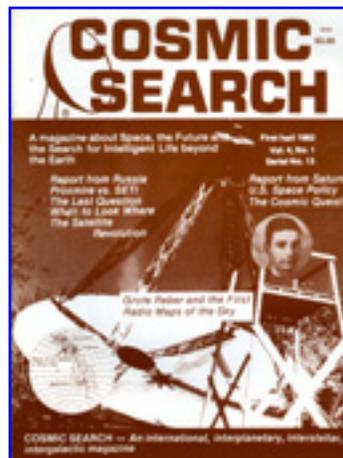




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The Last Question

By: Michael A.G. Michaud

I

What will happen if we detect another civilization among the stars?

Many scientists who write about communication with extraterrestrial intelligence foresee a high-minded exchange of information, with an emphasis on science. Some, like Carl Sagan, argue that we will gain access to an "Encyclopedia Galactica". There have been suggestions that we will be the recipients of a one-way transmission of wisdom from superior civilizations.



Michael Michaud

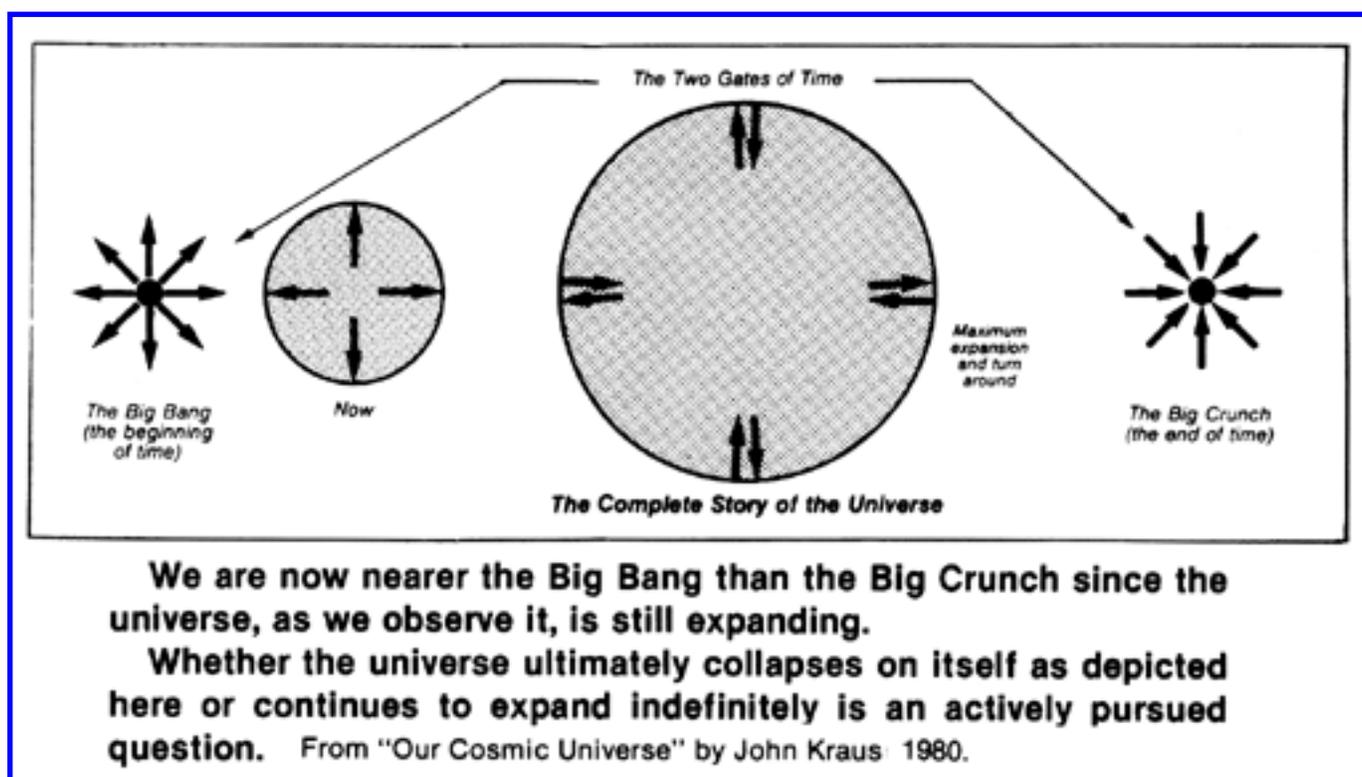
This is heady stuff. It is exciting to imagine that our radio technology could pull the plug on some ocean of galactic knowledge, which would drain into a waiting human consciousness. But this scenario, while attractive, may be a case of predicting what we would like to happen, rather than a likely reflection of the first concerns of one civilization discovering another.¹ (1. See, for example, Michael A.G. Michaud, "Interstellar Negotiation", *Foreign Service Journal*, Volume 49, (December, 1972), 10-14, 29-30. A slightly revised version titled "Negotiating with Other Worlds" appeared in *The Futurist*, Volume 7 (April, 1973), 71-77.)

