Tiwi system of hand counting reproduced below is that used in daily situations. There may well be one or more esoteric methods used. If so, these should remain esoteric. The following is the system used universally in everyday situations, and therefore readily understood in any learning situation.

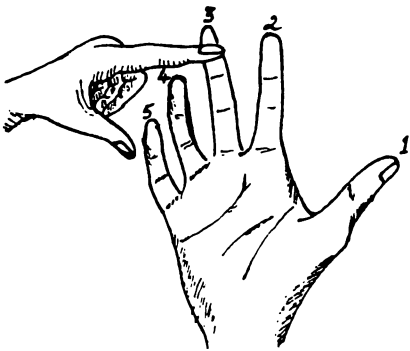


Figure 1: Counting sequence from 1 to 5.

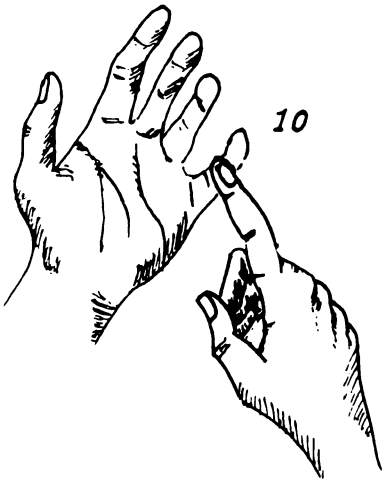


Figure 2: Counting 10

Illustrations by Sally Stott

Old people count from the thumb across the hand to the little finger, usually starting with the right hand. Some people count off 1 to 5 by striking the fingers of the right hand with the left forefinger. Sometimes the right hand is shaken for emphasis, with a pause between each number as that number is counted.

The right hand in this progression is held open, palm uppermost, at an acute yet natural angle, the fingers splayed and slightly bent. As the progression continues the fingers counted off are extended stiffly.

The process is repeated exactly on the left hand and using the right forefinger to count off the numbers 6 to 10. Ten is indicated by holding the right forefinger in the left little finger, which thereby is not held rigid, but is curved. Numbers between 11 and 19 are then indicated either by holding the left little finger with the right forefinger, and then counting off the extra numbers as for 1 to 9; or by lightly hitting the left palm with the right forefinger, and then counting as for 1 to 9. Twenty, 30 and so on are indicated as above, that is, by

either holding the left little finger an appropriate number of times with the right forefinger, or gently hitting the left palm below the little finger with the right forefinger the required number of times.

The sequence, counting across the fingers, is also used when enumerating, indicating a particular number. There are alternatives, but only when indicating 2 and 3. In this case, 2 may be indicated either as above, or by extending stiffly the little and ring fingers of the right hand. Three may be indicated as above, by striking the right index finger, or by extending stiffly the little, ring and index fingers of the right hand. This pattern is repeated through 12, 13, 22, 23.....92, 93.

In both cases, when indicating 2 or 3 in this way, the remaining fingers of the right hand are held in an open circle by the thumb.

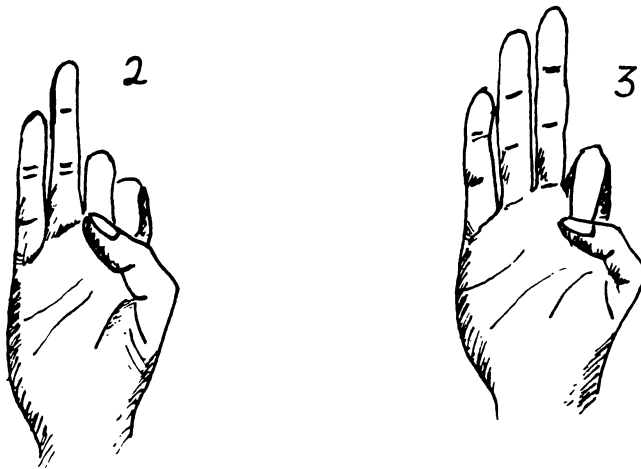


Figure 3: Indicating quantity.
Illustration by Sally Stott.

2: MODERN NUMERACY

The information here involves the young adults, though some information is included from the children, to show that the decline is more pronounced in their usage of traditional form.

The information on the ability of young adults to count in language is contained in Table 1. Young people, in the main,

can count only as far as six without prompting, though two can count to twelve and remember a word for twenty. Even within this narrow limit, there are gaps, an introduced word, and several words have declined (7 and 8, to *kijipayarrayati punyipunyipa*). Young adults know, and use no other numbers in traditional form.

