

AUSTRALIAN SPACE - PUSHING BACK THE FRONTIERS

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*This keynote address was an audio-visual presentation using over 30 overhead projector and colour slide illustrations. It is therefore impossible to reproduce as a written paper in the usual form and I have not attempted to present it as an academic paper. What follows is a lightly edited transcript of the tape recorded talk, with an indication of the visuals shown and their source. Many of the illustrations can be found in just two publications - the speaker's recent book, **Mathematics in a Cultural Context: Aboriginal Perspectives on Space, Time and Money** (Harris, 1991), and in **Dreamings: The Art of Aboriginal Australia** (Sutton, 1988).*

This transcript is intended only for those who attended the conference and should only be quoted as something that was heard, not as though it were a published paper.

INTRODUCTION

There is more than one context for this talk today. The most obvious context is that it is the last day of the MERGA conference and the last keynote address. The less obvious context, but one that we have talked about during the conference, is that it is International Space Year. This year was proposed by an American senator to commemorate the 500th anniversary of Christopher Columbus' voyage during which he "found" the Americas for the Europeans. It is also the 35th anniversary of the International Geophysical Year in which the Russians put the first satellite, **Sputnik**, into space, and that marked the beginning of the modern space age. Once scientists found they could get things into orbit, it was not long - only twelve years - before the Americans put men on the moon.

But, having decided on the topic of the talk and submitted an abstract, I discovered (from an Aboriginal person, not from anywhere else) that the MERGA conference coincided with National Aborigines Week, and my talk fell right in the middle of it. And National Aborigines Week has, I think, special significance this year, because at the end of last year the federal government of Australia passed an act which established a **Council for Aboriginal Reconciliation**. The aim of the reconciliation council is, for the next decade, right up to the year 2001 when we celebrate the centenary of Federation, to initiate and support a nationwide process of trying to bring together the indigenous people of Australia and the people who came and invaded the land and those who followed them; the indigenous people, the Aborigines and Torres Strait Islanders and those who descended from the first settlers and other later immigrants. One aspect of this process of reconciliation is a program of public awareness and public education to educate non-Aboriginal Australians about Aboriginal culture, Aboriginal priorities, disadvantages, dispossession, and the concerns they have today which stem from this original dispossession.

I have therefore chosen to talk less than originally planned about non-Aboriginal matters such as Captain Cook, and to concentrate more strongly on all matters Aboriginal. My aim is to raise awareness of some of the great differences between traditional Aboriginal

ways of viewing and valuing the world, and the Western, "Eurocentric" ways of viewing and valuing the world which are inherent in school mathematics.

So, these are the three strands of the talk:

1. First, in acknowledgment of **International Space Year**, I am going to look at **navigation** over sea and land, contrasting the methods, skills and motivations of a British naval officer, Captain James Cook, finding his way across the sea, and the methods, skills and motivations of a group of Pintupi and Luritja people finding their way across the arid Western desert.
2. Then, with the MERGA interests in mind, I will give you some of the results of the research I did for the Mathematics in Aboriginal Schools Project, mainly from the section on shapes.
3. Finally, in celebration of **National Aborigines Week** and with reference to the process of reconciliation and the need for public education and greater awareness of Aboriginal culture and values, I am bringing in a discussion of the **Aboriginal art** of the central and Western Desert regions, these being the regions, and the people, with which I am most familiar.

NAVIGATION

Captain Cook - Navigator and Map-Maker

OHP - 1 Captain Cook in uniform holding map. (Source: Ward 1987:8)

Captain Cook was a naval officer who had done well for himself in charting the coast of Newfoundland. He did not come from very wealthy parents. He had struggled to get himself an education and had been good at mathematics.

OHP - 2 Captain Cook using instrument, working on map. (Source: Gill 1988:69)

He was a hard-working man. Here he is working on a map - he was noted for his map-making abilities. He also carried with him maps drawn by others who had explored the parts he was going to and relied, too, on the scientific knowledge developed in Europe. Scientific knowledge which contributed to better navigation was rapidly expanding at that time.

OHP - 3 A sextant. (Source: Gill 1988:92)

He carried with him what one historian called "an armory of instruments" (Cannon 1987:17). The sextant was one of them. The sextant, with its curved bar in front marked with degrees, helped him to establish latitude. It was an improvement on the earlier quadrant, enabling more precise readings on the sun and stars to establish position.

OHP - 4 An azimuth compass, similar to that used by Captain Cook. (Source: Gill 1988:101)

He also carried a relatively new instrument, the azimuth compass. The azimuth was an auxiliary device fitted across the top of the mariner's compass, which allowed him to get better bearings on distant objects such as stars, ships, and distant landfalls.

OHP - 5 An 18th century chronometer. (Source: Gill 1988:114)

But the most advanced instrument he carried with him - on his second voyage at least - was something that helped him to establish **longitude**. Establishing longitude had been a problem for a long time. Latitude could be established with fair accuracy by taking bearings on the sun and stars using instruments such as the sextant, but longitude could only be discovered by comparing ship's time (ie local time) with Greenwich mean time. Greenwich time could be worked out by a skilled navigator by making astronomical observations and doing a long series of mathematical equations which very few people could do, even if they had the time. In any case, by the time they had done all the equations the ship had shifted position and they were no longer comparing ship's time in that position with Greenwich time. The British parliament had been so concerned about the number of disasters at sea because of inability to get exact location, that they had established a Board of Longitude in about 1690 and offered a huge prize for anybody who could create a chronometer which could keep accurate time at sea. One of the problems was that the metal would expand and contract with the changes of temperature in different climates, and this problem had to be overcome. A man called John Harrison, who worked on the problem so long that he was nicknamed "Longitude Harrison", created a watch which did keep very accurate time, and this was a great help to Captain Cook, who became noted not only for the length and success of his voyages, but also for his extremely accurate mapping of the places he visited, including the east coast of Australia.

