Inuit Navigation, Empirical Reasoning and Survival

Colin Irwin

(*Syracuse University*)

In order to navigate and thereby survive in a hostile environment the Inuit have developed a sophisticated body of knowledge that makes travel possible even during a blizzard or white-out. This unique skill was developed from a thorough understanding of the properties of snow and local meteorology. Problems of space, time and distance are also taken into account by Inuit navigators but this is done with minimal use of quantification and abstraction. However this highly practical form of navigation in which the Inuit deal directly with their environment is none the less scientific and empirical.

In 1971 the author attempted a single-handed sailing of the North West Passage and in 1973 completed a crossing of Arctic North America by dog team.

1. INTRODUCTION. The perspective of anthropologists like Levy-Bruhl that characterized primitive thought as essentially mystical has been absent from the mainstream of cognitive and psychological anthropology for many years. However, as recently as 1964 Thomas Gladwin[1] in *Culture and Logical Process* concluded that the thought of non-European peoples exhibited a lack of future orientation and planning which somehow functionally related to the lack of planning in cognitive or problem-solving activities. In *East is a Big Bird*,[2] Gladwin reversed his position in this apparent cognitive dichotomy and suggested that both the Pulawat navigators he was studying and western navigators have advanced plans that cover the entire voyage dealing with the same things for the same reasons. Gladwin concludes: 'However diverse the intellectual traditions of the navigator, the sea is a demanding master. No style of thinking will survive which cannot produce a usable product when survival is at stake.' Perhaps no culture as a whole is more adapted to the necessities of survival than the Inuit who inhabit the hostile environment of the Arctic. If Gladwin's conclusion is correct, then it should come as no surprise that an anthropologist like Williamson[3] who has spent his life studying the Inuit would write:

> It will be readily understood that the value system of the Eskimo people ascribes considerable importance to the capacity of the individual for thought... Only by the exercise of intelligence, alertness, and imagination was the simplest form of survival possible. It is a common observation among the Eskimo that the stupid do not survive. The Eskimo have remarkably well-developed powers of observation, and retention of visual memory, so that they are able to quickly discern changes in weather, which can come with great rapidity, the condition of ice, and the signs of wildlife upon which they depend. Nevertheless the Eskimo feel that the ability to observe is meaningless without the ability to analyze and interpret what is observed.

The ability to solve complex navigational problems perhaps demonstrates more elegantly than any other skill an individual's intellectual mastery over his environment. The navigational techniques of the Inuit have never been described in great detail so I offer this description to fill that ethnographic gap and at the same time add support to the thesis that human survival often requires nothing less than intelligent, empirical, scientific thought.

However, as my means to understanding Inuit navigation skills was through being taught them,[4] I should begin this paper by briefly describing what navigation processes I was familiar with and how these models operated prior to my learning Inuit methods.

During my late teens I was an active amateur diver around the coasts of Britain where the waters are never very clear. In the upper parts of the English Channel twenty-foot visibility was considered good; frequently it was down to a few feet. The normal procedure for boat dives in that area was to descend the anchor chain, explore the area for half an hour to an hour, attempt to return to the boat's anchor and ascend. As we never used compasses or other mechanical aids, inexperienced divers could not find their way back to the anchor so either the boat would follow their bubbles escaping on the surface or, providing they did not stray too far, wait for them to surface and pick them up. However, some experienced people developed what we considered at the time to be a sixth sense as they were able to travel extensive circuitous routes underwater and always return to the anchor without backtracking, even in poor visibility.

In the early 1970s I took up sailing and learned the conventional methods of nautical navigation using charts, compasses, plotted courses, dead reckoning and celestial position fixing. At the time I was preparing to sail the North West Passage and became friends with Michael Richey, of the Royal Institute of Navigation. Being better acquainted with the empirical aspects of his science we were able to discern what parameters I had employed in my supposedly sixth-sense underwater excercises.