Children know *yati* and *yirrara* (1 and 2). Many know (*i*)*yiratrima* (though as the derived form *yirrarratrima*). They know no other traditional forms, using English for all other numbers - they also usually use the English word for the numbers they do know in traditional form.

This pattern, of using English, even when a traditional form is known, is now widely used among all age groups. *Yati* and *yirrara* are often used in conversations in Tiwi (*i*)*yiratrima* less often. English terms are widely used even for these, and almost exclusively for the numbers 4 and above.

The words *gard*i ("big") and *kita* ("small") are also widely used to express quantity, even in enumeration. Though the evidence is slim, this seems to be an introduced practice: thus, people of all ages use *gard*i interchangeably with "mobs", "big mobs", and "biggest mobs" (Kriol for "many" and extensions therefrom).

When using their hands to count, children still usually indicate the progression of numbers by striking the fingers with the forefinger of the other hand. They usually start on the left hand, though sometimes starting in the traditional way with the right hand. No matter with which hand they commence, the progression is from the thumb, across the hand to the little finger. Ten is displayed with both palms outward, the fingers either splayed fully open, or slightly bent in a relaxed position. Only rarely did I see numbers of 20 and above indicated by children. In these few cases, the open palms of both hands, held facing outward, were pushed forward the appropriate number of times, and then the units displayed.

Young adults are caught between the practices of the old people, and those of the children, the actual usage depending on the individual and often depending on the person addressed. The most common factor seemed not to be relationship but degree of formal education. Especially those people with primary education to Grade 3 or 4 level often were confused when indicating numbers to me. They would at some stage of the exercise

try to use practices learned in school, and often, though not always, grow confused. This unsatisfactory situation ended when I undertook this research: thereafter, in any situation, the adult (of whatever age) would use traditional methods. In the first few months after I had been taught the old ways, the adult often asked, after using the old ways to indicate a number, something along the lines of "You know this way? You understand what I said?" and would then check that I did indeed understand. The old people would often ask me to state the number indicated on the hand, using the old Tiwi words to do so, and correcting any hesitance on my part.

When I used the old system in class, I followed this practice for my audience. I would use the old forms, then ask if they were understood, ask the class to tell me in English or Tiwi what I had indicated, and use English forms when it was obvious that there was misunderstanding in the class. The process was cumbersome, but ensured that all members of the class knew whichever numbers had been used. The process also utilised the standard local practice, that information be tailored to the particular audience: as stated before, young adults will vary their use of hand counting, to suit their audience, and their use of verbal forms similarly.

3. MEASUREMENT

The aim here is to determine if traditional measurement contained concepts of space, shape, time and similar values, such that the class teacher could determine the preconceptions of Tiwi students. If they knew such concepts, then class lessons using such concepts were viable; if the concepts differed in any way from the norm expected in their daily work (for example, in the powerhouse) then their learning could be endangered.

The information here presented should be regarded as preliminary: for family reasons, and because of the pressure of other work, and the time of the year (dry season) I left Pularumpi, and was not able to pursue further information.

A. Shapes

Tiwi contains expressions for the following shapes:

takarrimi.....a line (now also used to mean "door")
menauirripadi.....a circle (as in sun, moon, damper)]
untu uliḡinni.....a curve

uli arrima teripi.....a curve. The difference between the two words is that *untu ulipinni* means a smooth curve, as in the crescent moon, and *uli arrima teripi* is a rough-edged curve, as in a leaf.

kunji.....closed. (Of all the words here presented to describe shapes, *kunji* is the only term which the majority of young people know. Of the other terms, some know a few or one other, but none know all of these terms.)

aumpuraupurra.....open

kulalanni.....crooked

tulumiya.....straight (neutral gender)

tulumiyiyinni.....straight (male form)

tulumiyiŋa.....straight (female gender)

These words may be combined, as in the following sentences and phrases:

anupkua tulumiya ata inti...not straight that thing (It/that doesn't stand up straight)

kunji takarrimi.....close the door (imperative)

aumpuraupurra takarrimi.....open the door (imperative)

tulumiyiyinni takarrimi.....straight line

kulalanni takarrimi.....crooked line

B. Size

The most commonly used terms to describe size are *kita* (small) and *gardi* (big). These may be combined with other terms above, as in *kita menauirripadi* (a small circle with smooth edges).