Even if things work out this way, what will keep the cosmic dialogue going after the initial exchange of signals and basic data? There may be a driving force even more profound than a hunger for knowledge. In exchanging scientific information, communicating civilizations also will be exchanging perceptions of the position of intelligent life in the universe. To judge by our own experience, they might reach a common, depressing conclusion: no matter how wise they are, these highly evolved forms all are doomed to eventual extinction when the universe ends in disorder. Their dialogue may revolve increasingly around one question: how can intelligent beings deal with this apparent fact, physically or philosophically?

II

According to our present understanding, intelligence can not aspire to eternal existence because the universe eventually will die, from a process that breaks down its structured energy and increases its disorder. Scientists measure this process as entropy.

We think there are two possible endings for the cosmos. In an open, expanding universe, structured energy will be dissipated into the general environment, eventually leaving a scattering of black holes, dead stars, and other bits of matter surrounded by a medium cooling slowly toward absolute zero. In a closed universe, the expansion will stop and reverse to an infall, which will crunch everything together in a final singularity.



Our own history suggests that civilizations thrive on optimism and hope; this may be true of extraterrestrial civilizations as well. Yet those civilizations which study the nature of the universe will discover an iron law: that entropy steadily increases. That knowledge, as it seeps into the general consciousness, could be demoralizing, sapping the morale of the most advanced civilizations.

This is a matter of perspective, of course. The time needed for complete entropy — or universal thermodynamic equilibrium — would be extremely long by current human standards: tens to hundreds of billions of years in a closed universe, and

much longer in an open one. But the philosophical question would remain: have life, intelligence, and civilization evolved only to become aware that they face eventual collective destruction? If so, what is the point of going on?

The physicist and mathematician Freeman Dyson has suggested an ingenious way to deal with the implications of growing entropy in an open universe.² (2. Freeman J. Dyson, "Thinking Small in Space", paper presented at the annual meeting of the American Association for the Advancement of Science, Washington, D.C., February 15, 1978.) Since available energy will be gradually declining, Dyson proposes that intelligent beings (perhaps intelligent machines) replace themselves with successive generations which consume only half as much energy and think only half as fast. According to Dyson, this would allow intelligence to process information forever. However, even Dyson organisms would not survive the infall of a closed universe. And their scope for action in an open one would be narrowed steadily as usable energies declined.

III

Another approach is to use technology, the machines life creates, to challenge the entropic process. Life itself is a kind of anti-entropy, maintaining greater thermodynamic efficiency within its boundaries than exists outside them in the general environment. In an earlier issue of **COSMIC SEARCH**, Jerome Rothstein described life as a well-informed heat engine, and suggested that thermodynamic evolution will lead from systems of higher entropy to systems of lower entropy.³ (3. Jerome Rothstein, "Generalized Life", **COSMIC SEARCH**, Volume 1 (March, 1979), 35-38, 44-46.) Intelligent beings also can expand the volume of improved thermodynamic efficiency through their technologies, beginning with such simple things as clothing and buildings.