Captain Cook's motives were partly scientific - he was asked to go and check the transit of Venus from Tahiti. But he also carried sealed orders, which he only opened after observing the transit of Venus, that told him to go and look for the "Great South Land" that was believed to exist somewhere in the vast Pacific Ocean. The reasons the British wanted to find the southern continent were mainly related to what I would call "crass commercialism". All of the major European powers were looking for new commodities that they could trade, and because of the search for new commodities and the growing competition in international trade, they needed also to find places for colonies to support the trade. So Captain Cook, when he came to the east coast of Australia was motivated mainly by commodities and colonies; you might say, money and power.

ABORIGINES OF THE WESTERN DESERT - NAVIGATORS AND MAP-MAKERS

Captain Cook encountered Aboriginal people when he landed at Botany Bay and kept seeing them as he travelled up the coast. He gained some appreciation of how they lived and wrote in his diary that they did not appear to him to be "the most wretched people upon earth" as others had suggested, but in reality "far more happier than we Europeans; being wholly (sic) unacquainted not only with the superfluous but the necessary conveniences so much sought after in Europe" (Cannon 1987:11).

But I think he might have been surprised if he had been told that some Aboriginal people were very good at navigating too; in fact, in their own way, just as good as him - without all those instruments and all that scientific knowledge.

Two hundred years later, a man called David Lewis, an historian and medical doctor who had studied navigation in the Pacific Islands, written books about navigation, and who had himself almost circumnavigated Antarctica single-handed in a sailing boat, decided to see if he could discover how Aboriginal people navigate in the desert.

OHP - 6 Map of Australia showing regions of Lewis' journeys in 1972 and 1974. (Source: Lewis 1978: 76)

He went to the Oodnadatta area first in 1972 to test out whether it was feasible to study Aboriginal land navigation and he had such interesting results there that he decided to go ahead with a major excursion.

OHP - 8 Detail of the Wester Desert area 1973-74. (Source: Lewis 1978:76)

The map shows Yuendumu where I worked, where I lived for a total of 11 years. Lewis worked with people from Papunya, which is south of Yuendumu, and the nearest similarly large Aboriginal community, so that area is fairly familiar to me too. Lewis started from Papunya and went way out west past Lake Mackay on the Northern Territory/Western Australia border. Lake Mackay is Warlpiri country too. Warlpiri people live at Yuendumu (where I worked) and Pintupi people mostly live at Papunya and further west. Lewis' longest single trip was 1660 km, starting from Yayayi, west of Papunya, 300 km west of Alice Springs and going right across to the dried up wells of the old Canning stock route. Altogether he travelled a total distance of 7 800 km with his Aboriginal guides, including 1000 km of what he described as "completely trackless terrain". At the farthest point they were about 800 km west of the last human habitation in the Northern Territory.

OHP - 9 (colour picture) Lewis' Pintupi colleagues, Yapa Yapa Tjangala and Jeffrey Tjangala, on the Wati Kutjura track, Western Australia. (Source: Lewis 1978:77) [The picture is quite striking, with the two men standing on the end of a long piece of outjutting rock silhouetted against a clear blue sky. One is pointing with his arm fully extended.]

These Pintupi men were two of Lewis' guides on the trip that I'm talking about. They are on the Wati Kutjura track, which probably has no significance for you, but it does have a lot of significance for them. The word **wati** means "man", **kutjura** means "two", so they are on the dreaming track of two men, the **Wati kutjura** dreaming track. In a similar manner, perhaps, to how Captain Cook stood on the bow of his boat and looked out across the ocean to where he was going, these two men are looking out over their country. That is their place.

OHP - 10a (colour picture) Yapa Yapa and Jeffrey at Umari rock hole. (Source: Lewis 1978:80) [The men are standing on flat bare rock beside a sizeable water hole. The country beyond is spinifex and low scrub reaching to a low sandhill on the horizon.]

The early European settlers in Australia commented frequently on how Aboriginal people could find water in the most obscure places. Often they would be just walking with Aboriginal guides and suddenly a waterhole would appear in front of them in places where they had no idea that water might be found. Whereas Captain Cook was always looking for **land**, these Pintupi and Luritja people are always looking for **water**. This picture

shows what is often described as the flat, featureless terrain where Aborigines often find water where white people would least expect it.

Umari (also called Yumari) is also one of the dreaming sites depicted in the art I will show later. Most of the waterholes - probably all of the major water sources - are sacred sites. As Lewis pointed out, the sacred significance of the waterholes was no doubt an important aid to survival in a country where water is "the ultimate physical necessity" (1978:77, 81).

OHP - 10b (colour picture) Jeffrey at Wibri rock hole. (Source: Lewis 1978:80)
[Close-up of Jeffrey half lying on the rock surface with his head down to reach the water in a small hole in the rock.]

