Counting: What we can Learn from White Myths about Aboriginal Numbers

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The place of mathematics in the wide diversity of human cultures is a rich and rewarding field of study. From it, we can not only learn about mathematics itself, but about history, language and sociology. We can also learn a great deal about how we humans think, about how we respond to the need to describe our environment, and even some things about our attitudes to each other.

In this paper, we can only examine a very small sub-set of the field of mathematics in human culture and history. We will look briefly at Aboriginal counting systems and at how they can help us to understand what counting is. In doing so we will also see how myths about the supposed inferiority of Aboriginal counting systems arose, how these myths are perpetuated, and how they continue to be used to denigrate Aboriginal people. But first we need to establish what counting is.

WHAT IS COUNTING?

A source of confusion is that the term 'counting' is used in a number of different ways by different people. Most researchers who have described the way people of other cultures count — which usually means Europeans describing the way non-Europeans count — have acted as if counting simply meant reciting the number words in ascending order. Freudenthal (1973:170) calls this 'the reeling off in time of the sequence of natural numbers'.

Reciting number words is not in itself a meaningful activity. I have heard a cockatoo do it. Children of many cultures are taught to recite number words long before they know what they mean. They could just as easily be taught to recite a sequence of nonsense syllables. Children, of course, eventually discover that the recitation of the number names can itself determine the numerosity of a set; that is, to answer the question 'how many?' What the children have done is to learn a fixed sequence of sounds which can then be used to 'tick off' or 'tag' the items in a collection.

Historically, the English word 'count' is derived from the Latin word *computare*, 'to calculate', and this is still its basic meaning. The three dictionaries I consulted for their definition of 'count' all gave as their first meaning 'to find the number of'; 'to add up each unit in a set'; 'to enumerate'.

Most people who read this paper would normally count by reciting the number words in sequence; one, two, three, four . . . etc, linking each word with a specific item in the set being enumerated.

We do this so much that we forget that there are other ways of enumerating a set. Recently, I asked a teenager how many friends were at a recent party. Starting with her little finger, she pointed to each finger in sequence as she recited the set of names: Linda, Kylie, Jo, Michael ... and so on. She used all her fingers up and then started again, using two more fingers. She then told me there had been twelve people at the party. At no time did she say the sequence of number words, nor did she mentally think them. She linked each person to a finger and then read off the total at the end.

Was she counting? Of course she was, but she didn't use the number words. In the bad old days when I went to school, we were punished for counting on our fingers. It was, nevertheless, a perfectly natural way to symbolise visually the mathematical operations. Nowadays, structural materials of all kinds help young learners to do just that. But fingers are just as good a set of counting tags as anything else, and counting certainly doesn't have to be verbal.

> *The use of unique tags to mark or tick off the items in a collection is intrinsic to the counting process. Further, the tags must be used in a fixed order. Finally, the tags must have an arbitrary status; they cannot be the names or the descriptors of the items in the collection being counted. The set of count words meets these criteria, but then so do other sets of tags. One obvious candidate is the alphabet, and it is noteworthy that many languages have used the alphabet as count words (Greek and Hebrew, for example). But the tags need not be verbal. They may be any host of entities, including short-term memory bins.*
> (Gelman and Gallistel, 1978 : 76)

There was a deaf Aboriginal girl at Angurugu school, Groote Eylandt. She could speak neither English nor Anindilyakwa. She could lip-read a little, but not the number words in either language. She was, however, the most competent child in her class at all mathematical operations. I do not know what tags she used in counting, but having had little schooling and no contact with a specialist teacher of the hearing-impaired, she no doubt made the same kind of cognitive innovations which deaf people have always made.

I have mentioned her because it was through her that I first began to see clearly that verbal counting tags were not necessary for counting, and that counting was a process in which people of all cultures engage to whatever degree necessary. In all societies, people can and do count whether or not their language provides them with a long sequence of number words.

NUMBER WORDS

Human beings of all times and places have counted, but the importance of counting has varied widely. As a generalisation, it is probably true that hunting and gathering people rarely felt the need to count to very high numbers. The need to use high numbers generally arose in settled agricultural communities where there were challenges in the management of herds of animals or the storage of grain. As the need arose, people extended their languages to deal with the new needs.