A sense or rather knowledge of direction or orientation was given by ripples in the sand that ran parallel with the prevailing swell in shallow water or at right angles to the current direction in depths beyond the influence of swell. Where there was no sand, rock covered in seaweed would lie in the direction of the current or wave back and forth in the swell. Additionally, the direction of drift of the diver across the seabed gave direction of tide or current. The surface boat would always lie on its anchor with the swell and/or current so that the diver on descending the angled chain would be given a directional 'fix' at the onset of his immersion. Providing the diver could now discern 'distance covered' and compute this against orientation he could travel over an extended area and return to the anchor. As the diver was nearly always searching for something, he did not wish to cover the same ground twice, so the courses made were often triangular. In this case, as current would accelerate motion in one direction and retard it in another, visual reference to the passing of the seabed was a more accurate measure of distance than time and speed of swimming. Clearly the computation for the diver becomes more difficult when he travels at an angle to the current or makes repeated changes in direction (such as in pursuit of his dinner) or when the current changes speed and direction with a change of tide. If all these parameters are in a state of flux, most divers get lost or 'lose their bearings'; however, others do not. I found it helpful to accommodate changes in the navigation problem by asking in which direction the anchor lay and how far in terms of seabed to be covered each time I became aware of a new factor causing a change in position.

At this point it becomes apparent that if a navigation exercise of this complexity was to be carried out by dead reckoning using compass, chart and watch, it would probably fail. This is why the ice breaking oil tanker *Manhattan*, when sailing the North West Passage used doppler shift equipment which can directly measure motion across the seabed when the ship is being pushed around in pack ice. For the same reasons, the diver who is able to navigate 'by the seat of his pants' using visual references from the sea floor will sometimes be able to navigate better than divers using conventional dead reckoning methods.

Having learned that my sixth sense was nothing more than the subliminal computation of visual information I tried actively to improve my underwater navigation by making extended triangular explorations of several miles when I was in the Red Sea. At first my awareness of what I was doing was a hindrance as I tended to over- or under- compensate for navigational changes but in time my ability improved until I could travel extensively at night by watching the direction of the sand ripples in my flashlight beam.

When it came to sailing the North West Passage where navigational aids such as lights, buoys and markers are few and far between, I found my knack for navigation by judgment as valuable as the use of conventional methods because my little yacht had no computers or radar. It is possible that learning to navigate underwater by the direction of the ripples in the sand, helped one to acquire the Inuit skills of travelling by the patterns etched in snow by the prevailing winds.

2. INUIT NAVIGATION. The navigational problems for the Inuit differ in different parts of the Arctic depending on the topography.

In mountainous areas such as Greenland and Baffin Island, one glacial valley leads to another so that travel is accomplished by following a series of topographic features that are distinctive even in a blizzard. It is possible to say this as mountains affect local winds so that snow patterns tend to run along valleys. Consequently, in poor visibility it is quite easy to follow along the sides of a valley especially when the intended direction is enhanced by the snow ridges running parallel to one's path. Clearly the snow patterns change where the winds from intersecting valleys meet but the good navigator will identify this as a sign that his turning is close at hand.

This type of navigation requires a good knowledge of features which are well illustrated in the Greenland relief maps collected by G. Holm[5] in 1888. However, a rather different navigation problem is presented to the Inuit who live in the Central Canadian Arctic where the topography is comparatively flat and indistinct. As an Arctic traveller with a Greenlandic background, Rasmussen[6] noted this when travelling on the Barren lands:

> I have drawn attention to how extremely difficult it was to find our way on the Barren Grounds. The one part resembled the other, and as soon as we got a little way from the main channel of Kazan River, we ran as a rule into a net of small watercourses which wound their way between large and small lakes and made it difficult to keep the set course. The gneiss hills resembled each other, and only when one had very definite land marks and bearings to go upon

could the one be distinguished from the other. The Caribou Eskimos, however, had such marks in abundance, and they had also to a great extent given the land names, as a rule characteristic and informative names, the result being that to one who was familiar with these names it was not so difficult to find the way.

However, this type of navigation only works in good visibility and as the Barrens are notorious for their winds and blizzards it is necessary for survival for the Inuit of that region to navigate by dead reckoning which includes knowledge of direction between marks and camps independent of being able to see them until reached. I do not wish to suggest that Inuit of the Central Arctic are therefore better navigators than their counterparts in Baffin Island and Greenland. In my experience, this type of ability in navigation is largely a matter of a talent for the craft as demonstrated by different individuals. Unlike Polynesian society where navigators are a specialized group of individuals who pass their skills on generally within particular family lines[1,2] all Eskimo men must be individually autonomous hunters and travellers. But this does not mean that all Inuit are excellent navigators; as a group they are very good as noted by J. V. Berry[8] who tested for orientation skills between the Inuit, Temne of Africa and Scotts. Some Inuit are excellent and never get lost in the worst weather while others have notorious reputations as navigators and consequently seek to team up with a hunting companion who has such skills. Therefore, although the Inuit of the Central Arctic as a group may have certain navigation skills that Greenlanders as a group tend not to require so much and consequently may not have developed to the same degree, I am confident that a good Inuit navigator from either environment would soon do well if transported from one place to the other whilst a bad navigator will always continue to get lost, be he from the Barrens of Canada or the Fjords of Greenland. A psychological explanation for the occurrence or absence of this talent in given individuals is not within the scope of this paper; however Inuit hunters might consider it a valid parameter of intelligence. What is of interest here is how the good navigators do get around in an almost featureless environment when visibility is distorted or reduced by a white-out or blizzard.