This picture again emphasises the importance of water. Jeffrey is drinking water from the rock hole. This scene is not at all unfamiliar today. The interesting thing about Lewis' work for me is that he was doing it at the same time as I was at Yuendumu learning how to teach mathematics to Warlpiri children. His travels are in the same timespan as my first period of work at Yuendumu. I've seen rockholes like that. There was one just close to Yuendumu (about 12 miles away) where we (the white staff) would sometimes go to watch the sunset. For us, it was just called The Rockhole.

OHP - 11 (colour picture) Rockhole at Muranji. (Source: Lewis 1978:78)

This rockhole is very important too. This is the rock hole in Kapi cave at Muranji. Lewis and his guides visited Muranji twice during their travels. They went once and then came back to it later. In between the two trips, one Luritja man called Big Peter Tjupurrula did a painting of the Muranji dreaming.

OHP - 12 Muranji Rockhole and Dreaming painted by Big Peter Tjupurrula. (Source: Harris 1991:31 from Lewis 1976a, p268)

This is a diagram of the painting that Big Peter did. He took it on the second trip to Muranji so that it could be explained and sung. If you are not familiar with the idea of an Aboriginal painting being "sung" then it is hard for me to explain. It literally means singing. Singing the dreaming of the painting. In my first year at Yuendumu one of my jobs was to organise Warlpiri cultural studies for the girls on Friday afternoons. What the women always did was to paint the bodies of the girls with the red and white ochre (or using the school powder paints), and they were always singing the dreamings while they were painting the bodies. (This is similar to Big Peter singing his painting. The designs and the singing go together to re-create the stories of the Dreaming.)

This Muranji dreaming is a story about an old woman who chased a little boy. It is also a map. It is an Aboriginal map contained in a dreaming painting.

OHP - 13a Sketch map of Muranji Rockhole and vicinity. (Source: Harris 1991:32 from Lewis 1976z, p 269)

OHP - 13b Big Peter's painting (OHP-12) and Lewis' sketch map (OHP-13a) side by side. [Both Big Peter's painting and the sketch map have the locations visited marked with matching numbers.]

If you compare Lewis' sketch map of the area and the topographical "map" contained in Big Peter's painting, you might think it seems a bit strange. The locations (represented by concentric circles) numbered 1, 2, 3, etc in sequence on the painting are all over the place on Lewis' white man's map. However, what you have to understand is that Aboriginal maps always have to be interpreted. You can only understand Big Peter's map if you know that, first of all, the central (most important) site is placed in the middle. You will see that also in the Aboriginal art I show later. So here, the central roundel (as the art people call it) is the main site, Kapi. That has to be explained by the person who did the painting. Then the rock holes and other features which they visited are presented in the sequence in which they visited them. That is why it looks nothing like Lewis' sketch map. In the painting, the main site is in the centre, the other sites are placed in the sequence of travel. The directions east and west are also right, says Lewis, if you take into account that all Big Peter is trying to indicate is easterly and westerly, the directions of the escarpment.

The most important point about the maps contained in the dreaming paintings - which help them to find their way in the desert - are that they always need inside interpretation. The landscape features represented have to be identified by the map maker himself, or else by someone who is really familiar with the dreaming and its topographical setting and also familiar with that painter's idiosyncrasies. And singing the painting is a really important part of the interpretation but also, as Lewis points out, it is a wonderful aid to memory and therefore a great aid to survival.

OHP - 14 Schematic map of suburban bus routes. (Source: Harris 1991:29)

If you're inclined to think that Big Peter's map is rather abstract, then you could compare it with this Brisbane bus map, or a Sydney train map, or the like. They are very abstract too. They show places in sequence and general direction, and that is all they show. That is also what the Aboriginal maps show. But it has been pointed out by more than one writer that Aboriginal maps are always something more than just a schematic map like this bus map, because the dreaming paintings create an image of the ancestral journeyings and events which are the basis of all their social structure and all their law and all their beliefs. Although a painting like Big Peter's is a schematic map showing roughly places and the connections between them, it is far more than that, whereas the Brisbane bus map is just a schematic map showing places and the connections between them and that is its only significance.

Lewis was really surprised, he said, because he went into investigating Aboriginal land navigation with all the ideas that he had about sea navigation. He thought they would be looking at the sun and the stars and they would get the directions from them. And perhaps the feel of the wind. But he said that all his preconceived ideas about navigation turned out to be wrong in relation to Pintupi living in the Western Desert. He noted with some surprise in his writing that:

the main references of the Aborigines proved to be the meandering tracks of the ancestral Dreamtime beings that form a network over the whole Western Desert (Lewis, 1977:9).

Later, in the art section, I am going to show part of one of those networks.

Lewis said that the importance of sacred sites was brought out when he asked them to point out the direction of distant places (in various experiments with the people he was travelling with).

In 39 instances, accuracy varied between exactly right and 67% error - an enormous scatter. But every one of the big errors occurred when non-sacred places were being indicated. For the 6 far-away sacred sites, the error was never more than 10% and, in fact, averaged 2.8 degrees (Lewis 1977:11). (Maybe that has something to say about the importance of whether or not you are interested in what you are doing in school! Whether it is meaningful to you.)

Orientation and Mental Maps

Lewis also found that they were well oriented in compass terms. His companions, on questioning, make remarks like: "We knew north, south, east and west before the white man and his compass." "I can feel it in my head" (what direction I'm going).