It must be stressed that these generalisations have nothing to do with the *ability* to count, but only with the *need* to count. It seems a pity that such an obvious point needs to be made at all, but number words have so often been used wrongly as the index of the supposed intellectual or mental capacity of the members of a group, that the point has to be made. That human beings can respond to changed circumstances and engineer languages to cope with those changes is a mark of intelligence, but people who do not need an extended number system, and therefore do not develop one, are not less intelligent than people who do.

The ways in which number words are constructed are very similar around the world. The number words for 'one' and 'two', however, are of such supreme and ancient importance that it is impossible, in almost all languages, to trace their origins.

The English word 'one', related to English 'an' and its equivalent with the dropped n ('a'), is also related to words in other European languages like *eins*, *une*, *unus*, and so on. All trace themselves back to an ancient Indo-European word *oinos*, but it is now impossible to know where this word came from. One-ness is an important idea and hundreds of English words contain 'on-' or 'un-': unite, unanimous, alone ('all-one'), only ('one-like'), unique and so on.

'Two' and its European relatives like 'duo' are also very ancient words. 'Two' mostly as 'tw-' is found in many words: twice, twin, twine (two-strand string), twist, between, and so on. But so important is two-ness that English has a huge variety of other ways of expressing it, eg. duet, double, pair, couple, brace, both, biscuit ('twice-baked'), yoke and so on.

When we come to 'three', it is sometimes possible to trace the origin of the number word. There are many languages in the world in which 'three' was originally made from the words two and one (2 + 1). Some Aboriginal languages use this technique eg. Martu Wangka (Jigalong, W.A).

one : *kuja*
two : *Kujarra*
three : *kujarra-kujuuju*

(Harris, 1987:33)

Other Aboriginal languages have distinct words for three. eg. Kunwinjku (W. Arnhem Land, NT)

one : *na-kudji dji*
two : *boken*
three : *danjbik*

Another widespread technique is to make the word 'few' or 'some' refer specifically to three in number contexts. Those who malign Aboriginal number systems which seem to be 'one, two, many' are obviously unaware how universally words for precisely three or four are also used for vague numbers like 'some' or 'many'. This was true for Indo-European, the ancestor language of most European languages. *Trie* meant both 'three' and 'many'. From this we have English *three*, Spanish *tres* but in French *très* means 'very' or 'much' while a slightly different variation *trois* means 'three'.

Four, like three, is sometimes made by combinations (2 + 2). Four can also be made by what is called back counting, that is, counting back from five. Back counting is used in many languages. The best-known examples to many people are the Roman Numerals like IV or IX. Old Latin also named numbers this way eg. *un-de-viginti*, 'nineteen' (one-from-twenty). In languages where five is obviously related to 'hand', four is often constructed as 'one-from-hand' or in some similar fashion. This is almost certainly the origin of the English word 'four' (Menninger, 1977:147), although we can no longer be absolutely certain. As numbers become increasingly used, there is a trend for long and cumbersome words or phrases to be abbreviated. For example, in an imaginary language in which four is 'five less one', the shorthand way of saying four might be 'less one' and then be shortened to 's-one'.

In most languages of the world, the word for 'five' derives from a word for 'hand'. The human five-fingered hand, as we have noted already, has always been an obvious and convenient choice for counting tags. That is why we still use the Latin word for finger, *digit*, to mean a unit in a written numeral. There are hundreds of languages in Southeast Asia and the Pacific where *lima* (or a word derived from *lima*) means both 'hand' and 'five'. The English word 'five' is related to the words 'finger' and 'fist'. In most Aboriginal languages, the word for 'five' is the word for 'hand', eg. the Yolngu languages (NE Arnhem Land, NT).

one : *wanggany*
two : *marrma'*
three : *lurrkun*
four : *marrma'marrma'*
five : *gong wanggany* (hand-one).

(Harris, 1987:34)

Space precludes any more detailed study of these and the higher numbers, but this brief look at just one to five demonstrates the world-wide principles by which number words are created. High numbers are mostly created by combinations of lower numbers (eg. forty-two is short for four-tens-two). Sometimes there are some curious ones. English 'eleven' and 'twelve' are short for old phrases meaning 'one left over' and 'two left over', relics of the days when counting to ten was usually sufficient.

Apart from combinations, most languages invent special words for the major gradations (hundred, thousand, etc). Sometimes these just mean 'large x' where 'x' was the previous gradation. eg. English *thousand* come from the old *thus-hundi* or 'big hundred'. *Million* from the Italian *milli-one*, means 'great thousand. A fascinating technique for very high gradations was to use the name of something which occurred in large numbers. The Greek *myrioi*, '10,000' from which we obtain the English word *myriad* for a very large number, was derived from the Greek 'ants', *myrmex*. Similarly, in Egyptian the word 100,000 is the word for 'tadpoles'. In Gilbertese (Kirabati), the word for 10,000,000 is *Tetano*, sand.