3. WIND COMPASS. As mentioned the wind tends to blow along mountain valleys but on the Barrens, open sea ice or large lakes, the prevailing winds evenly etch the snow into a carpet of ridges that cover the entire hunting area. Local topography can alter this pattern slightly, but in general, the snow ridges run between NNW at Baker Lake to WNW at Cambridge Bay as is confirmed by wind charts for January in the Pilot of Arctic Canada[9] reproduced as Fig. 1.

The patterns are so consistent I was able to use them in travelling from Hudson Bay to Alaska by dog team[4] without using a compass. However, I learned my Inuit navigation skills in the Cambridge Bay area and consequently made a few navigational errors in my travels until I learned to check snow pattern directional reference against the Sun or rather an abstract conceptualization of north, south, east and west.

The snow pattern method is as accurate as the navigator's ability to discern his direction of travel against the pattern. I found I could make landfalls after travelling across 30 or 40 nautical miles of sea ice accurate to $\pm 10°$, that is to say within a 20-degree band. As I don't think it is possible to make a better course

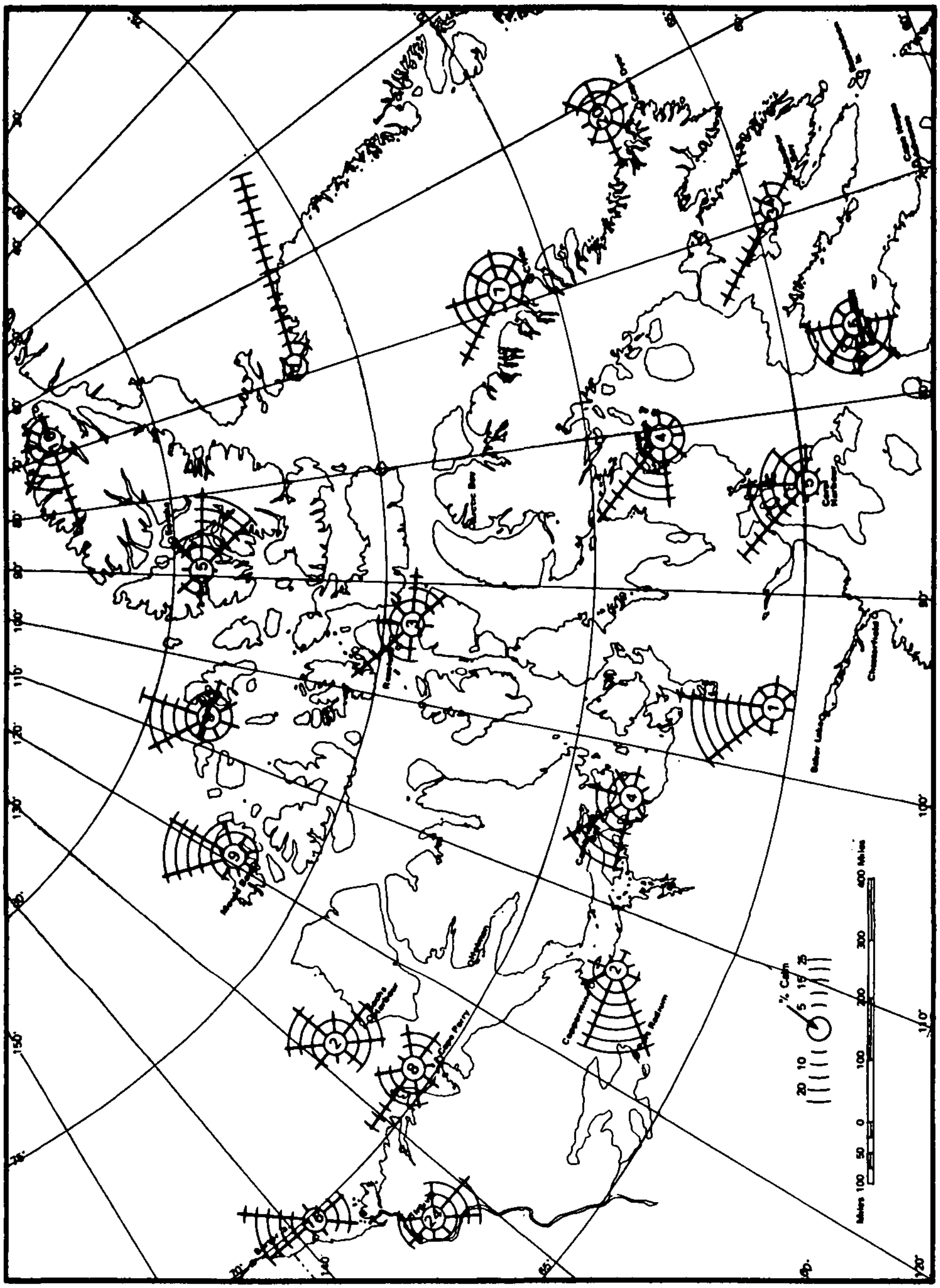

Fig. 1. Direction of frequencies of January winds

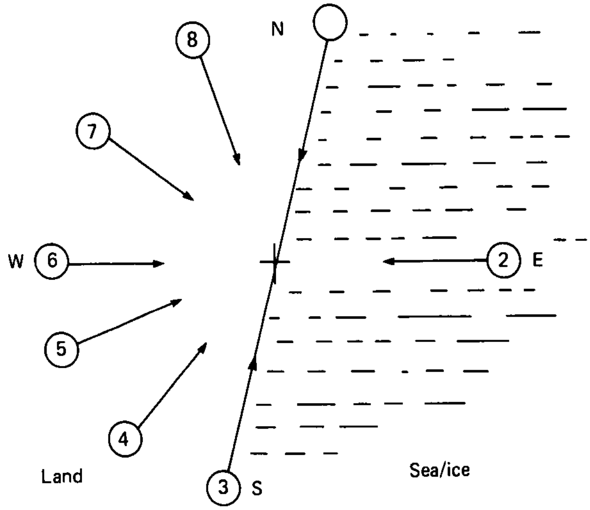

Fig. 2. (1) *Kanungnuk*, The wind that breaks the sea ice; (2) *Nigyuktok*, The wind that comes from the sea; (3) *Akinayaktok*, The wind that moves the ice; (4) *Piganiktok*, The wind that renders the ice dangerous; (5) *Piganalu Wanablu*, The wind that gives good weather; (6) *Waknak*, This wind also brings good weather; (7) *Kanaknakpasik*, The wind that comes before good weather; (8) *Wanak Kanaknak*, The wind that comes before bad weather