One time Lewis, being puzzled about the means by which they could always find their way back directly to the place where they had started, began asking questions. On one occasion they had been out hunting and had been chasing a kangaroo for about half an hour, dodging all over the place. After killing the kangaroo, Jeffrey and Yapa Yapa just turned around and started heading back to the Landrover, which had been invisible since the first few minutes of the chase. (In Lewis 1977, p 11, the country they were in is described as "featureless and flat, with moderately open mulga and spear grass, devoid of sandhills, creek beds, escarpments, tall trees or other references". Visibility was "a hundred metres at most".)

Lewis was wondering how they knew where the Landrover was, so he began asking questions:

Q "how do you know we are heading straight towards the Landrover?"

A Jeffrey taps his forehead "Malu (kangaroo) swing round this way, then this" - indicating with sweeps of his arm. "We take short cut."

Q "Are you using the sun?"

A "No"

(Lewis 1977:11)

Lewis wondered whether Jeffrey had any points of reference. The only external reference Lewis could think of was their starting point; the sun was not being consulted; they were not using the "points of the compass" (which could have been located from looking at the sun), nor in this case did sacred sites come into the picture. So after his questioning and further incidents like that, Lewis concluded that the people he was with were orienting on some kind of dynamic "mental map" which was continually being up-dated in terms of time, distance and bearing, and more radically realigned at each major change of direction, so that when out hunting or wherever, they remained at all times aware of the precise direction of their starting point. (It seems to me that such a mental map - that kind of ability, if that's what it is - must be extremely useful in many areas of mathematics learning, if it could be tapped.)

Children's Orientation Skills

This leads me into a story that was given to me in response to my questions regarding the Space strand as part of the Mathematics in Aboriginal Schools Project. As I recall, it was from a teacher from Ali Curung, which is also in Warlpiri country, but further north along the Stuart Highway south of Tennant Creek. The teacher, who was new to the place I think, went out hunting with a group of children. After wandering around for a while, he got the feeling they were lost. Certainly he was a bit lost - not sure where they were or how they would get back. So he said to the children "What do you do when you get lost?" They didn't really understand the question at first. So he rephrased the question and managed to convey that he wanted to know what you do when you get lost. "Oh," said the children, "We just go home." It seemed as though being lost - in other words not knowing where you are or how to get home - was an idea they did not apply to themselves at all. Whether they could have given him any advice about what he should do if he were lost, I don't know, but I think he would have just got lost. Probably they, too, from a very early age were oriented in compass terms and able to know the precise direction of their starting location.

The knowledge of compass terms and orientation to the points of the compass of Warlpiri children in particular, where I lived, is illustrated in another story told to me by a teacher at Yuendumu. It happened outside the language room where I worked when I was teacher/linguist. An Aboriginal woman, Nungarrayi, was walking past carrying her baby and somebody called out, maybe from the window of the language room, to the mother and child. (Because in Warlpiri culture a way of greeting adults is to greet the child, you say something to the child and that's a way of acknowledging the mother.) So, the bystander called out to the child, but the child could not locate the direction of the voice. This was an eighteen month old baby. Then the person calling out said Kakarrani which means "to the east" and immediately the baby, only eighteen months old, turned its head and looked in the direction of the speaker. I talked to the linguist, May Laughren, about that and she said that is par for the course, not at all unusual.

The Warlpiri children's knowledge of compass terms was such that I preferred to use them in the classroom in some circumstances where left and right would normally be used. It is on the syllabus in the Space strand to teach young children to know left and right, but this is difficult for Warlpiri children. Really, left and right are not essential directions in your body. You know where your front is because that is the way you face. You know where your back is because that is behind you. You know where your head is and where your feet are because you can feel them in the orientation of your body. But left and right are not primary orientations bodily.

So in the classroom, if I was teaching them to write the letter "a" for example, I would use compass terms. (I knew enough in the context of the Yuendumu community to know that when I was standing at the blackboard, my right side was facing yatijarra, north, and my left side was on kurlirra side, the south.) So I would say, "Start yatijarra side, go up, then kurlirra side (that is to the south), then go down and then go back yatijarra way and go up and make a stick to finish the "a".

The point is that in Warlpiri language not only north, south, east and west, but also up and down are all in one united set of directional terms, not just north, south, east and west. The terms related to up and down are also included in the set of directional terms. So for a Warlpiri child left and right are really difficult; the compass terms are much more their way

of doing things. There are many more stories in the books I showed (Harris 1989, 1991) about how Aboriginal people in the desert [and elsewhere] use compass terms even in the most confined spaces, like locating a picture out of several postcards on the front of the fridge or something like that. They'll say "to the east" or to the west or whatever.

MATHEMATICS IN ABORIGINAL SCHOOLS PROJECT - SPACE STRAND INVESTIGATION GUIDE

Background

Now I'm moving on to the research of the Mathematics in Aboriginal Schools Project. First I want to get you oriented to the location of my work.

- OHP - 15 Australia divided into "remote" and "settled" regions.
- OHP - 16 Major Aboriginal communities in "remote Australia".
- OHP - 17 Schools with Aboriginal bilingual programs. (Source: Harris 1991:6, 7, 129)

I often feel I face a risk when I write things about Aboriginal people or my experiences living and working with them. Because some people say, "I work with Aboriginal people and they're nothing like that" or "the Aboriginal people I work with say that they don't do that", I want to make sure you understand the particular context of my work.

