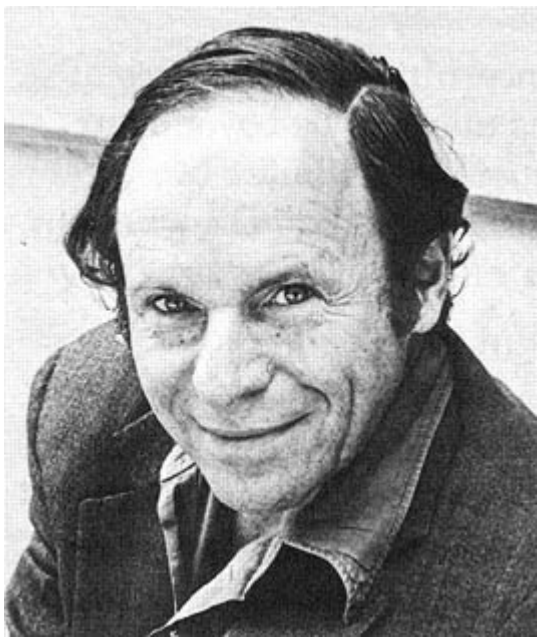
EP-125 WHY MAN EXPLORES



[15] Philip Morrison

Dr. Philip Morrison is Institute Professor and Professor of Physics at the Massachusetts Institute of Technology. He is a distinguished theoretical physicist and scholar-philosopher, whose ecumenical intellectual interests embrace the sweep of human and scientific history, from the origins of the universe to the origins and definition of life.

Professor Morrison has made many professional contributions to theoretical physics, most recently in astrophysics. He is a specialist in cosmology and the author of detailed theories aimed at explaining such celestial phenomena as supernovae, cosmic X-rays, and quasars.

He was one of the first scientists to predict [16] that knowledge concerning the existence of life on other planets may not be beyond our reach. He is a frequent contributor to literature on the discovery of life elsewhere in the universe.

Morrison was born in Somerville, New Jersey, in 1915. He received a bachelor of science degree from the Carnegie Institute of Technology in 1936, and a doctorate in theoretical physics from the University of California at Berkeley in 1940. For 2 years, he taught physics at San Francisco State College and the University of Illinois.

He was associated with the Manhattan Project from 1943 to 1946. In 1945, he rode in the back seat of an automobile, with the plutonium core of the first

atomic bomb, from Los Alamos to the New Mexico desert site of the bomb's first test.

He became Institute Professor at MIT in 1973, a rank the Institute reserves for its most outstanding scholars.

Morrison is the author of several books and of popular scientific articles in many magazines, including participation in a special series of "*Courses by Newspaper*," sponsored by the National Endowment for the Humanities and administered by the University of California at San Diego. He lectures extensively throughout the world.

[17] Mr. Morrison

The question, "Why man explores," was put very literally to us, and I found in myself an answer of the most old-fashioned kind, which I would hesitate to produce except that it is surely an essential piece of the story. I characterize my answer the following way: If you ask, "Why do human beings explore?" I would answer, as I think the Greeks would answer, "Because it is our nature." Now I am anxious not to make the mistake of thinking that the term "human nature" is explanatory, that it covers every activity of our species, the most diverse ethnographies, the artifacts that grace the museums, and the publications that crowd the newsstands of Los Angeles. "Human nature" is an impoverished description of all that diversity; but there is one feature for me it is perhaps the only feature which does define human nature , which parts our species (and a few vanished species of our family related to us) and has parted us from other creatures for surely tens of thousands of years , maybe for a few hundred thousand years. We are beings who construct for ourselves, each separately and singly, and as well together in our collectivities, [18] internal models of all that happens, of all we see, find, feel, guess, and conjecture about our experience in the world.

