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Man's Role in the Galaxy

By: R. N. Bracewell

Years ago when authors needed a habitat for extraterrestrial aliens they could always call on Venus or Mars and in even earlier times the moon was a favorite base. H. G. Wells, Andre' Maurois, Jules Verne and Baron von Munchausen all contemplated inhabitants of the moon but now that the moon has in reality been visited and many of the planets have been photographed at close quarters it is a little embarrassing these days to pretend that there are people there. Consequently

more recent fiction, *Star Trek* and *Star Wars* for example, have drawn on planets outside the solar system as the stage for interaction between our spacemen and alien societies.

"The discovery of the first non-solar planet would be a milestone in astronomy."

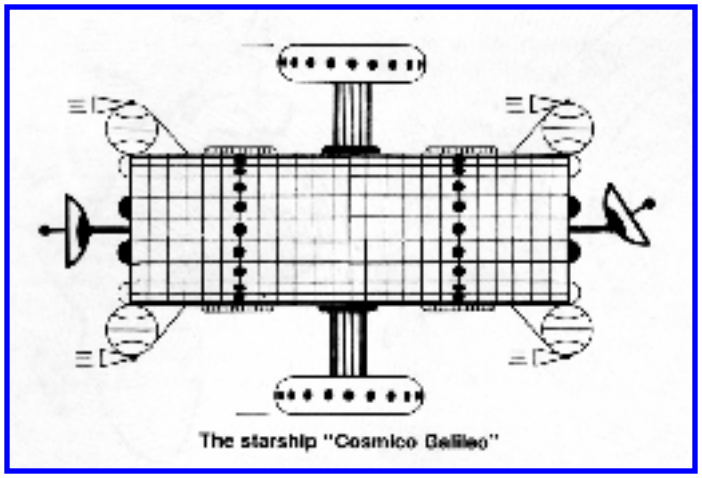
So graphic are some of these stories that we tend to forget that there is no scientific evidence for the existence of any planets other than the nine known to belong to our solar system. It may be plausible to assume that our solar system is just average and merely one of innumerable others rather like it, but in fact we do not know. The discovery of the first non-solar planet would be a milestone in astronomy and would undoubtedly engender great interest in the particular star found to have the planet. It would certainly make a difference to our outlook on the idea of searching for intelligent life by microwave radio receiving antennas. Instead of having to search the whole sky and share observing time over many stars we could focus on the candidate star. A strong incentive would come into existence for the construction of an adequate microwave listening system; and a variety of other means could be employed to find out more about the candidate star.

I have in mind telescopes specially designed for much higher angular resolution than is customary for current astrophysical research. One approach would be to improve astrometry, the classical technique by which the dark companion of Sirius was detected. The idea is to accumulate photographs of a star, together with its surround of background stars, over a period of months or years. If the star is a double star, then the two will circle about their mutual center of gravity. But if one of the pair is invisible, then the visible one will exhibit sinuous departures from its regular position as measured with respect to the frame of reference determined by the background stars. Of course, if the invisible companion is only a planet, then the amount by which the star wobbles is rather small and new instrumental developments will be called for. Another approach would be to work in the infrared where the planet's own heat radiation would be sought instead of just the reflected light. This approach would require a space mission in order to reduce the heat radiation from the earth's own atmosphere and from the interplanetary dust that pollutes the earth's orbit.

Even if other planets were found in the galaxy the existence there of life

comparable to human life would still be a moot question. It certainly would not follow hat because there are other planets there will be other beings with the understanding of the control over nature that man possesses. Indeed we may go further and say that life on earth, life of any kind, is the only life for which we have evidence. As far as we know today there may be no other life in the whole of the galaxy. The proposition that earthly life is the only life can never be proved true (in view of the vastness of the galaxy and the impossibility of inspecting all the sites). However, the proposition is subject to disproof, it would be disproved at the moment of discovery of life elsewhere. It is a general characteristic of good scientific theories that they are vulnerable, or subject to experimental disproof; theories that cannot be tested or can be tested only with extreme difficulty, are of little use to current progress in science. Now, it may take some effort to discover other life, but instead of sitting idly speculating and expressing opinions pro and contra we should be demanding action to look for life. The sort of action I have in mind is the construction of special instruments to look for planets as described above or searching for radio signals that may be arriving from extraterrestrial civilizations or certain other astronomical observations that might turn out to be related to the occurrence of living communities. In addition, it is practically certain that action-oriented thinking would produce new initiatives that have not been thought of yet. I strongly favor action in this field.