None of these numbers is unintelligent, weird or 'primitive'. They are simply human, cultural, and the mirror of our histories.

THE MYTH MAKERS

When Crump (1982:286) wrote that the concept that two is greater than one 'could be made intelligible even to the Aranda', he was simply one of the most recent in a long line of historians of mathematics who have wrongly used Aboriginal number systems to demonstrate prehistoric counting. Aboriginal number systems are wrongly but frequently thought to prove that Aboriginal people are of inferior intelligence because they are less highly evolved.

It is regrettable that mathematical historians should continue to promulgate this myth of Aboriginal inferiority. In the most recent major text of mathematics history, Burton (1985:1) calls on anthropology, because history sheds no light on the counting practices of our remote ancestors, citing 'certain Australian Aboriginal tribes' to illustrate groups who are 'destitute of number words'. Not only is Burton falsely allowing ethnography to masquerade as history, he is in fact quite wrong. The best that can be said for Burton is that he has believed a myth. This situation is certainly not helped when even modern linguists like Blake (1981:3) can claim that :no Aboriginal language has a word for a number higher than four'. Blake is wrong.

WHERE DO THESE MYTHS COME FROM?

Australian Aboriginal people came to the attention of the European world in the late eighteenth and early ninteenth centuries. Information about them first became generally available to the scholarly world in the form of diaries, travellers' tales and in papers presented to learned societies. The sketchy information gathered in this way re-inforced the pre-Darwinian ideas of the Great Chain of Being in which the Aboriginal people were seen as much farther down the chain than Europeans.

In the second half of the nineteenth century, Darwin's theory of evolution burst onto the intellectual scene. The first generation of anthropologists desperately needed examples of human beings in a low stage of evolution. This coincided with the sudden availability of information on Australian Aboriginal people, members of a very different culture. They seemed to exhibit few of the characteristics which to the educated European mind bespoke 'civilisation'. Edward Tylor, the eminent early anthropologist, gathered information on Aboriginal people from various sources and concluded in his influential book, *Primitive Culture*, that they were 'the lowest of living men' (Tylor, 1871:242). 'In mixing with them we feel doubtful whether we have to do with intelligent monkeys or very much degraded men'. (Oldfield, 1863:227)

It was John Crawfurd, President of the prestigious Ethnological Society of London who introduced into the all-too-willing European mind, the idea that cultures could be ranked in a scale of 'civilisation' on the basis of number words. Aboriginal people were his lowest starting point on his assent to the high degree of 'civilisation' supposedly achieved by the Europeans. 'I begin with the people among whom the numerals appear to be in the rudest form. These are the Australians . . .'. (Crawfurd, 1863:84)

Generations of anthropologists and other researchers simply accepted the views of Tylor, Crawfurd and others. Aboriginal people were 'primitive savages', they believed, so therefore they would not be able to count. When they *did* find evidence of counting they dismissed what they saw.

When they found body-part words in the number systems, they did not regard them as numbers. As we have seen, 'hand' and 'five' are closely related in virtually all the number systems of the world. 'Hand' is as good a word for 'five' as any other word and there is nothing inadequate, savage, or unintelligent about it. Smith (1923:7) wrote that Aboriginal people 'show habitual uncertainty as to the number of fingers they have on a single hand'. This is the ignorant conclusion of those who asked a stupid question ('How many fingers on your hand?') and got the answer they deserved — 'hand' — which functioned as the number five.

Where researchers found compound numbers, they concluded that these evidenced a lower degree of civilisation. This is plainly a ridiculous conclusion. To apply it in Europe would mean that the French for 90, *quatre-vingt-dix* ($4 \times 20 + 10$) must be evidence that the French are a lower civilisation than the English whose *ninety* (9×10) is a shorter compound. The Danes, whose 90 is *halvfemsindstyve* (½ [of 20] from 5×20) must, by this logic, be very primitive indeed. Debunking this nonsense, Barnes (1980) described the Kedang number systems, one used by adults, the other by children. The adult system is highly compounded , nine being *leme-apaq* ($5 + 4$) while the children's system is not compounded, nine being *sukoq* (9). Applying the false logic, a tongue-in-cheek Barnes (1980:199) concluded that Kedang children were more civilised than Kedang adults. Compounding is, of course, a number-naming technique which Aboriginal people share with the whole of humanity.

