PRIMITIVE MAN AS SCIENTIST

LOWELL D. HOLMES

The Nobel Prize-winning physicist, P.W. Bridgman once defined science as "doing one's utmost with one's mind". If this is what makes one a scientist then we must agree that scientists are to be found in all cultures—even in those which anthropologists refer to as "primitive". Although the dictionary defines "primitive" as "simple, old fashioned, plain, pertaining to the beginning or origin" and although many people believe that the word denotescrudeness or childlikeness, anthropologists merely use "primitive" to refer to those indigenous populations of Africa, the South Sea islands, interior Asia, and North and South America which may be differentiated from modern industrialized peoples by the fact that they live in relatively small communities, have somewhat simpler economic and political institutions and are characteristically quite slow to accept new ideas and alter their time-tested ways of living.

Because these people have not attained the technological proficiency of Europeans or Americans it is often

Lowell D. Holmes is a Professor of Anthropology at Wichita State University and National Secretary of Lambda Alpha.
believed that there is something in their makeup which causes them to be dominated by their emotions and therefore not seek cause and effect relationships. If anything, the primitive's failing is that he thinks too much in terms of cause and effect. He is not incapable of logical thought, but he operates in terms of insufficient premises. He frequently believes that events which are associated are causally connected. Hopi Indians hold annual rain dances and carry about live rattlesnakes in the belief that there is a causal connection between their activities and the advent of rain. To the mind that does not systematically test and retest premises there is good reason for this belief. On many occasions the dances brought rains so heavy that the roads between the Hopi villages and Flagstaff, Winslow and Holbrook were turned into muddy bogs and visitors were stranded for days until the roads were fit for travel. The Snake dance phenomenon is however a case of being scientific without realizing it. While the snakes are believed to carry requests to the gods who govern the falling of rain, it is well known that Hopi Snake priests study the sun, clouds and sky for weeks before proclaiming that the gods are ready to receive their petitions. The Hopi priests are probably very good meteorologists without knowing it.

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"Weather bureau? What are the chances for a rain dance succeeding today?"

(Reproduced from True Magazine)

world this has been the practice and a common explanation for the reasons why the Western countries have dominated the world as colonial powers is that they had the gattling gun and the primitives didn’t. Actually many Americans and Europeans who take pride in their gattling gun superiority are themselves helpless with anything more mechanically complex than a hammer or a screw driver.

The story is told that a white explorer was telling an African how much superior he was to the black man. "For example," said the explorer, "we know how to make guns. You have to admit that that is quite an accomplishment."
The African then asked, "Do you know how to make a gun?" The explorer, somewhat irritated with this question, said, "Why of course not! Only certain people do. But I could certainly learn if somebody showed me how." The African then said quietly, "And so could I—if somebody showed me how!"

While primitive man is usually pictured holding a crudely fashioned stone-pointed spear, this does not mean that he is inherently incapable of developing a complex technology. Actually, there is a scientific attitude embodied in all primitive technology. Scientific behavior involves observing nature’s regularities and utilizing this knowledge in future performances. If we look at the problems the primitive people must overcome and the resources they have at hand, we find that great ingenuity is utilized, and there is a great awareness of natural principles. This can perhaps be seen best in the characteristics of native architecture.

Although the primitive architect almost always works in an economy of scarcity where materials and energy are limited, his creations are often more successful than those of Western designers, for he always works with nature and not against it. Advanced technology tends to make a people arrogant in their attitude toward nature but primitives see nature not as something to be conquered
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but as something with which they must achieve harmony. We have come to believe that our technical abilities have freed us from bowing to the demands of climate and therefore we far too often created beautiful futuristic structures without proper attention to functional qualities. Glass walled skyscrapers often leak in rainstorms and require special types of air conditioners and blinds to reduce excessive heat or glare. We build antebellum mansions in Maine and Cape Cod cottages in Arizona.

The genius of primitive architects in working with the physical environment can be seen by analyzing the structural features of the Eskimo igloo. The hemispherical shape of this dwelling offers the maximum amount of resistance and the minimum obstruction to arctic winds, while at the same time offering the largest amount of living space with the smallest structure. An oil lamp, centrally placed, can effectively heat every cubic foot of the interior. The house is insulated by a glaze of ice which develops on the inside of the snow block walls when they melt slightly from the heat of the lamp. This glaze serves as both insulation and radiant heat reflector.