Young people know of no other Tiwi way of measuring size.

C. Time

The system for measuring time is very serviceable. The most common terms, which everyone knows are:

imuga.....time of the day, which is broken into many phases. The longest word in Tiwi is used to describe the dawn as it first appears. In its full form it means "She there with a light in her hand is moving". In present usage it is shortened to "She with light moves". The important thing is that such concepts remain, and are used everyday to describe the phases of the day.

aumuga.....day/days. The organisation from there is basically lunar, with additional information on the animals or other foods to be gained at that stage of the annual cycle.

kulama.....the annual cleansing ceremony at the end of the wet. The entire family dances together, in rigidly specified forms, and joins the ceremonies of other families. The song-maker in each family must compose new songs, based on specified sounds and forms. As in all monsoonal climates, the wet is a time of slow hunger; the *kulama* then celebrates release from hunger. It is also therefore used as a focus of worship, of remembering. It is also a time of cleansing; with the family together before they split up for dry season hunting and gathering, the events of the past year are remembered, any grievances aired in song, after which they must be forgiven. It used also to be the time for every one of the levels of initiation, but this has disappeared with the disappearance of initiation.

With all this, the *kulama* is then the basic measurement of the passage of the years. Yet, measurement of those years is not in terms of *kulama* but in terms of wet seasons and dry, with memory of whether each wet was long, short, with heavy rain or light. There was then no use for a measurement of how old a person was, as expressed in years. Instead, age was based on one's status in life. One's generation in the family and level of initiation were the main measures of age, as in the Yirrkala system, where "*Dungarra ni namarri?*" (*dungarra* is also the term for generation) is used to ask a person's age, and "*Dungarra ja nugo namuna mirri?*" (year/generation..plural..you..how many..plural) is used in one's own camp. (These days in the bilingual school, the question is asked as "*Woltjanya nugo namurra mirri?*" - how many rains are you?) The Tiwi do not measure age in terms of rains or wet seasons, though these days the concept of wet seasons experienced is used especially among the young, to reinforce the introduced concept of age in years, which everyone uses.

The other basic measurement of time was in terms of generations, of which five were counted, two each up and down from the person talking - (see Table 2)

Table 2: Generations in Tiwi

Level	Female	Male
grandparents	manigau	amene
parents	inarriga	girriganni
self	nya	nya
siblings	...boka	...wanni/winni
children	meraniga	umeranni
grandchild - old Tiwi...nyemauana young person's Tiwi..... nyamanya		nyemawanyinni nyamanyinni

Note: The terms for siblings are always prefixed with nyu (my) or ntu(your), thus,

nyuboka.....	my sister
ntuboka.....	your sister
nyuwinni.....	my older brother
nyuwanni.....	my younger brother

The fact that male society is ordered hierarchically into older and younger brothers, and women in society are not, has the effect of ordering male society, whereas female society is more flexible, all the women of one generation regarding themselves as sisters, whereas the men of the same generation are divided. In any conversation between men of the same generation this distinction in age is maintained (men outside the family are usually addressed as *inyamini* [(brother)-in-law: because of the size of the Tiwi population, and the consequent effects of marriage, this applies to nearly everyone]). *Inyamini*, however, refers to any male in-law, and so cuts across generations.

A new term is used these days, especially in situations such as the club, to refer to a male of the same generation: "my bras". In all other situations, however, and especially exclusively Tiwi areas of association, the old terms are used.

The effect of this flexibility in female society and inflexibility in male society, is that girls in a school can help each other and even form friendships among girls of any age. Boys, on the other hand, are restricted: older boys are responsible for younger boys who, in turn, must respect and generally obey their elders. For them, only boys of mixed or other race can be counted as friends. These boys of other race may then

be accepted individually, whereas the girls tend to exclude from their society girls who are not Tiwi, therefore not fully related, and not part of the Tiwi sorority.

With travel, the Tiwi are in contact with people of other tribes and the distinction above carries over to them. Women are quick to accept any woman, especially if she is married, even more so if she has children. The Tiwi men are suspicious of all outside males, with natural consequences for the classroom. A male teacher, or student not Tiwi, may be accepted in the classroom or other learning situation: but, even if accepted, they must not try to carry this over into the extra-learning environment. To do so is to risk alienation, with consequent effects on the Tiwi student's willingness to accept the teacher or fellow-learner, and their consequent performance in learning will suffer, through no fault of their own. Any teacher, male or female and especially the single teachers, must realise that the students' learning performance is affected by the teacher's social behaviour.