Economists divide Australia into "remote" and "settled" regions - this map (OHP-15) is from an economic survey (Altman and Nieuwenhuysen, 1979, *The Economic Status of Australian Aborigines*). Most of Australia's population lives around the south-east coast. So for census purposes and economic studies Australia, is divided into the settled regions and the remote. Most Australia and perhaps less than you might expect of Queensland is classified as "remote".

Within remote Australia, this map (OHP-16) shows the major Aboriginal communities. In the middle is Yuendumu where I worked, and it shows that it is on a reserve. West and south-west of that is the enormous North-west reserve going from the north-west of South Australia, over into Western Australia and up into the Northern Territory. The North-East Arnhem Land reserve is also shown. That is where Helen Watson (whose work you might have read) has been working, mostly at Yirrkala. That is a different scene from where I was working at Yuendumu. Working up in North-East Arnhem Land is a really different proposition from working with people in the central Australian and Western Desert areas. Some people who have worked in different areas have said to me they think the hardest place of all to work is the north-west of South Australia, and from my experience I would tend to agree with that.

There are a lot of Aboriginal people - although it is regrettable in another sense how few - who still have their first language and it is still strong and they are determined to keep it, even against the encroachment of English, and these languages are now being used in a lot of bilingual schools in the Northern Territory (OHP-17). I think it is important to acknowledge what the Northern Territory has done. When I was there we often grumbled about what little they did for bilingual education, but they've done an enormous amount

compared to other parts of Australia and other parts of the world. In the middle is what we called the "Warlpiri triangle" - the three Warlpiri communities of Yuendumu, Willowra and Lajamanu that all had bilingual education programs. Warlpiri is the language that I worked in at Yuendumu.

My orientation when I did research was, and always has been, Aboriginal people who live in remote communities, fairly isolated, who still have an Aboriginal first language, which is very often a language used in a bilingual program in school.

So when I did the Space strand section of the Mathematics in Aboriginal Schools Project, I did the work on Space in preference to looking at Number. I had a choice. I included the study of Time and Money mainly because I had research data "left over" from the work I had done at Monash University (1976), from the measurement study (published in the NT 1980). I felt that Time and Money were just so important in the relations between Aboriginal and non-Aboriginal Australians. How often you hear white Australians bemoaning how Aboriginal people use their time and, worse still many think, how they use their money - for gambling, drinking and so on; the criticisms are endless. This is why I did major chapters on time and money. Then I had a choice about Number and Space. Because in the Northern Territory at the time I was doing the project, we had three major strands in the mathematics syllabus - Number was first in the syllabus; Space came in the middle, and Measurement. So I just put aside Number and decided that because Space is far more important to Aboriginal people I would concentrate on that first. I knew that what I was likely to find out if I looked at number concepts was what Aboriginal people don't have and don't do, and I like to avoid that kind of research which only has negative-sounding results. So I concentrated on Space.

By looking at the space sections of various syllabi, I made a list of headings of what things are usually included in the space section of a primary school maths syllabus, and thereby devised what I called a Space Strand Investigation Guide. (See Harris 1991, Appendix E) I put this out to linguists mainly, many of them missionary linguists, and to teacher/linguists employed in the bilingual programs and anyone else I thought interested and able to help. I had to keep stressing that it was a **guide** to investigating spatial concepts, not a questionnaire. It was a guide intended to help them to sit down with the Aboriginal language workers whom they worked with and find out what they could about spatial terminology in the language and the people's spatial concepts.

Shape

Not surprisingly what came back were messages to the effect that what I was asking about was nonsense to the Aboriginal people and they would tell me what they were interested in. Similar messages came from the very first time I sent out a questionnaire. One of the main comments coming back from the Space Strand Investigation Guide went like this, "In our language objects are classified by shape as to whether they 'sit', 'stand' or 'lie'. There is no word for 'to be'." (That is reminiscent of some of the American Indian languages where every noun is classified according to the shape of the object.) The comment about verbs in the Aboriginal languages came from places as far away as Noreen Pym, missionary linguist in the Iwaidja language on Croker Island, right up off the coast of Arnhem Land, and Faye Bell who had worked in the central desert at Areyonga in the Pitjantjatjara language.

OHP-18 Stance verbs in Australian languages. (Source: Harris 1991, pp 40-41)

Faye Bell said:

The four verbs (nyinanyi "sitting", ngaranyi "standing", ngarinyi "lying", and pupanyi "leaning") describe the state of "being" for all things ... it would appear that relative proportions within a three dimensional frame of reference determine which verb describes the state of being.

What I find really interesting is that these highly trained linguists found it really difficult to use the verbs correctly. Two of them mentioned this. They said that some things that appeared to them to be lying turned out to be "standing", and something that appeared to them to be standing turned out to be "crouching" or "leaning". That sort of thing. (You have to use one of the verbs because there is no general verb "to be" as there is in English.) This emphasises to me the difficulties that must be encountered by Aboriginal children who have an Australian first language and have to do their schooling all in English. They cope easily with these classifications but must have a lot of problems with our English classifications but must have a lot of problems with our English classifications in other areas. It is the problem of trying to think in a different framework. If the experienced linguists can't do it easily, why should the 8-year old Warlpiri child in school be expected to do it without a lot of help? Why do we expect them to cope easily with another people's ways of classifying the world?