without intimate knowledge of a given area or reference to more accurate marks such as tracks, river courses, coast lines, etc., it is not necessary or practicable to describe the direction of the wind or snow patterns by terms that surpass approximately 20-degree divisions.

My Inuit father-in-law, Kako, is able to give names to the different principal winds that combine concepts of direction with meteorology. These are illustrated in Fig. 2 with their descriptive meaning.

The wind is the central and key parameter by which Kako judges direction. As he explains: 'One time I was snow blind so I had to find my way home by feeling the wind on my face. So the most important thing is the wind. When it's foggy and I can't see anything it's very hard to tell direction. But if I can get a bearing on the wind when it is clear I can then use the wind to judge direction when the fog descends. This would be in the summer when there are no snow ridges, or in a boat. However I use the Sun as a point of reference if the wind is shifting a lot.'

The wind compass has the advantage over the use of celestial bodies as it is always present in the snow and can continue to be used even in a blizzard or white-out. At such times shadows may be lost almost completely but the ridges can still be discerned by allowing one's foot to run along the ground whilst sitting on the sled. This method can be as accurate as visual reference because I found that it was necessary to think very carefully about direction at sunset and sunrise as a marked change in shadows at that time would cause a general change in the visual appearance of the carpet of snow ridges. Therefore under some circumstances the tactile method has distinct advantages over the visual method although I tended to use the latter perhaps because of my experience with underwater sand ripples.