There is a final distinction made in age: old people are singled out as a group and respected as such. An old man, any old man, may be called his relationship term, or addressed as *iurrula* (old man); any old woman may be addressed as *intula*, the old Tiwi word for "old woman"; young people use the Arnhemland term *ulugemaga* for "old woman" and *ulugemanni* for "old man": *ulugemanni* is often used even by old people themselves.

4. SHOPPING AT PULARUMPI

This was the main area of interest of Harris's pioneering study of Aboriginal mathematics, and the first area of focus in my research at Pularumpi.

The information here is in three categories: in the shop, at the snack bar, and at cards - three of the most important foci of Pularumpi life, and of the use in everyday life of mathematical concepts. In this respect, the third section is included here even though it is not, strictly speaking, shopping. People also regard playing cards as a social mechanism, a means of redistributing income, of the circulation of money, and will play cards to gather funds for a bout of purchasing, particularly a major acquisition such as a trip to Darwin.

A. In the shop

The preliminary to any shopping expedition is a withdrawal of funds from the bank. This sometimes entails withdrawing enough money for several days, as the shop is open Monday to Saturday from 10.00 a.m. to midday at the latest, and Monday to Friday for half an hour from 3.00 p.m., yet the bank, being only an agency, is open only from 10.00 a.m. to noon on Monday, Wednesday and Friday.

The normal morning routine is then:

- 7.00 a.m. work commences at the Police Station, Essential Services and Housing Association. Cleaning in old camp and in houses
- 8.00 a.m. work commences at the Health Centre. Children prepare for school. Anyone requiring medical attention goes to the Health Centre
- 8.30 a.m. teachers and students at school
- 8.45 a.m. or thereabouts, daily flight from Darwin bringing mail
- 9.00 a.m. at the earliest, mail is distributed into mail boxes. Shortly thereafter, most people in the Community meet around the area which contains the Council and Housing Association offices, bank, TAFE centre and shop
- 10.00 a.m. the shop opens every day; the bank opens Mon., Wed., Fri. Funds are then withdrawn, bills paid (as rent), and shopping done. Thereafter work continues in home, office, school, health and police centres, and Council and Essential Services and Housing gangs, until midday when everyone breaks for lunch. During this time any hunters or fishermen return and their product is added to lunch, which otherwise consists of whatever was bought at the shop that morning.

In the shop itself, no prices are displayed on items, even though the store is self-service. This requires that the shoppers have enough money to pay for all their purchases. An element of shame is introduced into not having enough money to pay for all one's purchases, as the store manager is of mixed race; so is his wife, who also works in the shop in the mornings, as does his daughter-in-law, also of mixed race. The wife is related to local families, but the manager and daughter-in-law

are not and, when moody, they often make pointed remarks to people who don't have enough money, or in other ways give them cause for comment.

Perhaps because of this, or because of increased numerical capacity, there has been a change in shoppers' behaviour in my time. In my first year, 1980, at Pularumpi, it was quite common practice that, if one had not enough money to pay for what was in one's basket, one put the rest on tick, or simply removed items until one had enough money to pay for the remainder.

Shoppers usually buy enough only for the day or for the weekend or, for durables such as tea, flour and sugar, buy only when they have run out. Goods are selected from the shelves and put into a wire basket provided by the store, taken to the check-out counter where the staff work two cash registers. No one makes any attempt to buy items one at a time in the store. But this cannot necessarily be taken as indicating numerical capacity as the range here also varies little - apples, oranges, bananas, tomatoes, potatoes, onions (though not always in stock, these are the items most normally in stock) and processed cheese in block form (though this is stocked less frequently). Thus, the shoppers know roughly what can be bought with a particular note or sum of money.

The big change is at Christmas when the store stocks items for presents, and summer produce such as cherries and plums. Normally, people ask the prices of these as the goods arrive in store; that price is then passed on through the community and people will ensure they have enough money to buy these items.

Often, when extra items are in stock, such as at Christmas or when the store stocks fish or cheese, people will return to the bank to withdraw extra money with which to make these extraordinary purchases. That is, funds are withdrawn from the bank sufficient only for the day's purchases: money is planned.