School Shapes

In the Space Strand Investigation Guide I asked specific questions about what I called "school shapes". My labelling of them as "school shapes" goes back to my early days of teaching at Yuendumu when I was required to use attribute blocks for teaching maths. I absolutely hated using the attribute blocks. It seemed to me quite nonsensical to sit there asking Warlpiri children "Give me a square, show me a circle, can you find a triangle?" and so on. I just thought that if we had to classify, we should classify something that was meaningful to them.

OHP-19 Plane and solid shape.

OHP-20 Circular, spherical shapes. (Source: Harris 1991:40-42)

In response to the Space Strand Investigation Guide questions about school shapes, one linguist said that an Iwaidja woman (on Croker Island off the coast of Arnhem Land) described the plane shapes drawn by the linguist as follows. A square was described as "flat, smooth"; a circle as "round" (however you say that in Iwaidja language); an oblong simply as "long", and a triangle as "having sides".

What I found intriguing was that from a linguist with Gurindji people in the desert a long way south-west of there came categories for solid shapes which were almost the same as those the Iwaidja woman gave for the plane shapes. They said that there seemed to be roughly three categories for solid shapes - flat, round, and long. Books, mangoes, and boxes are "flat", berries, eggs, and balls would come into the category of "round", and yams, swags, and tin cans would be considered "long". It was noted that most things that would be considered "long" also had a component of being somewhat cylindrical.

Overall, the replies about shape were very much along the lines that there are no descriptions (ie no vernacular vocabulary) for the shapes with straight lines. One may assume that this is partly because in nature itself there are very few straight line shapes like squares, cubes and triangles. But they did give descriptions for circular shapes. For example, in Gurindji the word *mirta* could stand for "circle" or "round thing". *Mirta* is the word for a round coil women used to place on their head to help carry water or food. The plural of that, *mirtamirta*, could be used for "circles", plural. But you would not know, except perhaps from the context, whether it referred to circles concentrically placed or circles scattered around separately.

WESTERN DESERT ART

One conclusion from the sections on plane and solid shapes in the Space Strand Investigation Guide is that the straight-line shapes of geometry are not usually described in Aboriginal languages, but there are terms for circular and spherical shapes. A look at the art of the Western Desert suggests perhaps a reason for the greater number of terms for circular shapes.

Slide 1 Figure 167 in Sutton 1988 "Ceremonial Ground at Kulkuta Anatjari Jampijinpa, Papunya. (The painting consists entirely of dotted concentric circles and the spaces between them.)

Circle is the main shape that is used in Western Desert art. The people who compiled the book of the Dreamings exhibition of Aboriginal art (the one that went to New York) analysed 300 samples of Western Desert art. The circle is the main icon used, followed by the circle and line motif. Why circle? Circle represents ceremony. One French anthropologist said that whereas in Western art the aesthetic focus might be on religion, and is a personal, individual expression, in Aboriginal art the aesthetic focus is ceremony. And that is a social thing, not an individual thing. The circle has all the connotations of a camp, a waterhole, a circle of people around a campfire, or the campfire itself. The circle has connotations of intimacy, of unit, and of an unhierarchical social order. These are all part of the symbolism of circle.

Slide 2 Figure 177 in Sutton 1988 "Jangala and Two Women at Ngurrupalangu" Uta Uta Jangala, Central Australia.

The circles in the paintings often represent topological features. In this one the circles (3 large concentric groups and 14 smaller ones) all represent caves. The bumps at the top are people - a Jangala, his sister Nangala, and a Napanagka woman who are in the Dreaming story. The other dotting and other shapes in the background are hills and vegetation in the area.

Slide 3 Figure 148 in Sutton 1988 "Kangaroo and Shield People Dreaming at Lake Mackay" Timmy Japangardi, Papunya. (Consists of many circles, almost all of them joined to each other by two or more lines with infilling between them. There are just a few unconnected circles.)

The unconnected circles in the middle of this one are trees, and the circles which are connected are campsite water soaks. At the very top, the little tracks are kangaroo tracks, as this is about a kangaroo ancestor and the connected circles and lines depict travels from

place to place. This is an example of the circle-and-line motif which Nancy Munn, who studied Warlpiri iconography, called the "site-path" motif. The site-path motif makes up about 60% of all the symbolism in Warlpiri art.

Slide 4 Figure 178 in Sutton 1988 "Old Man Dreaming at Yumari" Uta Uta Jangala, Kintore.

Slide 5 Figure 179b in Sutton 1988 "Yumari" Uta Uta Jangala, Papunya.

These two paintings bring us back to Yumari (Umari) rock hole - the one I showed on the coloured overhead. They are both Yumari Dreamings. It is an Old Man Dreaming and was considered too secret for many details to be revealed in the catalogue. This also shows very strongly the site-path motif. You can see the network - the network that Lewis talked about that crisscrosses the country, connecting people to each other and to the land.

OHP-21 Selected Dreaming tracks in the Yuendumu region. (Source: Sutton 1988:122) (This relates to the following slides. The OHP remained on the screen while the slides were shown alongside.)

Slide 6 Figure 157 in Sutton 1988 "Wild Yam Dreaming at Yajarlu" Paddy Jupurrurla Nelson, Yuendumu.

Slide 7 Figure 138 in Sutton 1988 "Water Dreaming at Mikanji" Judy Nampijinpa Granites, Yuendumu.

Slide 8 Figure 160 in Sutton 1988 "Water Dreaming at Mikanji" Tilo Nangala, Yuendumu.

Slide 9 Figure 144 in Sutton 1988 "Burrowing Skink Dreaming at Parrikirlangu" Darby Jampijinpa, Yuendumu.