Even more amazingly, when some researchers encountered Aboriginal words for quite high numbers, they did not believe them. In 1886, E.M. Curr compiled four volumes of information from many sources, including Dawson's word lists from South Australia. Curr (1886 [1]:32) believed everything Dawson discovered *except for high numbers*. When Torres Strait Islanders told A.C. Haddon their words for 100 and 1000, he wrote 'these and several other numbers I do not believe in' (Haddon, 1890:305). They did not *want* to believe them.

Thus the myths were invented and entered the literature. (More detailed discussion is in my earlier papers, Harris 1982 and 1987.)

HOW THE MYTHS ARE PERPETUATED

The most surprising thing about the view that Aboriginal number systems prove that they are 'lower' than other humans is that this view persists today *and continues to be stated in the literature.* Crawfurd invented the 'scale of civilisation' based on number words in 1863, and his opinions still influence modern scholars. In the Open University textbook *Counting 1*, it states: 'the fact that many Australian Aboriginal tribes cannot count beyond 2 is indicative of a comparitively primitive state of civilisation' (Open University, 1975:12).

Where do these textbook writers obtain their information? I did some sleuthing for myself and came up with some very interesting connections. I looked for references to the inadequacy of Aboriginal counting systems in books on the history or use of mathematics, and then traced the origin of the authors' opinions. One which particularly interested me was *Understanding Arithmetic* by Swain and Nichols. It was a textbook which I used as a teacher, upgrading my qualifications in the late 1960s. It contains these remarkable words.

> *Where the extent of man's mastery over nature is slim, his number system reflects his ineptitude.*
>
> *1. Neecha (1)*
> *2. Boolla (2)*
> *3. Boolla Neecha (3)*
> *4. Boolla Boolla (4)*
>
> *A primitive chant? The sequence furnishes a fine accompaniment to the boom-boom drone of the tom-tom. Yet is is actually the complete counting system of a native Australian tribe ... We can scarcely imagine what it would be like to face the world around us with mental tools so crude and blunt.*
>
> (Swain and Nichols, 1965:1,29)

Boom-boom drone of the tom-tom? Where exactly is Australia, Swain and Nichols? The racist tone of this writing is obvious. But where did Swain and Nichols get this sort of information from?

Swain and Nichols don't do us the favour of footnoting precise references, but if you read through their bibliography, you find two major sources on the history of mathematics: D.E. Smith's *History of Mathematics* (1923), and T. Dantzig's *Number, the Language of Science* (1930). It was from these books that Swain and Nichols learnt of Aboriginal people, despite the fact that they seem to have thought they were American Indians.

Let's go back further. Where did Dantzig and Smith gain their information on Australian Aboriginal people? Suddently we discover the names of the nineteenth century 'experts' whom I have already mentioned. Dantzig used Curr's *The Australian Race* (1887), while Smith used both Tylor's *Primitive Culture*, and J. Crawfurd's original paper *On the Numerals as Evidence of the Progress of Civilisation* (1863).

And, as we have already seen, Tylor, Crawfurd and others used travellers' tales, amateur word-lists and many other unreliable late eighteenth and early nineteenth century sources.

Once you become familiar with the eighteenth century sources, the sleuthing task becomes easier. The latest book I have on the history of mathematics is David Burton's *The History of Mathematics* (1985). In his first two pages, Burton informs us how Australian Aborigines (and other people) were 'destitute of number words'. Where did Burton discover this false information? Two or three guesses would inevitably lead to the right answer. Yes, Burton (1985) used Smith (1923) who in turn used Crawfurd (1863), and suddenly we find ourselves back at the same source.

Thus it is that the misguided, inaccurate and racist writings of the mid-nineteenth century entered the literature and remain influential, continuing to be quoted today. Thus the myths are perpetuated.

THE TRUTH ABOUT ABORIGINAL NUMBER SYSTEMS

Aboriginal people did not often have the need to count to very high numbers. They did not, for example, accrue material goods of which they had to keep record. Indeed, one of the traditional uses of counting most frequently mentioned by Groote Eylandters was to *share*, particularly to share turtle eggs which are found in quantities of 100 or so.

This is not to say that Aboriginal people never added up. They did, but a system more often used for sharing is likely to be different from a system more often used for adding. To share equally a large number of similar items, it is not necessary to count them all. If I were to be given a bag of hundreds of marbles to share between, say, six children, I would probably make six equal sets, not by ones but possibly by fives.