The people who inhabit tropic areas encounter less trying climatic conditions but their construction methods show no less of an awareness of natural principles than has been observed among the Eskimos. The beehive shaped
thatched roofs of South Sea island dwellings shed the torrential downpours and provide a maximum of shade. In Melanesia and New Guinea floors are often raised on stilts to provide better exposure to the trade winds as well as protection from rats, snakes and crawling insects. In West Africa, Nigerian peoples have developed a double roofed dwelling. An inner roof of clay has projecting pegs to receive an outer layer of thatch. The thatch sheds water and protects the clay; the clay dome conserves heat for cold nights, and the air space between the two serves as insulation from the heat of the mid-day sun.

The Indians of the plains regions of North America had a whole set of problems of their own with which they had to deal. In a nomadic culture such as theirs, requiring constant pursuit of herds of buffalo (their chief source of food), houses had to be capable of being easily dismantled and moved from place to place. Furthermore they had to be made from suitable materials readily available on the prairies. The tipi, with its buffalo hide covering represented maximum use of their most abundant commodity, buffalo products. The tipi poles not only supported the hides but when lashed to the sides of a horse or dog made an excellent trailer (travois) for the transport of camp equipment.

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material wealth and tools testifies to his capacity for creative thought and technical know-how. One of the most outstanding inventions of pre-industrial peoples is the fire piston. Although this prototype of the modern cigarette lighter is based on a very simple physical principle its development required the utmost in intelligent observation and experiment. The principle involved is that if air is suddenly compressed, heat will be developed which can ignite tinder. The fire-piston, used throughout Southeast Asia even today, consists of a slender cylinder of bamboo, hardwood, or horn closed at the bottom end. A piston which is fitted snugly into the top of the cylinder has a small depression in which the tinder is placed. A sharp push on the piston compressed the air inside the cylinder and enough heat is produced to cause combustion. Besides being an accomplished architect, it would appear that primitive man has in the invention of this device shown himself to be no slouch in the realm of physics.

Turning to still other physical sciences—astronomy and meteorology—we are awed by the scientific achievements of Polynesian and Micronesian peoples in navigating the vast Pacific and maintaining contact between island groups separated by hundreds of miles of open sea. For these peoples' voyages of 2,000 miles and more in open canoes were made possible by their acquaintance with the
mysteries of the heavens. Pacific island mariners laid a course to a given destination by keeping the bow of the vessel pointed toward a star on the horizon that lay in the direction of their island goal. However, the poetic references to native navigators steering by the stars often gives an erroneous picture, for anyone who is acquainted at all with the movements of the stars will quickly realize that due to the earth's rotation, use of a single star as a sailing beacon should result in a boat sailing in circles. Instead of taking one star and following it, the native captains used a series of stars which rose one after the other. They could identify all the stars associated with their island destination and would steer by each in turn before it rose too high above the horizon. In one respect, the native method of laying a course was superior to that used by navigators today. Using stars as celestial beacons toward which to sail results in a course which is the shortest distance between two points. In other words, it gives a Great Circle course which we, using a compass, can accomplish only by altering our ship's heading at given intervals. The Pacific islander's observation was so thorough that they realized that stars rise four minutes earlier each night and in the course of a year, star time gains one day on sun time. In both Micronesia and Polynesia the navigators constructed
Polynesian navigation chart of tied sticks and shells
In this Måtæng instruction chart, A represents the Shell, B the Rilif, C the Kaelif, and D and E the Boats. The Rilif and Kaelif consisted of curved ribs, and the Boats were the points where the ribs met and were fastened together.
charts by tying together strips of bamboo and securing shells at various points to indicate the position of islands. Some of these charts served as actual sailing charts while others were used for training novice navigators with one of the greatest problems of Pacific voyaging—that of making a land-fall after a long voyage. Since outrigger canoes lie low on the water and since the line of coconut trees on atolls is difficult to see more than a few miles away, it was easy to miss an island completely. In order to prevent this, Micronesian navigators developed a method of observing the pattern of swells and counter swells found around an island. Their system of discovering their island destination was as follows:

The prevailing wind brings parallel swells to an island. As the swells approach (even out of sight of land) they begin to curve to the shape of the island obstructing their progress. The swells directly in front of the island start to form into smaller waves which build up and break over the reefs surrounding the island. On the leeward side of the island a counter swell develops and where the swell and counter swell meet there are areas of disturbed water which the islanders call "boots". These "boots" are of tremendous importance in finding the way to an island. If a boatload of voyagers should miss an island by a slight margin, they would at some point come upon this row of
"boots" and sail down them as if they were buoys leading them to their landfall.