4. CELESTIAL BODIES. The winds are the primary reference of direction but as this changes from place to place and as the snow ridges are not present in the summer the Inuit have a frame of reference that is almost abstract against which the movements of the celestial bodies are predictable. However, this is kept to what would seem to be a necessary minimum of north, south, east and west, defined in the language terms used for the different winds. Although it is true the Sun is at its highest in the south and at its lowest (above or below) the horizon in the north, the point of setting and rising is dependent on the season especially in latitudes above the Arctic Circle. The position of hills will often obscure the Sun's theoretical setting or rising below or above the theoretical horizon. Consequently although the motion of the Sun is known to arch east to west across the sky, rising to the south and descending (in summer) to the north; the variance of this phenomenon – apart from its principal motion – is no more an absolute frame of reference than the wind as Inuit deal only with real horizons and not theoretical ones.

The Moon can also be used as a point of reference as it arches across the sky, particularly in the winter when moonlight can provide sufficient illumination for travel when the Sun is of minimal use. A star or planet can also be a useful guide in a like manner and no doubt Inuit in the High Arctic make considerable use of these bodies during the long periods of no sunlight. However, in the Central Arctic I personally never used stars as a primary source of reference; they and the Moon were checked against the snow and the Sun and were used as secondary temporary points for guidance. But I would not be surprised if Polar Inuit have a fairly sophisticated knowledge of the movements of the planets and stars.

Thus the one phenomenon that provides the basic frame of reference is the Sun's general apparent motion described by names of winds. As to the real motion of the Sun and Earth, that is of no practical importance for the Inuit navigator nor for that matter most navigators.

5. TRACKING. As the use of the wind or snow compass is only good to about $\pm 10°$, other methods of reference are necessary when landmarks are not visible on open sea ice or in a blizzard or white-out. At these times a knowledge of tracking or following trails turns an imprecise art into a pinpoint science.

For the Polynesian navigator the target size of an island is increased by observation of the diurnal movements of sea birds, flotsam, clouds and patterns in ocean swells which effectively place a circle of recognition of some 35 miles around a coast line[7]. For the Inuit, tracks accomplish the same ends as they radiate from camps to hunting places and vice versa. Consequently so long as the traveller is going in approximately the correct direction he will eventually cross a trail that he can follow to his destination even in the worst of weather if necessary. However, to do this well the Inuit navigator must be able to read tracks to determine when and by whom they were made and therefore in what direction or to which hunting ground or camp they are likely to be going.

To determine the age of a track it is necessary to understand the properties of snow at different temperatures and to have a good knowledge of local

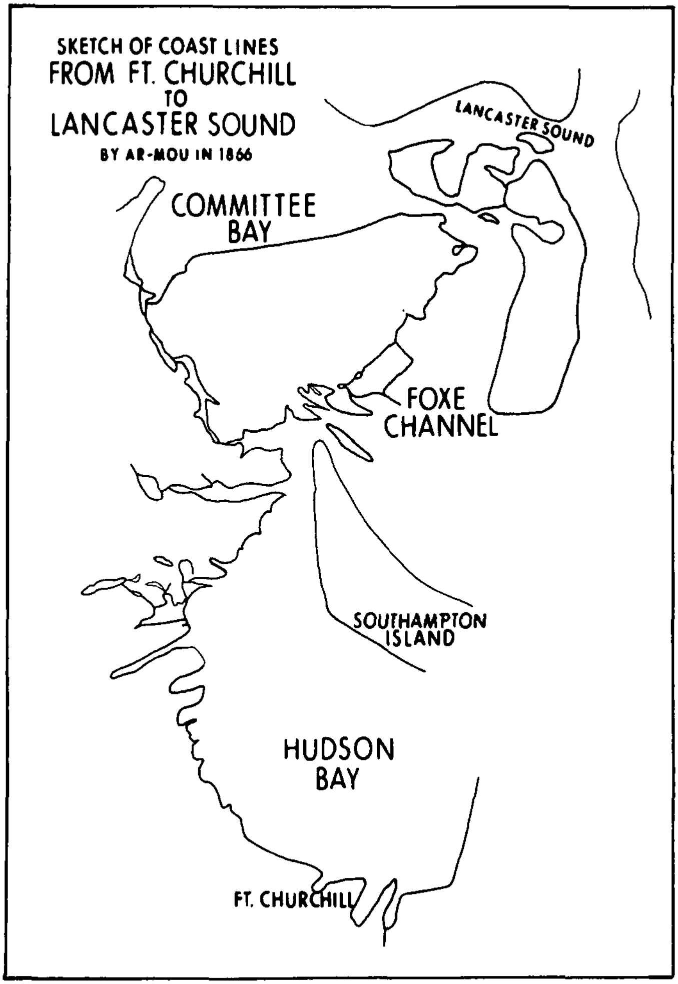

Fig. 3. Eskimo map of coasts from Churchill to Lancaster Sound. Source: Hall, *Narrative of the Second Arctic Expedition*, p. 225

meteorology, particularly an historical memory of recent storms, their direction, duration and intensity. For example, snow tracks made the same day that are both new and fresh, within a few hours, will be visible in all the snow ridges, drifts and patterns laid down in previous storms. Additionally the splashes of dislodged snow around the tracks will not have adhered to the adjacent snow by either the action of warmth of the sun or the extreme cold of the night.