Meanwhile, is there anything we can say that might have a bearing on the possible uniqueness of life as we know it on earth? It is often argued that our sun is an average star, that it is situated in an inconspicuous place neither in the middle of nor on the edge of the galaxy, that the earth is not the center of the universe as Ptolemy supposed and that the Mediterranean is not the center of the world as the Romans evidently thought. In fact it is pointed out that whenever man has assumed that he occupies a privileged position he has been demoted to a humbler position as knowledge has expanded. Therefore, it is said, it would be wrong to assume that we are unique in being the only life in the galaxy. As Gus Arriola's comic strip character Porfirio put it, "Panchito! It'd be gross conceit to imagine that in all those awesome endless galaxies we are the only worms!"



The starship "Cosmico Galileo"

Whether it would be conceit or not, it would be an assumption. The danger in reasoning from such a position is evident when we apply the averageness argument to intelligent life on the earth. Would it be a gross conceit to suppose that in all the hundreds of thousands of living animal species populating the planet earth that we are the most intelligent species? Apparently not, seeing that we really are a unique species on earth. Why then should we not be unique in the galaxy?

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Not only are we unique on earth but we are unique in the solar system. Now here is an interesting line of thought. Some many years ago there were no intelligent humans on the North American continent but there were intelligent humans in Africa. It seems that apes already endowed with special abilities as regards hand, eye and brain descended from the trees and spread over the African savannah, growing in intelligence as they engaged in group hunting. They developed tools and weapons and came ultimately to derive more advantage from language and transmitted instruction than from continued bodily evolution.

Why shouldn't an intelligent bear have emerged from the North American forest onto the prairie and developed along similar lines? Perhaps given time, this might have occurred. It could never happen now because even minor threats from predators are handled very sternly by human settlers; witness the virtual disappearance of the wolf and grizzly bear. But in the days before man reached North America why should not an intelligent rival to man have developed from some bearlike or raccoonlike ancestor? There have been many cases of convergent

evolution on separate continents; examples would be the marsupial cats and the Tasmanian tiger which in Australia evolved to fill niches occupied by wild cats and dogs in Asia. Very similar creatures developed from quite dissimilar ancestors.

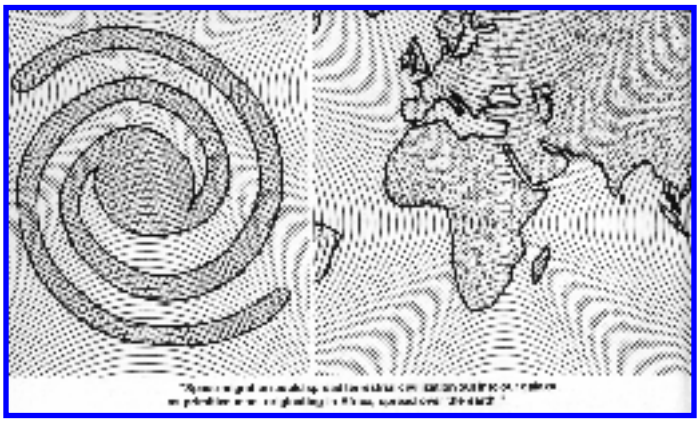
The reason that no intelligent species arose on the American prairies or the Siberian steppes or the South American pampas is a simple one. In the time needed for such evolution to take place, tens to hundreds of millions of years, the early models of primitive man originating in Africa were able to walk all over the earth, except for Antarctica, and preempt further natural evolution of independent intelligent species elsewhere.

From Africa to America may be a long walk and the going was undoubtedly rough but I should think that 10,000 years would suffice. Under the influence of population pressure gradient family groups would migrate outward sometimes imperceptibly, sometimes on longer marches and an average speed of one mile per year does not seem unreasonable. Thus, although no conscious intention existed to cover long distances, nevertheless, that is what happened. The persons arriving at the ultimate destinations were not the same persons that set out and they never returned to their original homeland. In fact they completely lost memory of their origins. We need only recall that when the great European voyages of discovery began in the fifteenth century the scattered races of man began to gain mutual awareness of their existence over the whole of the earth for the first time.