Explanation of Overhead Projection Transparencies

Now, to help you understand more about the Dreaming networks, I am showing a diagram of some of the tracks and some paintings that belong to those very same tracks. This diagram (OHP-21) comes from the book called *Dreamings: The art of Aboriginal Australia*. It shows selected Dreaming tracks in the area of Yuendumu, which is where I lived. So a lot of the people and the place names mentioned are familiar to me. Some of them are people I worked with. These are their homeland centres - their **home land**, their real home was in these places.

It shows one Dreaming track for Pamapardu (the Flying Ant) going from Wantunguru in the east towards the west. Then crossing over that is the Wild Yam (Yarla) Dreaming starting at Yamaparnta in the north and going through Yumurrpa to Warrikinpirri in the south. In that southern part you are just about into Pintupi country; in the north you are in Warlpiri country. Then there is the Blue Tongue Lizard Dreaming, the Initiated Youths (Maliyarra-maliyarra) Dreaming (the word written twice indicates plural) and the Yankirri (Emu) Dreaming which is quite important at Yuendumu, and those three come from the north-east to Warlukurlangu and on down to Ngarna in the south. It is this place, Warlukurlangu, that the Warlpiri artists chose for the name of their art group. They called themselves the Warlukurlangu Artists Association. That's why, because of that particular Dreaming site. Then, perhaps even more interesting, with more connections, is the Rain Dreaming. A lot of Rain Dreamings interconnect at Mikanji.

Explanation of Slides

The first two were Yumari rock hole, and the Old Man Dreaming. Now to Yajarlu, the Wild Yam Dreaming (Slide 6). This place, Yajarlu, is where I went camping overnight just before I left Yuendumu. So the place and the people whose homeland it is and the fact that you can find water there, are all very real to me, and I'm just a white visitor who's been there once. (How much more real and significant it is to them, who "belong" there.)

This painting is a bit unusual in the composition because the roundels are not connected and the line wanders around a bit (ie a contrast to the previous two in which circles were mostly connected with straight lines, the site-path motif). Again, the lines are the travels of ancestors and the circles are places where the mythical ancestors stopped.

(Slide 7) Those I have shown so far have been men's paintings. This is a woman's painting, done by Judy Nampijinpa. "Nampijinpa", "Jangala" and those other names I mention are tribal subsection names. There are 8 subsections at Yuendumu. (Women's names start with N and corresponding men's names start with J, eg Nangala and Jangala are sister and brother.) Judy inherited this Dreaming (a segment of a Rain Dreaming) from her father (and father's father) and she learned from her father and father's sisters the symbols she had to use, the ritual designs.

(Slide 8) Looking rather different, but still a Water Dreaming, is this one by Tilo Nangala. Nangala and Nampijinpa both inherit the same segment of this Dreaming track from their fathers. This helps illustrate the important connections associated with the Dreaming tracks. (Refer back to OHP-21) The Rain, or Water (Ngapa) Dreaming track connects Pintupi people from the south-west, up to Mikanji where several Rain Dreamings interconnect, to Warlpiri country as it goes north, and going westwards towards Mt Wedge it connects with Anmatyerre people. So it is not only families and subsections that are connected by the Dreamings, such as I've just shown with the paintings by Judy Nampijinpa and Tilo Nangala. The Dreaming tracks also connected neighbouring tribes and this was really important for their survival, because in times of drought when, say, the Pintupi waterholes were all dried up, they could approach their Dreaming partners in the connected tribal areas for access to other waterholes.

(Slide 9) This painting is also associated with one of the Dreaming tracks on the OHP - the Blue Tongue Lizard Dreaming but it also introduces the topic of symmetry. (The painting has roundels (of concentric circles) in the shape of a cross, ie three down the vertical axis and one at the mid-point of each side all connected by dotted lines. Four slightly smaller roundels roughly mark the corners (the two bottom ones are higher than expected, up the side) and then there are two roundels above either side of the vertical line and above the horizontal arms of the cross. These last two are not balanced by any similar motif in the lower half of the painting.

In Warlpiri art, there is a tendency always to be symmetrical. If there is one roundel (circle or set of concentric circles) it will be in the middle, if there are three they will be down the centre axis and maybe the one in the middle will be bigger, if there are more than that they will be at the corners of the rectangle or at the mid-points of the edges of the rectangle. This is a bit unusual in that it has two extra circles that aren't balanced on the bottom.

Slide 10 Figure 91 in Sutton 1988 "Witchetty Grub Dreaming" Theo Brown Jakamarra, Mbunghara. (There is a roundel of 5 concentric dotted circles in the middle and the two axes and the diagonals of the square are marked with a distinctive recurring motif of small roundels and crescent shapes with an unobtrusive overall background.)

This one, I think, is beautifully symmetrical. A good example of the "tendency towards symmetry". It is a Witchetty Grub Dreaming. The central circle is a ceremonial site. The Dreamings are related to not only land nurturing the people but also the responsibility of the people to nurture the land, so they have the ceremonies to ensure the continuation of the species and a good supply in the coming season. In this painting the small circles are the leaves on the tree on which the grubs feed, and the little crescent shapes are the grubs themselves.