Tracks that are new but not fresh will be similar but the splashes will have adhered to the surrounding snow. Depending on the time of day they can be determined to have been made the previous day or that morning.

Tracks older than a day will start to be altered by any drifting snow that will fill in the leading edge (relative to the direction of the wind at the time) and form ridges behind the trailing edge or protrusions in the tracks.

Tracks older than several days can be gauged by noting in which snow drifts they appear. For example a track made before a storm from the NW that blew two days ago will appear in all drifts except those made by that storm. Older tracks are analysed in the same way as snow drifts harden with age so that tracks that may be weeks or months old may only appear in the oldest hardest drifts known to be laid down in a particularly harsh storm that blew out of the NE two months ago and so forth. An exception to this are tracks made during a storm as these will compress the fresh snow being laid down. The loose snow around these compressions will then be eaten away by the wind leaving tracks that appear in relief as ridges above the snow. This, of course, dates the tracks as being made in a particular storm on a particular day.

Providing the hunter has a general knowledge of the activities of his colleagues, it is now possible to know where a trail is going by determining who it belongs to. This is quite simple as it will be known that a certain friend has a wide or narrow sled, with wide or narrow runners, that he has six, seven or nine dogs, that one of his dogs has very long feet, that his son was with him for his small tracks can be seen running beside the trail from time to time when he got cold, that the sled runners cut a deep impression as they had a heavy load of meat. In this manner through the use of logic associated with detective work, it is possible not only to identify a trail but also to have considerable knowledge about the condition and activities of the persons who made the tracks.

Other visual aids that help identify a distant target are animal droppings, steam rising from warm caribou in cold weather and likewise steam rising from open water as well as dark shadows on clouds made by open water and bare rock.

Using all these aids it is quite an easy matter for an expert Inuit navigator to find his way in the most appalling weather even when he cannot see his own lead dog providing that dog is good at following trails, which some animals do very well especially when pursuing game or going home. As tracking can bring an individual right to his front door in a blizzard it is a superior method to the very best dead reckoning which could never accomplish such accuracy although Inuit dead reckoning methods can be used in the first place to find the trail that leads to the front door. Watching Canadian armed forces personnel equipped with compasses and maps get lost in the Cambridge Bay area whilst on exercises was a source of considerable amusement to the local Inuit who had undoubtedly developed a navigation system better suited to their environment than classical western methods.

6. SPACE, TIME AND DISTANCE. Even if an individual can get from A to B by travelling in a straight line until he intersects a trail that leads to his destination this in itself is not a sufficient skill to allow him to get home without backtracking after the circuitous pursuit of game. Naturally when in doubt the safest thing to do is to backtrack but generally good Inuit navigators do not find this necessary as they can judge distance and direction in a two-dimensional mental model with considerable accuracy.

On one occasion when hunting for polar bear on the open sea ice between Victoria, Gateshead and King William Islands with Komoyak of Cambridge Bay, we left Gateshead Islands and travelled south and west for a hundred miles for five days. We remained out of sight of land for this period and made various side