The Pacific island peoples were no less meteorologists than they were astromers. One of the things which greatly impressed Captain Cook was the ability of islanders to predict the weather. They associated the various changes in the direction of winds with the appearance or position of various celestial bodies. Equally impressed was the explorer Andria y Valera who wrote in 1774:

"What took me most in two Indians (Polynesians) whom I carried from Otahiti (Tahiti) to Oria-zatea (Raia'tea) was that every evening or night they told me, or prognosticated, the weather we should experience on the following day, as to wind, calms, rainfall, sunshine, sea and other points, about which they never turned out to be wrong."

This ability to notice small features of nature on the basis of repeated observations to make predictions is certainly the essence of science. This same ability has even been observed among such rude peoples as the Australian aborigines who are considered by many at the very bottom of the technological heap. These Australians who wear no clothes and live in the simplest of brush lean-to's are capable of astonishing feats of observation. Anthropologists have testified that while traveling with these hunting peoples that it was not a bit unusual for a man to look at the ground and remark that a female kangaroo had passed across the trail going in the direction of the setting sun two or three days earlier. It
was obvious, they said, that the animal was a female because its tracks revealed that it hopped as though it were carrying young in its pouch. Its direction of movement could be told by analyzing the shape of the almost imperceptible tracks and the amount of dust or sand that had drifted over the prints told how long ago they had been made.

Having observed that primitive people are capable of some rather remarkable intellectual accomplishments it is reasonable to ask why such peoples have been so overshadowed technologically by those of Western cultures. Actually our technical superiority over such peoples is quite recent. When Northern Europeans were still chipping stone for their tools, West Africans were smelting iron. In the 12th century a Negro university in Timbucktu was equal or better than any in Europe at that early date. When the Spanish conquistadors occupied the Mayan territory of Central America in the 16th century they found that these people had developed an astronomical science which surpassed any in Europe at that time. Approximately 100 years prior to the climax of the Italian Renaissance, Inca artisans in Peru were producing priceless tapestries of gold and silver threads and fashioning unbelievable objects of sculpture from precious metals. One Conquistador's account describes a great golden garden on the grounds of the Inca emperor's
Palace where llama and their herdsmen, flowers and birds were wrought life-size out of gold. Over many of the artificial flowers tiny golden butterflies with filigree wings floated like little kites.

What happened to all this ability, ingenuity and technical know-how? Why have these primitive people not gone beyond a certain place in their development while the Western world has constantly progressed in its mechanical achievements? I believe the answer to many of these mysteries can be provided in a single word. That word is isolation. Thru some quirk of fate Europe has for the last two or three hundred years been a great mixing pot of both peoples and ideas. Armies of every nationality have marched back and forth across the continent, and trade routes have covered Europe like a great net bringing goods from all the remote parts of the earth to be seen and adopted by the white man. European people have not had the opportunity to be isolationists even if they wanted to.

Compare, for a moment, the situation in Europe with that in which the Australian aborigines were involved. After entering the continent of Australia about 10,000 years ago, they remained almost totally isolated from other peoples until the 17th century when they were discovered by Tasman. In other parts of the Pacific the great distances between island groups in Polynesia and Micronesia kept contact and consequently
exchange of ideas to a minimum. Although there has always been some inter-tribal contact and trade in Africa, this continent remained a remote and isolated area until its coast was explored by the Portuguese beginning in 1415. Even today movement from one part of Africa to another would be difficult or even impossible if it were not for air transportation.

Technological inventions do not grow out of thin air; every new idea rests on a base of accumulated knowledge. The invention of the television, for example, did not come about until man knew about electricity, metallurgy, glass manufacture, sound and light wave theory and hundreds of other scientific principles. Inventions breed inventions, and the larger the base of knowledge the more likely it is that innovations will appear.

The primitive's present day lack of technological development can also be understood in part by their general attitude to change. In most European cultures, the fact that father and grandfather "did it that way" is no reason at all for continuing a process if a better method has been found. Primitive people, however, who have worked out their technology painfully through the process of trial and error tend to find an acceptable method and stick to it for many generations. Change takes place slowly and painfully. The new and different seldom hold
fascination for them if it touches on their basic subsis-
tence methods. Life is difficult, and if they have found
effective methods of hunting, fishing or farming, they tend
to hold fast to them rather than take a chance on new un-
tried methods. While primitive man has shown himself to be
capable of the understanding advanced scientific principles
he, like Rip Van Winkle, has been out of touch for a long
time and has a lot of catching up to do.