We might suggest that technological civilizations could deliberately challenge their apparent fate by expanding the volumes in which they reduce or control entropy. In the long term, an expanding civilization might aspire to the ultimate command of mind over matter — an intelligently controlled universe. But there are at least two obstacles to any civilization achieving this.

There appear to be physical limits to how far any one civilization can extend its control over matter. Gale and Edwards studied this question and concluded that the "mass horizon" at which half the matter could be prevented from expanding might

be 1.6 giga-light years away.⁴ (4. William A. Gale and Gregg Edwards, "Models of Long-range Growth", in William A. Gale, Editor, *Life in The Universe: The Ultimate Limits to Growth*, Boulder, Colorado, Westview Press, 1979, 71-106. (1 giga-light-year= 1 billion light-years).) This is an enormous distance, but it does not encompass all the universe.

An expanding civilization might encounter another civilization possibly engaged in the same activity. Inter-species communication could head off an unfortunate collision between these expanding volumes of reduced entropy. But it also might be used for something greater: cooperation, to jointly expand the volume directed by intelligence.

But even this is not enough. If our understanding of physical laws is correct, even cooperating civilizations will encounter a more fundamental problem. Reducing entropy within a given volume increases entropy in the environment around it. Creating more order within the zone of intelligent control creates more disorder outside it. This means that even cooperating civilizations can never aspire to control the entire universe, and turn it into an intelligently controlled, thermodynamically efficient heat engine.

IV

Here we may have identified the ultimate dilemma facing technological civilizations. How do they escape the implications of eventual total universal entropy? A civilization which concludes that the task is impossible may decide that life is pointless, and awareness a cruel joke.

One of the most important functions of the intellectual leadership in an advanced civilization may be to counter this conclusion, to maintain optimism that somewhere, somehow a solution can be found. But this is a terrible burden, one that may not be sustainable over the millennia. What is needed is an outside stimulus, and new perspectives on the problem. Communication with other civilizations could provide the hope, if not the solution. Together, communicating civilizations could keep up each other's spirits, while searching for the answer to this, the Last Question.

From our limited vantage point, we can only guess what that answer may be. Perhaps we — alone or in contact with other civilizations — will discover new

physical laws that open up new routes to a solution. Perhaps we will find that the structure of space-time we call the universe exists within a larger environment, which could absorb the increased disorder caused by our efforts to control our own cosmos.

If not, technological civilizations might seek instead to isolate their expanded volumes of order from the continuing process of universal entropy, so that they will not share the fate of the rest of the universe. In this case, they would strive to create a bounded system which would not lose its energy to its environment, would not be drawn into a supermassive black hole or suffer heat death in an open universe, or would somehow escape the infall or recompression in a closed universe. In their final, most dramatic effort, intelligent beings might try to transfer this cocoon of thought out of our own cycle of fate to another place, such as a parallel universe, or another time in our own.

We do not know enough to be able to answer the Last Question. But other civilizations may be asking it as well, in exotic languages and alien modes of thought. By searching for those other minds, we keep alive the hope of a new stimulus to our own thinking. It may be a congress of intelligence that will sustain optimism over the millennia, and someday reveal an answer.

It is exciting to imagine that our radio technology could pull the plug on some ocean of galactic knowledge which would drain into a waiting human consciousness.

It may be a congress of intelligence that will sustain optimism over the millennia and some day reveal an answer to The Last Question.

References are merged into article text.





Michael Michaud

Michael Michaud is a professional diplomat and a writer with 62 published articles, book reviews, and stories to his credit. During the years 1976-78, he represented the Department of State in U.S. Government studies of national space policy, and served on the U.S. delegation to the U.S.-Soviet Anti-satellite talks. Since 1972, he has written frequently on the question of extraterrestrial intelligence and on the future of spaceflight, with 36 published articles and papers on those subjects. He has spoken at a number of meetings and conferences, and recently presented a paper to the Tenth Annual CETI Review Session at the International

Astronautical Federation Congress in Rome, Italy. He was the author of "Extraterrestrial Politics" in the Summer 1979 issue of **COSMIC SEARCH**. Mr. Michaud presently is U.S. Consul-General in Belfast, Northern Ireland. The views expressed here are the author's.

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