Slide 11 "Witchetty Grub Ceremonies" Paddy Carroll Tjungurrayi. (Source: 1986 Aboriginal Art calendar)

I thought this one was completely symmetrical. But I showed it to some mathematicians at QUT and one of them surprised me by asking if there was any reason why it was not completely symmetrical? I said, "Where?" "There", he replied, "there's a mirror image most of the way (in the curly shapes either side of the centre line), but there are a couple of places near the bottom and at the top where it is not a mirror image". Well, I couldn't see it and they had to stand up and point it out to me on the screen, and I wonder whether the difference between me (with my rather limited mathematics background) looking at this picture and a professor of mathematics education looking at it is perhaps a little bit like the difference between an Aboriginal person and a mathematics person looking at it. You just don't see the same things.

It is interesting that it was noted in the Dreamings book that if an Aboriginal artist comments on another person's work - "That's a good painting you're doing!" - they are not talking about whether it is perfectly symmetrical, or the dots are all clear and neat and the same size, or that sort of thing (although that comes into it a bit). When an Aboriginal painter in the Western Desert area says to another Aboriginal painter "That's a good one" what he means is you (the artist) are faithfully and truly representing the Dreaming that has been handed down to you by your fathers. That's what is "good" to them.

CONCLUSION

What does all that show us?

What I was trying to do was to raise your awareness. As I said at the beginning, an aim of the Council for Aboriginal Reconciliation for the next 10 years is to raise the awareness of non-Aboriginal Australians of the culture, the values, and the disadvantages suffered by Aboriginal people. I hope I have at least done that. I often find it difficult - I certainly did when I wrote the Space Strand book (Harris 1989) and chapter (in Harris 1991) - to say what action should follow from what I've written. It's a difficult question.

But following this presentation, I think that there is some action that we, as MERGA people can take, because, you see, this year the theme of the conference fitted in nicely with the fact that it was International Space Year. And next year, as it happens, has been

declared by the United Nations as International Year for the World's Indigenous People - next year, 1993. And next year MERGA is going to be held in Brisbane. Brisbane has a higher ratio of Aboriginal and Torres Strait Islanders living in it than any other Australian city. And it is in Queensland, the state of Australia that has the highest number of Aboriginal people of any state or territory in Australia. The projected theme for the conference is "Contexts in mathematics education". Surely this presents an opportunity and a challenge:

International year for Indigenous People,
Brisbane,
Queensland (which also has perhaps the blackest history of its treatment of indigenous people),
and a theme of contexts in mathematics education.

Is there something we could do to include Aboriginal people and Aboriginal values? or emphasise them somehow at the next MERGA conference? Is there something we could do to pay special attention to the context of teaching in remote Aboriginal communities like those shown on the map of "remote Australia"? Could we pay special attention to the problems of non-Aboriginal teachers who go to those communities? Could we listen to Aboriginal people somehow in the preparation of the conference?

I've been influenced in the preparation of this talk by two Aboriginal people, two Aboriginal women. A month ago I went to a 2-day course called "An Aboriginal World" taken by a woman called Mary Graham, in Brisbane. I also have a copy of an interview with her about why she runs these courses on an Aboriginal world. Also I have a paper by Lilian Holt that she prepared for an international conference. Lilian is the principal of the Aboriginal Community College in Adelaide. In both these papers, the theme that comes through again and again and again is that Aboriginal people feel that they have a spiritual identity and White Australians do not; and that White Australians need one. Mary Graham quotes the oft-quoted old Aboriginal man who said "White man got no Dreaming" and she explains that what he meant is that they have not got any collective spiritual identity and, as Lewis discovered when he went out with Pintupi and Luritja in the Western Desert, and as anybody will discover if they really study the meaning of the Aboriginal art, some of which I've shown you, Aboriginal people do have a collective spiritual identity which is based in the land and connects them with the land and with each other.

So, going back to the beginning of my talk, Captain Cook pushed back the frontiers of the oceans to find Australia and draw maps of it, the first English settlers pushed back the frontiers of the inland to explore Australia and come to dominate it completely. Perhaps the last frontier to be pushed back is in the realm of the spiritual and also the frontier of communication between Aboriginal and non-Aboriginal people, being able to talk to each other. To help the communication, and in the spirit of the Council for Aboriginal Reconciliation, I will finish by quoting from Lilian Holt's paper.

The topic on which she was asked to speak was "Aboriginal Justice, Democracy, and Adult Education". Throughout the paper she expresses her concern for the missing dimension of spirituality in Australian life and education and she calls for a more holistic education. She wants a three dimensional education which includes the physical, the mental and the spiritual such as they try to have at the Aboriginal college in Adelaide. Along with other writers like Edward de Bono she raises the question of how to survive in an increasingly complex and technological society, which can even put men on the moon, a society where

skills are so necessary and everybody knows you need them, but how to do that while at the same time enhancing your spirit and identity? Lilian expresses discomfort about national educational policies which are only geared towards numbers for employment and with an emphasis solely on production and profit and she says, "Sure, we need to advance, but to where and for what?"

I leave you with the closing lines of her speech:

The qualitative in education has, for too long, been diminished and dismissed. The language of the spirit - passion and intuition - those unquantifiable aspects - may need to be included if we are to get to the core issues of true human education. The logically viable and the quantifiable will no longer take precedence, but will have equal partnership with all other areas.

Catering to the physical, mental and spiritual is, I passionately believe, what true life-long education should be about. In the incorporation of all this, justice and democracy automatically flow, not just for indigenous people such as ... Aboriginal Australians, but for all of humanity. (Holt 1991:12)

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