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ETI in the Classroom

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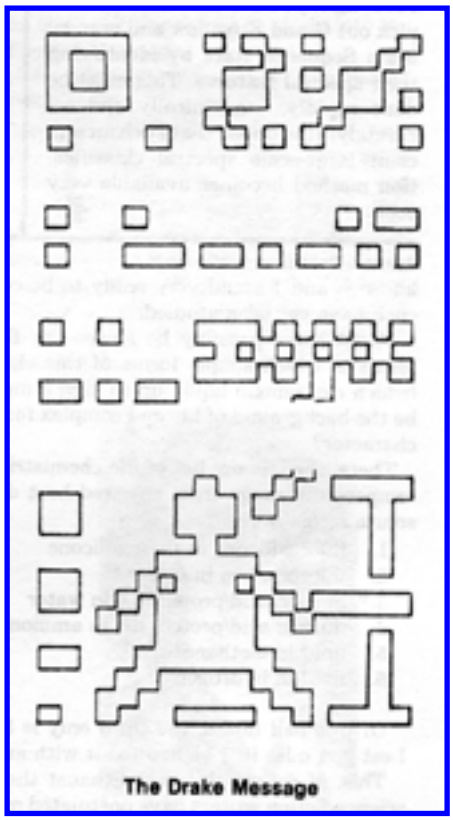
For some years science fiction has served as a lure to attract the college student seeking to expand upon a traditional experience in literature or basic communications. Such courses seem popular and students evaluate them as meaningful experiences, but as a teaching scientist I avoid using fiction for two reasons: (1) much time is spent in dispelling gimmickry and (2) my experience with non-fictional science leads me to conclude scientists are far more imaginative and creative than non-scientist writers of fantasy and fiction.

The coming of age of exobiology with the acceptance of a serious search for evidence of ExtraTerrestrial Intelligence (ETI) meant that I had a real subject with which to hook the imagination of curious, motivated students. Although contact with ETI is not a *fait accompli*, the history of science abounds with protracted searches for predicted phenomena. Stellar parallax, a direct consequence of the Copernicus heliocentric model of the solar system, eluded observers from the latter part of the 16th century until 1838, yet many valuable and meaningful discoveries were made as a result of the search. The neutrino, postulated in 1933 eluded detection until 1956. Isolated quarks may never be found. The grand achievements of science come only with the search.

My awakening to the possibility of appealing to the natural urge on the part of students to explore beyond the bounds of their provincial existence came with my first reading of Shklovski and Sagan's "Intelligent Life in the Universe." In this work I was introduced to the almost trivial exercise devised by Frank Drake to illustrate how radio transmission could allow communication with a civilization having no possibility of linguistic interchange. The only common bond would be experience with the same cosmic environment. The common language must be the science and logic needed to comprehend the cosmos to the extent necessary to build instruments capable of exchanging communication. I, at least, was hooked.

I had to play with the idea for a while. My experience with ETI, coding, anti-

coding, searching, interpreting and believing were as fresh and untried as would be that of my students. I started slowly; making slides of the Drake message, lecturing to local groups about "Communicating with ETI," slipping a lecture here and there into courses in introductory astronomy, beginning physics and faculty seminars. I began to see where the interest and fascination came during the presentations.



The Drake Message

I even recorded the Drake message as a two-tone beep signal on magnetic tape. A series of 1 second tones separated by 1 second intervals requires 18 minutes and 20 seconds recording time. I then speeded it up by a factor of 64 so the entire message requires just over 20 seconds to play and comes out as an unrecognizable whistle.

A final step of adding a large quantity of random noise gives me the opportunity to introduce the whole process, from signal search through noise suppression to analysis. The detection of a noisy radio signal provides an opportunity to illustrate the nature of measurement at the threshhold of detectability. The simulated computer processing to remove the non-random signal from the noise (accomplished on the master tape by suitably adjusting the gain downward on the random noise and the gain upward on the Drake signal (a process I call "manual signal averaging"), and manipulation of the playback rate puts the Drake signal in a form recognizable as intelligently generated. It is also subject to transcription by moderately adept students.

The student, when presented the puzzle of the Drake message in this way, develops a heightened fascination with possible content. I find students devoting the same time and effort to the solution as they invest in computer games and racquetball. The next step in using the Drake type of message will be an interactive program in which a variety of messages can be introduced at a terminal so a student may employ a variety of strategies to find and process anti-coded messages.

After the Drake picture is rendered, whether by individual students or the instructor, the class is invited to produce interpretations of the message content.

There exists in Shklovski and Sagan a fairly complete description of Drake's original ideas with which to compare different attempts to decide what the message communicates. In a typical class it is not unusual to find conceptualization ranging from a cartoon-type portrayal with dialog balloons, through sexual fantasy to speculation about galactic evolution. Class discussion to resolve differences in interpretation produces fascinating insight into the processes and information utilized by college students to solve problems.