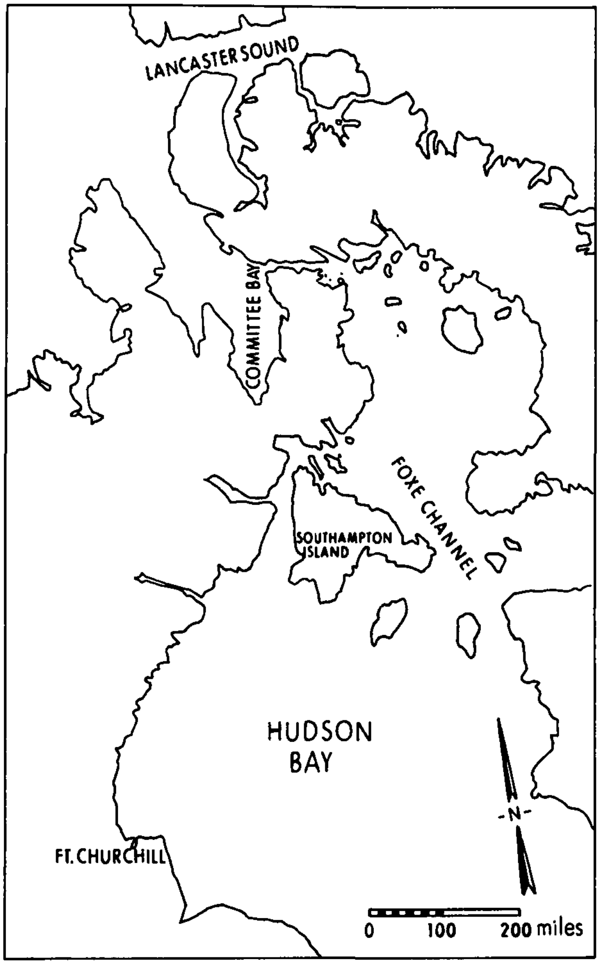

Fig. 4. Survey map of Hudson Bay and Baffin Island. Source: Eskimo maps from the Canadian Eastern Arctic. Spink and Moodie, (1972).

treks along pressure ridges in search of our quarry before achieving Komoyak's intended landfall on Admiralty Island from where we could make our best time home. This was my first long trip without navigation aids and I thought we would have made our landfall some thirty miles further south but in time I became as good a judge of direction and distance as my teachers.

The method used was essentially no different to that used in underwater navigation where distance covered is a matter of judgment and experience whilst orientation is continually checked by asking oneself, 'Where did I come from? Where I am going? In what direction is home?' Indeed Komoyak's main method of teaching me was to ask me these questions and correct my response. This was also the technique used in teaching me tracking but he never analysed my misjudgments to pinpoint a theoretical error as emphasis was always on a practical type of knowledge. He was of the opinion that I could only acquire this knowledge by learning from my own mistakes and my later success in these matters perhaps proves that he was right.

This judgment method of navigating in a two-dimensional plane does not use a quantified approach to space, time and distance in terms of degrees, hours and miles, but rather an orientation to north, south, east and west coupled with a knowledge of where one came from and where one is going. It follows that at any point in time, it may not be possible to say exactly where one is although the relative positions of important geographic features are known in terms of direction and distance. Direction in such cases may most easily be expressed as a bearing relative to the prevailing snow-wind pattern and distance can be expressed in terms of numbers of sleeps if it is a long way, or portion of a day, if it is not far. When expressing distance as a function of time it is important to be dealing with a specified speed just as astronomers find it convenient to talk in terms of light years where the speed being dealt with is the speed of light. Traditionally Inuit generally expressed distances in times made under the best travelling conditions, i.e. with a healthy dog team in the spring time on hard snow. From this standard it is simple enough to compute in a judgment kind of way that if I am told it takes four sleeps to get from A to B then as it is now winter and my dogs are skinny it will probably take me eight or ten sleeps and therefore I need to prepare my provisions accordingly. It can be seen from this type of example that the use of the standard of measuring both time and distance in terms of sleeps is a most practical parameter in gauging the logistical needs of a given trading or hunting expedition. It deals directly with the real needs of the problem without recourse to symbolic quantities whereas the western approach becomes quite complex with *X* miles at *Y* speed takes *Z* time for *P* calories at *Q* pounds for *R* number of men, etc.

7. MAPS. Inuit maps collected by Rasmussen[10] in the Central Arctic seem to fall into two distinctive groups: those which are linear and give travelling distances as a series of features or events in much the same way as driving instructions on a 'tulip diagram' which pays little or no attention to distance or two-dimensional spatial orientation and two dimensional renditions that do have a sense of spatial orientation. The former type of map is the easiest kind for an inexperienced navigator to use as he just has to follow the intructions from A to Z to get to his destination. However, the experienced navigator prefers the spatial map rather than diagram as it offers him the opportunity to change his course by longer or shorter routes as suits his purposes.

With regards to proportion, the spatial maps tend to be drawn on a large scale where the person has an intimate knowledge of the features and wishes to put in as much information as possible and on a smaller scale as he gets away from his home hunting grounds and no doubt approaches the edge of his piece of paper. However, distance is measured in time and if this parameter is introduced through inquiry or explanation on the part of the person drawing the map then the correct sense of scale can be restored.