A clear context in which this was put for me is a beautiful ethnographic work by a woman called Edith Marshall Thomas, who lived for many seasons among a small group of the wandering peoples of the Kalahari whom we call Bushmen, people whose inventory of physical goods is very small indeed. They own nothing that sits still. They carry all that they have, all that they make, in a pouch of hide which they bear on their shoulders. They wander forever through life, stopping now here, now there, to sleep in a kind of nest, to try the fruit of this tree, to scratch up that waterhole, to meet for a ritual encounter with their wandering friends, and so on. These people, whose minds are full, though absent writing,

absent crowds-in fact they are few-live in small bands of extended families. Each band tends to stay within a region about like that of Los Angeles County, an area of a thousand square miles or two, in quite desert country. From their point of view they are by no means poor; they manage to make an excellent living, as the time-and-motion study people have [19] demonstrated to us, while working rather less hard than the Harvard anthropologists who watched them. Their skill is so great, their understanding and their wants are so well controlled in the environment, they are so beautifully adapted to their situation, that they need not work harder.

The one need they constantly discuss as they wander through the cool mornings, the cool evenings, and as they rest in the heat of the day, is to know exactly where they are. They discuss it always. They note every tree, they describe every rock. They recognize every feature of the ground. They ask how it has changed, or how far it has been constant? What story do you know about this place? They recall what grandfather once said about it. They conjecture, and they elaborate; their minds are filled; their speech elaborates exactly where they are. You see they have built an intensely detailed, brilliant, forever reinvigorated internal model of the shifting natural world in which they find their being. What that simplified case suggests I dare to extrapolate to all human beings everywhere. I see in it, I think, my own behavior; I hope it will be so for others. It is fair to say that our [20] language, our myth and ritual, our tools, our science, indeed our art, are all expressions translated in one way or another by the symbols of our communication or otherwise of certain features of this grand internal model. The presence of that internal model and its steady need for completion, the obviously adaptive need of its leading edges to have continuity, not to fade off into the nothing or the nowhere: this is the essential feature of human exploration, its root cause deep in our minds and in our cultures.

For me, exploration is filling in the blank margins of that inner model, that no human can escape making. Of course, we can rest content within the margins; then we live with a shadow of uncertainty at the edge of the map. Indeed a culture is free to do that, as many cultures have done it-I should say a little more about that later. I want to make quite plain that an internal model is not the only way in which complex accomplishments can be produced. I suspect that we are not the only creatures to show this quality, although we show it in quantitatively distinct form; but we need not fear comparison with other creatures. There is [21] another way to construct even complex architecture without ever having an internal model; were we built that way, we might yet in the course of sufficiently long time evolve all the complexities we have, even if we would not explore. It's conceivable, save only that the universe might not last that long. It is the speed, which is our way to change, that eventually marks us.

When I was a schoolboy, I learned (from a very bad book, I am now sure) that one of the distinctions of truly high civilizations is the ability to construct the true arch, that curved arch with the keystone that holds everything together-not the lintel beam which the Mayans had-but rather those things which Greeks and Romans and other proper countries had which made them high culture and restricted the others to the first chapter of the book. I soon grew away from this kind of provincialism, which was more common a hundred years ago when the man who wrote the book was trained.

I was most forcefully struck by the work recently reported by some French entomologists who have studied in South Africa the work of certain species of large [22] termites. Termites, of course, are social animals of considerable power and prowess. The structures these particular forms built are great things. They are 15 and 20 feet high on some occasions; they dot the landscape like so many termite skyscrapers. They are large and enduring architecture. Layer upon layer hidden within this termitary which rises out of the ground, are true arches, curved arches which support the next floor, and then more arches for the next, and so on, exactly like the crypts of a building somewhere in Italy. You have to ask yourself the question. Are termites then such thinkers and philosophers as we? That would be the most fallacious view; the reason is not that we can dismiss their accomplishments. As with the qualities of human beings, you cannot judge only by what they have done. You have to judge them in the sense of potential, because what they have not yet done, what is contained in the internal model, is the key.