With many variations across Australia, this is what Aboriginal counting systems are generally like. Terms for 1, 2, 3 and 4 are used, then there are terms for 5, 10, 15 and 20. These may be *hand* terms but may not be. Counting typically proceeds like this.

one, two, three, four, five
one, two, three, four, ten
one, two, three, four, fifteen
one, two three, four, twenty

The person counting does not normally say numbers like fourteen (10 + 4) or nineteen (15 + 4). I have watched English-speaking people count out a dollar in one-cent pieces. They count out ten piles of ten. At no time do they say a number like 'fifty-three' or 'eighty-seven'. They do not need to say them.

Aboriginal people *can* make and say numbers like fourteen, nineteen, or for that matter, fifty-three or eighty-seven. Tindale (1925:129) using finger signs, was able to ask Groote Eylandters for 150 spears. They delivered the correct number to him.

The point, of course, is that in traditional Aboriginal society, precision in higher numbers was rarely important. It was not that Aboriginal people could not count. They could count when they needed to but such a need was rare. This is the mental block which many historians of mathematics still have. Many Western writers project a totally unrealistic need for precision onto non-Western cultures and build theories of number development on quite absurd speculations. One of the more notable examples describes the dilemma of a 'primitive man' observing a herd of animals in a valley below him and finding himself unable to communicate the exact number of animals to his tribespeople.

> *... our primitive man ran into trouble. Can you imagine him staggering back to the tribe with 25 rocks, 87 rocks, or perhaps even 100 rocks in his hands to indicate that he has seen that many animals?*
>
> (National Council of Teachers of Mathematics, 1966:18)

The answer to this question is, of course, no we can't imagine it because no one in their right mind would want to count, rock by rock, all the animals in a herd and then carry this huge pile of rocks back home to communicate what they had seen. Rather a person would use a descriptive phrase such as 'a huge herd' or 'a very big mob', or 'twice as many as we saw yesterday' and everyone would be so familiar with the animals' herding habits, that they would have a very good understanding of the size of the herd.

Because we are preoccupied with measuring, counting and recording things, this does not mean that we should denigrate the culture and language of people with no such preoccupation. This is the difficulty I have with the way in which data on Aboriginal counting systems is used in the literature. There is every reason why the authors should mention and discuss them. The problem is that they do so in order to demonstrate that these systems are 'primitive', 'inadequate', 'inept', or 'stunted'. The inference is then drawn that Aboriginal people are cognitively inferior. This is wrong and it is racist.

ABORIGINAL CHILDREN AND COUNTING

It does not matter what language a child learns to count in but as a general rule, all things are best learned in a child's primary language. Where traditionally-oriented Aboriginal people still use traditional number names for some purposes, children should first learn to count with these number names. Counting is a skill which has to be learned, but once learned can readily be transferred to another language. Teachers in early childhood classrooms in traditionally-oriented Aboriginal communities should be particularly aware of this. While most traditional Aboriginal speech communities are multilingual, and while today English may well be one of those languages, full multilingualism is not acquired until adulthood. Aboriginal infants will be competent in one of their home languages and may have a developing competence in others, but English is unlikely to be one of them. While English is a foreign language or only a partly-acquired language, any activities which are taught in English insert an additional cognitive task (translation) into the learning process.

In Aboriginal communities, the need to use higher numbers frequently and with precision, is associated with European goods and European activities. It is thus inevitable that Aboriginal people, even in traditional communities, should use English numbers in these contexts. This is a reality which cannot readily be changed, nor should it be changed. The consequence is that for most mathematical activities in schools, the English number system should be used. It is, after all, the system in use in the community.

The present-day reality is that Aboriginal children who grow up in communities where traditional languages are still spoken will become bilingual in English and their traditional language (or languages). *It is vitally important for schools to preserve distinct domains in which Aboriginal languages are used.* Schools will otherwise contribute, not to true bilingualism, but to language mixing.

These domains include local history, local biology, traditional skills, songs and so on. These should form part of every school day and should be the particular responsibility of Aboriginal teachers or teaching assistants.

Where the skills or stories include numbers, then the Aboriginal number systems should be used. If, for example, turtle egg distribution is being learned or dramatised, then the Aboriginal method and words should be utilised.

In this way, respect is accorded to traditional number skills, and an important and interesting cultural activity is preserved intact.

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