I have found most of my students are unfamiliar with the early Drake message. Many have encountered similar demonstrations generated at later times but practically none have bothered to delve into any meaning contained in the messages. Both the Drake message and Sagan's Pioneer plaque provide departure points for various scientific ideas. Each provides a substantial case for a "need to know," especially of the mathematical and astronomical fundamentals.

After using the Drake message for brief periods in several classes I began to explore the possibility of expanding the study of ETI to a full unit course. At Otterbein College we have a program of composition and literature courses spread throughout the student's entire college career. During the first term in college a student may select a topical seminar as a means of fulfilling the introductory composition and literature requirement.

These Freshman Seminars are taught by faculty from all divisions of the college. Subject matter usually centers about a special interest of the instructor. Typical subjects encountered are ecological awareness, stress management, the study of ghosts, and utopias. Among the objectives of the seminars are the development of communication and study skills along with the discovery of research tools available on the college campus. A substantial amount of writing experience is required and growth in this area is expected.

To me, the concept of communication as a raw, theoretical idea can best be explored in the context of communication with an intelligent extra-terrestrial culture. A beginning college student has had many experiences of communication success and failure across cultural and generation barriers, and it seemed like a good opportunity to make use of these experiences in exploring the possibilities and probabilities of communicating with ETI.

I volunteered to conduct a Freshman Seminar the fall of 1976 which would bear the presumptuous title "Communication with Extraterrestrial Intelligence." The course description handed to all incoming freshman students referred to attempts to answer questions like: "Why do we communicate?," "What do we communicate?," "When should we not communicate?," "How, other than verbally, can we communicate?." Limited to 15 students, the section soon filled and I felt somewhat put-upon to have to conduct the class for the first time with 19 students. I learned much that first year; mostly how inexperienced I was at exploring philosophical issues, keeping ahead of interested, curious students and most of all, how unprepared I was to stimulate good writers and good speakers to become even better.

Those of us who have been through the process have discovered that ten weeks is too short to do all we would like. With weekly written assignments and daily discussion sessions to prepare for, time runs out far quicker than ideas and questions.

I have worked traditional assignments into appropriate ETI formats. An introductory biography is prepared by each student (and the instructor) on a 20 by 30 element grid. The purpose is to have each student place as much information about himself as possible using a maximum of 600 characters, i.e. letters, digits or symbols. The objective is to transmit the maximum of ideas in the limited format. Class averages run about 20 ideas. Obvious limitations are set by traditions of writing, grammar, and lack of awareness of common, non-verbal modes of communication. Full meaning to the experience does not arrive until the "scientific picture" method of Frank Drake begins to pour idea upon idea later in the course.

In addition to the above exercises, an experience extending over the entire term is a class project to evolve our own estimates for values of each of the seven factors in the Drake equation for the estimated number of communicating technological civilizations in our galaxy (See **COSMIC SEARCH**, vol. 1, no. 1, Jan. 1979, page 34). A system of committee assignments puts each class member on two committees each charged with justifying an assumed value for one of the factors that goes into the calculation. With the value selected, each committee must arrive at limits on their uncertainty by specifying a maximum value and a minimum value for their variable along with a rationale for their choice. In spite of the fact that this is one of the most stimulating aspects of the course, college freshmen seem unable

to arrive at and defend a thought of their own, even if they obtain help from other sources. Our educational system seems to turn them away from independence and creativity of thought.

For textbook reading I have used quite successfully, "ETI: the First Encounter" edited by James Christian, "Cosmic Connection" by Carl Sagan and "The Selfish Gene" by Richard Dawkins. Many other sources are used, some of which I list in the bibliography. Students respond very well to the Boston University Seminar, published by NASA in book form under the title "Life Beyond the Earth and the Mind of Man." It is very appropriate because we use the NASA film "Who's Out There" which includes segments of that seminar.

While I was observing at Kitt Peak National Observatory one of the visitors touring the McMath Solar Telescope introduced himself to me. When he found out I was teaching a course related to ETI he volunteered to send me reprints of some of his articles on the subject. As a result, part of our courses now include consideration of the idea of diplomatic exclusion of communication with ETI presented by Michael Michaud. (See **COSMIC SEARCH**, vol. 1, no. 3, Summer 1979, page 11). It turns out this is not an unpopular position for many students contemplating ETI for the first time.

The inclusion of original artwork depicting possible intelligent life forms proves to be an eyeopener for us all. Imagination, evolutionary awareness and a keen sensitivity to the value of non-violence in intellectual pursuits, if not in evolution, becomes evident as the group shares their beliefs and fears in drawings of alien beings.

Short stories based upon their view of ETI also reveal their awareness and apprehensions about the discovery that we are probably not unique in the universe. It may be of interest to note that only four of the 52 students who have taken this course were previous readers of science fiction. Practically all have been students without background in science. I am confident some have turned to look more favorably upon science as a result of their encounter with ETI.

As Carl Sagan points out, the searches and speculations about extraterrestrial intelligence certainly reveal to us far more about ourselves than it does about "them." I testify to the validity of his observation when college students investigate

their role as stewards of intelligence awaiting the time when other intelligence becomes accessable to our minds.

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