Why one individual should express his world in a linear form whilst another does it in a two-dimensional manner may be due to the type of information he is trying to express, i.e. 'travelling directions' or 'map'. However, as suggested in the section on topography, individual talent in these matters is dependent possibly on psychological as opposed to anthropological factors which would seem to bless some people with certain orientation skills that not all persons seem to have. However, in looking over Inuit maps[11] I continue to be amazed at the areas covered, which can be as much as 500 000 square miles.

8. CONCLUSION. The problems that the Inuit hunter has to solve are extremely complex. The captain of a ship cannot separate questions of navigation from questions of seamanship for the problem of how to get from A to B is not only a matter of knowing one's position but also of the weather, sailing characteristics of the vessel, food and water resources, and even the morale of the crew. Likewise, an Inuk sustaining his family on the land in the traditional manner has to take similar factors into account when solving problems. His decisions must be right for errors would invariably cost lives, perhaps his own. A knowledge of seasonal game behaviour would determine the forward planning of the hunter to move his family to various camps and store food or equipment at particular places with a view to possibly using them again a year hence. The analysis of the logistical problems of life in the Arctic and the deductive detective work employed in the interpretation of tracks is characteristically scientific and empirical as opposed to folkloric.

A dichotomy would seem to exist however, between the typically western approach to solving problems and the Inuit method. Most westerners would consider a thorough theoretical foundation to be a prerequisite to problem solving, but the Inuit have no use for theoretical methodologies. Their emphasis is all on the practical which deals directly with the reality of problems that must be solved with minimal recourse to theoretical concepts. This results in ideas, concepts and language that for the Inuit has minimal use for terms, words or symbols that discretely parcel aspects of their reality into abstract or quantified expressions. On the other hand, western thought uses symbolic quantifiers to a maximum extent so that position is expressed in degrees and minutes of longitude and latitude with the vectors of direction, speed and drift computed in miles per hour and compass degrees. The advantage of this method is that information so codified is malleable or transmutable and can easily be communicated or transmitted. This symbolic quantifying of information today allows for the programming of computers to solve problems. However, I do not wish to suggest that Inuit solve complex problems without recourse to analysis and logic. I have never seen or experienced the use of some sixth sense to solve a problem of logistics, position or interpretation of tracks. These questions are solved by solid and substantial thought based on empirical knowledge acquired through experience. However, this process does differ considerably from that used by westerners. The Inuit, in a very practical and direct way, relate to their reality with a minimal use of symbolic quantifiers and abstract concepts. But this lack of abstraction does not of itself deny the possibility of logic, analysis and scientific thought without which the Inuit could not have survived.

REFERENCES

[1] Gladwin, Thomas (1964). Culture and logical process. In *Explorations in Cultural Anthropology*, ed. Ward H. Goodenough. Essays in honour of George Peter Mardock. New York: McGraw-Hill.

[2] Gladwin, Thomas (1970). *East is a Big Bird, Navigation and Logic on Pulawat Atoll.* Harvard University Press.

[3] Williamson, R. G. (1974). Eskimo underground: Socio-cultural change in the Canadian Central Arctic. Institutionen for Allman och Jamforande Etnografi vid Ippsala Universitet, Uppsala.

[4] Irwin, Colin (1974). Trekking the frozen Northwest Passage. *National Geographic* **145**, 3, 295–321.

[5] Bagrow, L. (1948). Eskimo maps. *Imago Mundi*, **5**, 92.

[6] Rasmussen, Knud (1930). Observations on the intellectual culture of the Caribou Eskimos. *Report of the Fifth Thule Expedition 1921–1924*. VII. 2. Copenhagen: Gyldendalske Boghande.

[7] Lewis, David (1972). *We the Navigators. The Ancient Art of Landfinding in the Pacific.* Canberra: National University Press.

[8] Berry, John W. (1966). Temne and Eskimo perceptual skills. *International Journal of Psychology*, **1**, 207.

[9] Canadian Hydrographic Service (1970). *Pilot of Arctic Canada*, col. 1. Marine Sciences Branch, Department of Energy, Mines and Resources, Ottawa.

[10] Rasmussen, Knud (1931). The Netsilik Eskimos, social life and spiritual culture. *Report of the Fifth Thule Expedition, 1921–1924*. VII. 1–2. Copenhagen: Gyldendalske Boghandel.

[11] Spink, J. and Moodie, D. W. (1972). *Eskimo Maps from the Canadian Eastern Arctic.* Monograph 5. Ed. Conrad Heidenreich. B. V. Gutsell, Department of Geography, York University, Toronto, Canada.