The termites, of course, always do the same thing. They have done their thing now for twenty million years without changing very much. Mind you, they build the true arch-in the dark. Blind [23] animals building arches in the dark! There is no architect, there is no building-code inspector, there is no critic. All there is is a little hollow in the ground and a thousand termites milling around in the dark making pellets. There is a built in instruction: "Make pellets out of the discarded leaf matter, the fecal matter, which lies around on the floor." They form lots of pellets. Each one by himself makes pellets. If it should so happen that the density of pellet construction in some region is greater than that in the neighboring region-of course, it must happen that way sooner or later by the laws of chance-then the instruction is: "Leave your pellets which are few and go to where there are more fragrant pellets, a few inches over." Pretty soon they divide themselves into little groups of pellet builders, all making piles of pellets. In between they have stopped making them; those termites gather around the larger piles. Now the piles grow to columns; they stick them together. The next instruction says: If, as your pillar gets pretty high, you detect another pillar higher still, stop yours and go to work on one that has crossed a certain limit." (We reconstruct these rules by watching their behavior.)

[24] Pretty soon you have many half-finished stumps of pillars, but you have also a few rather high pillars sitting on the floor. The next instruction is: "If two high pillars chance to be reasonably close together, get on top and build each toward the other." That's exactly what they do. So, of course, in each layer the number, size, and placement of arches is different. No great architect has seen where they will be, no one has counted them, no one has decided on them; but the work overall is adaptive, improves the termitary, its strength and its ventilation. So they go on building arches; they will do so for tens of millions of years on end. There is no internal model within any termite, or even in the collectivity, for how those arches should be built. There is in the DNA, in the chromosomes, some kind of simple rules that tell them how to make arches in a broad general way-not the making of the arch itself but the giving of rules of the kind described. There is never an arch present until one appears by chance; whereas when we build arches, or anything else, the arch is in some sense present before it ever exists. That is what I mean by an internal model. Now the need to complete that internal model-to extend and fill in its fringes-is, I think, [25] what we mean by exploration.

I recognize that this deep need to complete the internal models is certainly expressed differently in different cultures. Sometimes it lies very quietly. The pioneer Alpinists who came in the early 19th century to Switzerland found villagers who had lived there all their lives and never had searched their peaks. But once the visitors raised the idea that it might be worthwhile, it turned out that among the villagers there were a few young men who had quietly ventured into the peaks even before the English gentlemen came to hire them. They became the first guides. Climbing wasn't celebrated, it didn't butter any parsnips or feed any goats, but it was needed somehow to complete a model. I believe those cultures which manage to show some public concern for filling in the edges of that model, for extending the margin of the map, are those in which we now live, and those in which we shall live for most of the time of human history. Democritus said, "I would rather find one cause than be emperor of Persia." That is a statement which a physicist can beautifully adhere to; were we to lose that feeling, it would indeed be a heavy loss.

[26] There is one problem which Viking, the prototype of what I am describing, does not solve, that is, access for a wider number of persons to this scheme of filling in the edge of the incomplete internal map. We have founded such great social structures to pyramid our exploration upon, that those at the base often do not get to see the stars shine above the apex. This problem, a gathering like this, like the television screen, will step by step come to solve. Finally, for me, human beings explore because in the long run, time after time, when we wish to adapt to the world as our inner nature has evolved, both by genetics and by culture, we can do nothing else.

[27] Mr. Cousins:

Phil Morrison, in your reference to the Kalahari I found echoes of Lawrence van der Post's book about the same people. You refer to them as people who really want to know where they are. We're told by A. L. Rouse, the English historian, that the one thing that all great events in history have in common is that the people who are caught up in those events never really know what is happening to them. And I just wonder, James Michener, whether people today have a sense of what is happening to them or what will happen to them. Do they know that their lives will never be the same after that robot lands on Mars? Isn't it the job of the writer to take this vast incomprehensibility and to convert it into the comprehensible? You write about the human situation. We met in India once; I don't know whether you remember it or not. We also met in Madison Square Garden once when the Knicks were playing. We met on a tennis court once. You were in Iran last week; you were in the South Pacific; now you're going off to Maryland, where the oysters will become your world. And all of us here tonight, Jim Michener, look to you as someone [28] who wanders not just through space but time, who understands history and human experience, and who can tell us whether Viking can be made comprehensible to human beings.

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