We are accustomed to speak of the earth as inhabited by humans but of course most of it is inhabited courtesy of remarkable developments in Africa which, at one time, was the only habitat of man. We regard Antarctica as inhabited by man because the numerous permanent expeditions on that icy continent maintain a steady population in the hundreds. But it is hard to think that intelligent life might ever have evolved there independently. Now before many decades pass there will be expeditions on the moon and Mars and there will be interplanetary space colonies and we will be accustomed to saying that the solar system is inhabited, and indeed it will be, but not because life originated or could have originated there, given time, but because life got there by migration (just as it has migrated all over the earth) long before evolution received a chance to try a new and independent tack.

I am leading up to my interesting idea. After we have explored the solar system, or even before that exploration is completed, it will become technically feasible to

send probes to nearby stars and in time to send expeditions. I am not thinking necessarily of round-trip expeditions where those setting out from home also return home but of something more akin to migration. Underthese conditions speed is not of the essence and thus many of the scientific objections to space travel that have been voiced by prominent physicists do not apply. It is not necessary to travel at speeds approaching the speed of light if you are not planning to come back; consequently great feats of rocketry are not required.



It is not clear to me what force will impel the migrants to travel. We can hardly draw a parallel with our hunting and gathering ancestors whose movements may have been controlled largely by food supply. But conceivably forces of political and religious persecution, which have caused substantial migration in the past, could become factors. Population pressure is sometimes mentioned. In any case, when the possibility comes to exist, will not some group at some time seize it?

In time, space migration could spread terrestrial civilization out into our galaxy. Now the key question here is, how long will this take by comparison with the characteristic time for independent evolution?

The factual piece of information we have about evolution is that it took about 5 billion years for man to appear on earth following the formation of the earth. If conditions had been more favorable in some way it might have taken less time, perhaps one billion years. Certainly if conditions had been less favorable it could have taken much longer as we see from the examples of Venus, Mars and the moon.

If man can migrate into neighboring galactic space in noticeably less than a billion years, then he will undercut independent evolution just as he has already done in

the non-African continents, and the solar system. Whatever stage life may have reached in the favorable habitats that our spacefaring descendants discover, continued natural evolution there will be hampered by man's arrival.

If, on the other hand, a billion years is to elapse before we significantly penetrate the galaxy, then we must entertain the likelihood that a certain fraction of the (as yet unknown number of) suitable planets may have intelligent life. So let us quickly do the calculation. Just as we do not know whether the migrants from Africa to America averaged one mile per year, or ten times more or ten times less, so we also do not know with what velocity we might migrate into space. However, to gain a feeling for the numerical magnitudes involved let us adopt one percent of the speed of light as an average speed, that is 3000 kilometers per second. This speed, while high, is rather modest by fictional space travel standards. For example, at this rate it would take 450 years merely to reach the nearest stars (in the Alpha Centauri system). Now the galaxy is immense and it might be considered a significant penetration of the galaxy if we were to reach say the closest thousand stars. But as a galactic yardstick I am going to adopt 30,000 light years, which is the distance from here to the center of the galaxy.

At one percent of the speed of light that distance would take 3,000,000 years. Thus the calculation comes out resoundingly in favor of migration as a means of civilizing the galaxy rather than independent evolution. In other words, confronted with the problem of endowing the galaxy with intelligent life, a master planner's best strategy would be to do a good job in one place and let the intelligent life spread out from there.

Are there weak points in this reasoning? Well, the average speed of space travel, though modest, is necessarily conjectural. Still, even if the assumed speed is reduced ten or one hundred times the conclusion is unchanged. On the other hand, who knows what higher speeds might not be achievable by our descendants in the course of time. We are discussing events that will be spread over the next million years or so of the history of the human race.