The sort of behaviour Harris noted is evidenced only at the check-out, after payment has been made for all items in the basket. The checkout has racks of cigarettes, matches and chewing gum. Many people, though fewer as the years progress, will make their purchases of fruit, vegetables, meats, flour, tea and so on, pay for these, then use whatever change they receive to buy the items behind the check-out counter. Once very common, this habit was rarely seen by 1984-5, when people asked for those items as part of their normal purchases, that is before the staff totalled the bill for what was in the basket.

In 1980, people also often made several trips per session into the shop. One load would be purchased and the change counted outside the shop. If there was enough, then a second expedition would be made, and more items purchased.

By 1984-5, this behaviour also was infrequent, people tending to make only one trip into the store. As a consequence, the queues became longer, and the second cash register was used more frequently because each person bought more at one time, and because the store more frequently stocked fresh produce. This reinforced the trend to one exit through the check-out per session.

The only people who continued to make more than one exit were: old people, one family on social security and with nine children, and three mothers with less than Grade 5 primary education - that is, the poor and the least educated.

The habit of one exit also grew at the bank, where expenses were planned, often in my office, on pieces of paper and with pens requested from me (my office was next to the bank), had chairs and was in shade: the bank had no seats and offered no shade). Wives and husbands conferred, quietly, made a decision, filled in the appropriate bank form and then, usually the wife (mainly because the husbands had limited morning tea time-off work), went to the bank. Such decisions on withdrawals included budgeting for rent, for the days the bank would not be open, for saving for extraordinary purchases such as a trip to town or at Christmas, and for any extraordinary items in the store (such as children's or adults' clothing), cooking utensils and so on. The final decision was usually mutual: any disagreements were decided not on gender, but according to the characters in the relationship.

The main point in all this is that behaviour changed from that described by Harris. The reasons for this are beyond the scope of this article, but seem to include: better education, more regular income, self-government and land rights (and the effect on health, education and incomes of these), pressure on both old and young Tiwi by the manager of the store.

B. At the snack bar

The snack bar is attached to the rear of the licensed club premises, all run by the Progress Association. I have not included the bar in this investigation, as the product is always

the same (various brands of beer only), the price rarely changes and there is six-can-per-person limit per day, all of which limits the customers' ability and need to make economic decisions.

In the snack bar the range of goods varies, though there are constants. The stock usually includes soft drinks in cans and potato crisps. Variables over my time at Pularumpi included packaged fruit juices, hot chips, pies, and full, locally-prepared meals of rice with fish or curry of meat and vegetables.

The snack bar opens for the same hours as the bar, usually from 4.00 p.m. until 6.30 p.m. on a weekday afternoon, and for two to three hours on a Saturday afternoon: it does not open on Sunday but will open at other special times, such as a home football match.

Shopping at the snack bar is usually for snacks, though when it stocks hot food some people buy their evening meal there. Prices are constant over a period of weeks, and the range of product supplied is usually stable over a period of weeks as well.

As with the shop, buying behaviour has also changed in the snack bar. In 1980, people bought one item at a time, in a style which might be characterised as 'no-shame cash-purchasing', the pattern Harris characterised as 'Aboriginal', but which is more normally characterised as a part of the culture of poverty.¹

By 1984, people invariably ordered all they wished to purchase, in one go, and handed over money sufficient for the entire purchase. This would indicate an increased numeracy, or an increased confidence in numeracy skills. Indications of this include:

- a) some customers (children especially) do not have enough cash to pay for all they have ordered. By 1984, it was rare that this caused embarrassment in the customer.
- b) in one month, in 1984, two highly-suggestive incidents occurred. In the first, A. tried to 'diddle' the snack bar staff. What started out as an accidental miscalculation of the amount owed by the customer, became a heated

¹In which culture, purchases are made frequently (because of lack of cash and of storage space in the home), and piece-meal (to avoid over-spending, or the shame of being seen not to have enough money).

argument, until A. grimaced, grinned and said to the other customers, "That's right, soft drink is eighty cents a can; I thought sixty cents." A. then handed over a two-dollar note to cover the difference on the six cans she was purchasing, choosing this note from amongst others of large denominations which she had in her pocket.

In the second incident, S. handed over twenty dollars for an eleven dollars account and then whispered to the other customers, "Watch this!" When the staff member returned with nine dollars in change, S. refused this and said he'd added up incorrectly. The staff member, W., checked, then returned with eleven dollars change, which he gave to S. It must be remembered there were two protagonists in this encounter, and that the behaviours of S. and W. indicate varying degrees of numeracy.