Another feature to consider is that there are many other stars that have been around as long as or longer than our sun and since intelligent life arose here we cannot absolutely exclude current intelligent life elsewhere. There may very well be some and we should take the possibility into account even though it can reasonably be

pointed out that America was around as long as Africa and Mars was around as long as the earth. Furthermore, it remains to be shown that those other stars have planets. Even so, other intelligent life cannot be ruled out merely by reasoning. If such intelligencces exist, then my idea applies to them too. They also may become centers of expanding spheres of migration and for all we know may already have begun to expand. There has been plenty of opportunity.

"How you and I, trifling subsets of the atoms of the universe, can be conscious of the whole is a mystery."

The universe dates back about 15 billion years to the Big Bang. Star formation began almost immediately and generations of stars have been born and have lived out their lives since then. The first generation of stars is not likely to have provided life niches, certainly no rocky planets with oceans, because in the beginning there was only hydrogen and some helium. Oxygen, which is needed for water, did not exist at that time but was manufactured in the interiors of those first stars. It is interesting to contemplate the human body, the vehicle of the intelligent life that we are discussing, and to note that most of it is water—hydrogen and oxygen. *Numerically*, the majority of the atoms in our bodies are the selfsame hydrogen atoms that took part in the Big Bang and have come down to our times unchanged since then. The atoms constituting the majority of the *mass* of our bodies are oxygen atoms whose history is quite different. They originated in nuclear reactions inside stars at immense pressures and temperatures, were later expelled explosively as the star burned out, and became a trace constituent of the interstellar matter from which second generation stars condensed. The same story holds for the carbon atoms whose unique and rich chemistry is the basis of all known life. *Thus, in ourselves, we are profoundly cosmical creatures who are now discussing the conscious redistribution of ourselves back into galactic space*.

By cosmological standards, the million years or so that would suffice to penetrate the galaxy by space travel is a mere instant. An outside observer who had inspected our galaxy thousands of times at regular intervals since its birth would find intelligent life all over the galaxy on one of his inspections whereas there had been only isolated pockets on his previous inspection. It is hard to believe that intelligent life has already flashed through our galaxy for no signs of it have been detected. Therefore, I am inclined to think that favorable conditions for development of

intelligent life are not abundant, suitable planets are not common, and that man may indeed be unique or quasi-unique. The only way to find out is to do something, such as searching for nonsolar planets; speculation will not tell us.

Still, the prospect of man's uniqueness certainly has an impact on man's view of himself. Instead of seeing ourselves as a rather ordinary byproduct of stellar evolution, whose accidental demise would have very little impact on the galaxy as a whole, we are presented with a broader vision of a remarkable destiny to transmit consciousness through the galaxy. The fragility of such a cosmic plan, if I may so describe it, is extreme; yet despite many setbacks life on earth did rise to the point where inanimate atoms, mere products of a lifeless universe, bundled together and staring up into the sky, could begin to ask questions about and even dimly to understand the universe. How you and I, trifling subsets of the atoms of the universe, can be conscious of the whole is a mystery. Although we are indeed mere byproducts of natural universal laws governing stars, galaxies and the whole universe, we are already beginning to influence the course of natural events on earth. It may be man's noble role, as I am suggesting here, to spread this new phenomenon of consciousness through the galaxy.

Bracewell

Ronald N. Bracewell has served nearly a quarter century on the faculty of Stanford University where is now the Lewis M. Terman Professor and Fellow in Electrical Engineering and Director of the Radio Astronomy Observatory. Born in Australia in 1921, he received his bacheor's degree from Sydney University in 1941 and his doctor's degree from Cambridge University, England, in 1950. Coming to the United States in 1954 he joined Stanford the following year.

His important contributions to the theory of radio telescope antennas have resulted in numerous scientific articles. He has written books: "Radio Astronomy" with J. L. Pawsey (Oxford, 1955), "The Fourier Transform and Its Applications" (McGraw-Hill, 1965) and "The Galactic Club: Intelligent Life in Outer Space" (Freeman, 1974). Bracewell has been a leader in discussions of extraterrestrial intelligence and methods of its detection, originating the concept of using robot probes for the exploration of the interstellar neighborhood. His broad interests include the study and cataloging of the trees and rare plants of the Stanford area. Bracewell is a member of the Editorial Board of **COSMIC SEARCH**.

"The greatest discoveries are yet to come." **John Archibald Wheeler** in the *American Scientist*.

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Designed by Jerry Ehman.
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