Whilst these incidents indicated growing numeracy skills or confidence, it is the question of varying abilities which is most noticeable, especially in that some people still ordered in small lots. On one other day in this same month I watched as N. ordered six cans of soft drink. Having paid for this, she then ordered two bags of chips and paid for these; then, in a third purchase, she ordered three ice creams - whereupon the (educated, mixed-race) staff-person said, "Ah what! Why you can't say everything together? You making more work for me." N. thereupon withdrew her torso from the counter and lowered her head slightly. In the weeks afterwards she sent a member of her family to make these purchases, but did not go herself.

The question is, then, how much of the changed purchasing behaviour was caused by increased numeracy skills, and how much by the desire to avoid shame.

As part of this, it must be noted that soft drink was usually bought in six-can lots, and by mothers and elder daughters (all of whom had at least primary schooling; the younger they were, the more schooling they tended to have, and many of the daughters had attended Years 9 or 10 in secondary school). Were they then buying six cans at a time out of necessity, or because it was known how much six cans cost? Was the train of thought, "I want/need six cans: I have enough money", or "I have five dollars: I can buy six cans". The caesurae are important, as guides to the motive of the purchaser - especially as it is this rationale which we need to know as a guide to numeracy skills. Virtually any behaviour could be the result of memory,

or of numeracy skills sufficient for daily survival. The educator needs to identify this pre-cognition in clientele so as to rationalise their educative approach. The rationale for the purchase of six-can lots could be, as Harris says, an example of 'no-shame cash-purchasing', except that the customers make their calculations before making any attempt to purchase - that is, there is a degree of numeracy skill involved in purchases made by all members of the community.

C. Playing cards

The most usual card games played were 'kunt' and rummy, both involving numeracy skills. All adults played, at various times of the day, and for varying reasons, including social commerce, or a need to amass money for an extraordinary purchase such as a ticket on a flight to Darwin. Even the arrival of television and video did not overly affect the level of this activity, which had always slowed only at meal times, and when the club was in session, though even then there were games available.

Although some people were especially noted for their ability to remember all cards already played from a deck, most people had some ability in this area, and all games were conducted speedily, in silence for the most part (with conversation in between hands), and points were always calculated very quickly at the end of every game. Children were generally excluded from playing, but were often sat on an adult player's lap, and (partly seriously) consulted re strategy.

My observations were made, always as a player: that is, there was no suggestion that I was an observer taking notes.

One game may exemplify the issues in this discussion of the community's numeracy skills.

On the evening of September 2nd, 1984, I played gin rummy with three men, all aged in their early thirties. All three had been at the club, and had consumed at least four cans of beer each, this undoubtedly impairing their play. Yet, all were able at the end of each hand to calculate quickly (in no more than four seconds) the value of the cards remaining in their hands. This appeared not to be a feat of memory alone, but rather to indicate numeracy skills.

S. and P. had Year 11 education, attending secondary school in Darwin. S had lived in Perth, playing football there for a couple of years and had returned only in 1983. P. was a trained teacher and taught mathematics.

B. on the other hand did not have either such advanced or such recent numeracy skills. He had attended Year 9, leaving school over fifteen years previously. He was currently unemployed, and had been so for several months, his previous occupations always having been as a labourer. He had a good grasp of foreign events, and was especially interested in China.

My attention was especially drawn to one hand, where B. played last, picked up a card, placed his melds on the table, threw out a discard - all this within twelve seconds. In another three seconds, he announced that his remaining five cards totalled seventeen (he was correct). B. played at this pace all evening.

The question is, then, how much was his speed and accuracy the result of numeracy skills, and how much the result of memory (he played cards fairly regularly and constantly)? That is, if he were in a numeracy class, how much would he learn by repetition, and how much by induction or deduction? The indications in his behaviour were that he had a sound basis (repetition and practice), but was able to apply his basic knowledge in an individual way (deduction).

5. SUGGESTED METHODOLOGICAL PRACTICES IN ABORIGINAL NUMERACY EDUCATION

The previous sections contain a range of evidence: as stated at the beginning, the aim of this paper is the more effective numeracy education of Aboriginal students. To this end, the evidence above leads to certain methodological practices suggested for educators of Aboriginal students, as follows:

- a) ascertain the pre-cognitive abilities of the students.
 - learn the traditional numerological capacity of the community, but do not assume that this applies to all students, as the society is changing and some students will have missed out on this aspect of their culture.
 - do not assume that the systems of counting and measuring are common across a range of communities. For example, what is presented here is the Tiwi system. Some Yirrkala

variants are also included, mainly to show that the differences between the systems are great. This, of course, is part of the Australian society's perception that Aboriginal society is an homogeneous whole, when in reality, whilst there are commonalities, differences exist as wide as the gap between the different languages.

- learn the history of each student. There is a wide range of educational achievement in all communities, and in individual experience, even in the present, television generation.

b) Ascertain the rationale for these precognitive ability differentials. This involves what is probably the basic issue in Aboriginal education today: is the student behaving in a particular way, because he/she is Aboriginal, or because of socio-economic conditions (which, in most cases, means because the student's family is poor). Thus, do people make one purchase at a time because that is an Aboriginal shopping pattern as Harris suggests, or because they are poor and this is the way most poor people shop? Are changes in such shopping behaviour caused by anything other than changed socio-economic conditions, including land rights and community self-government whereby people are encouraged to gain increased education levels, and to take positions of authority and responsibility wherein they must use their numeracy skills, especially to take technical and managerial positions in which numeracy skills are practised daily, and expanded with experience.

Educators should also be aware of their own socio-economic station, and how this affects their perceptions of the students, and their expectations of student achievement. Because teachers are white-collar workers, there can be a socio-economic gulf between them and certain of their students.

c) In this respect, the educator must identify why any student is not achieving to the educator's satisfaction. The causes can include:

- language deprivation in either the language of instruction or in language as such, by the student;
- cultural deprivation by the student, in either the educator's culture or, increasingly, in the student's own cultures, including the cultures of the community and of the wider Australian society;

- experiential deprivation by the students, which can include a lack of experience in their numeracy skills, that is, that they have not previously, or for some time, had to use what they have learned in this area of knowledge;
- low expectations for or by the student;
- malnutrition and other physiological dysfunctions to learning.

That is, the student may not be learning slowly, but be dysfunctional in the particular learning experience, and for reasons external to the particular learning experience.

Thus, before the educator classifies the student as dysfunctional in the particular area of numeracy learning, the educator must ascertain if they themselves are dysfunctional to the student's learning abilities and needs, or are teaching in an inappropriate way.

d) Within the delivery of the lesson the educator must

- beware of inappropriate body language. A first example is the way in which we count on our fingers. Because this is not necessarily the same method used by the student, unnecessary confusion may be caused for the student by the educator's particular hand gestures.
- be aware that the students do have numeracy and measurement skills. Learning is enhanced if the educator can assimilate into the lesson some of the local terms and values used, but only if those terms are readily known by the student.
- be aware that these skills will normally include a range of numeracy and measurement skills required, but may not include all. For example, the Tiwi measured time, size, space, line, and used a decimal system: but I can find no direct evidence of the concept of 'odd' and 'even' numbers, nor of fractions. These concepts would have to be explained, whilst the educator who spends overmuch time on teaching a decimal system, assuming that the students do not know this system, is at the least wasting time. On the other hand, an educator who talks about a 'dozen' or 'half a dozen' may cause confusion, as this is another concept not used in traditional Tiwi systems.

Finally, the educator must take care not to confuse the holistic with the monolithic. That is, whilst taking cognisance

of the whole background, pre-cognition and needs of the community, and in particular of the students, the educator must not consider the students as having the same pre-cognition or ability or need. Even between communities there are large differences in numeracy and measurement terms and concepts. Thus, what can be used by an educator on one community may not transfer directly to any other community.

Likewise, as society and culture change, so have the experiences of the students been different. Some students have been taught traditional concepts; some have not. Some have been well nourished and so are more capable of learning. Some students use numeracy and measurement every day and so have practice in using these concepts and a perceived need for knowing more: others do not have such readily perceived need.

Over all, is the relationship between student and educator. If there is misconception, failure or dysfunction in learning, or even success, neither the educator nor the student will necessarily know the cause of such a result. Indeed, the educator will probably continue his/her career regardless, and the student will remain employed in the community. This paper is therefore only of interest to those who wish to assist in a more effective learning by Aboriginal students, especially at Pularumpi.

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Rock stays,
earth stays.

I die and put my bones in cave or earth.
Soon my bones become earth...all the same.
My spirit has gone back to my country...
my mother.

from *Kakadu Man* by Bill Neidjie