Section II

Contact: Long-Term Implications for Humanity

If extraterrestrial intelligence exists…its discovery may not be so much of a "wild card" as a high probability —perhaps inevitable—event.

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During the next millennium we may not only establish a permanent human presence throughout our solar system, but also begin interstellar migration.

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INTRODUCTION

Confirmation of the existence of extraterrestrial intelligence (ETI) is one of the major scientific discoveries that could instantly alter the course of society and have profound cumulative effects on humanity for all time. Confirmation has yet to occur, but changing views of the universe, a parade of scientific discoveries, and themes in popular culture have led to the widespread belief that "we are not alone." Many people expect that some day we will find incontrovertible evidence of intelligent extraterrestrial life.

Since earliest recorded history, humans have wondered about the possibility of intelligent life among the stars (Dick, 1982). Only in recent centuries, however, have we been able to pursue this problem with the sophisticated techniques required (Crowe, 1986, 1994; Dick, 1996; Guthke, 1990; Shostak, 1998). In the 17th through 19th centuries, theory and observation indicated that the same physical laws apply in all places and at all times. In the 20th century, growing evidence pointed to the conclusion that the laws of biology are universal also. If this is so, then life, including intelligent life, may have evolved in nearby solar systems.

As we attempt to forecast humanity's long-term future, the possibility of contact between human and extraterrestrial intelligence requires careful thought. Australian astronomer Ray Norris (1998) points out that our ability to conduct radio telescope searches continues to increase dramatically, and estimates a 50–50 chance of a confirmed detection within the next ten years. This estimate is based on only one of many possible search strategies. If extraterrestrial intelligence exists, given a thousand-year time perspective and burgeoning technology, its discovery may not be so much of a "wild card" as a high probability—perhaps inevitable—event.

The scientists who formulated SETI, the scientific search for extraterrestrial intelligence, were keenly interested in how people would react to "contact," or incontrovertible evidence that we are not alone in the universe (Finney, 1999; Morrison, Billingham, and Wolfe, 1977; Swift, 1990). Most past discussions of the impact of contact (Berenzden, 1973; Billingham et al., 1999; Harrison, 1997; Morrison et al., 1977; US Congress, 1961) were predicated on the microwave search strategy, and emphasized people's initial reactions to the discovery of extraterrestrial life.

The present essay extends this tradition. Based on a symposium sponsored by the Foundation For the Future on the Island of Hawaii in July 1999, our essay draws heavily on the ideas of the participants as well as on the literature that we cite. In keeping with the goals and objectives of the Foundation, our discussion encompasses a range of search strategies, and emphasizes the long-term consequences: how contact with a communicative civilization might shape humanity over the next thousand years.

Rationale and Justification for the Search

Estimates of the number of extraterrestrial civilizations in our galaxy rest upon an elegant but simple heuristic known as the Drake Equation. This states that the number of extraterrestrial civilizations existing simultaneously with our own depends upon a combination of physical, biological, and social variables (Drake and Sobel, 1992). These are the number of suitable stars in our galaxy, the fraction of those stars that have planets, the fraction of those planets that give rise to life, the fraction of life forms that evolve into technologically advanced civilizations, and finally the average longevity of advanced civilizations. (Longevity is important because it affects the chances that civilizations will exist simultaneously.)

In essence, as we proceed through the Drake Equation we eliminate sites that do not host extraterrestrial civilizations that coincide with our own. People who desire a positive search outcome hope that despite the many points for elimination, the resulting number of civilizations will be large. Since Drake formulated his equation in 1961, almost all findings support the "many inhabited worlds" hypothesis. These include discoveries that planets are common rather than rare in other solar systems (Croswell, 1997; Goldsmith, 1997; Marcy and Butler, 1998; Marcy et al., 1999); that complex organic molecules are commonly found in comets and in giant clouds where stars and planets form; and that the initiation of life may be a "cosmic imperative" that depends upon reliable principles of self-organization rather than nearly impossible chance events (Davies, 1998; de Duve, 1995; Kauffman, 1995). As suggested by the evaporation of the Cold War, societies may survive their own technological adolescence and achieve very old age with the result that many advanced societies exist at the present time. Despite growing circumstantial evidence, we have yet to confirm the existence of any extraterrestrial life.

There are strong justifications for continuing, indeed accelerating, the search. Professional astronomers have, in essence, a commission to keep an eye on the universe. Even as astronomers are obliged to inventory stars and the rest of the physical universe, they must now join with a variety of other disciplines to survey the biological universe (Dick, 1996). Their responsibilities include looking for evidence of cosmic life in all of its forms, ranging from fossilized single-celled organisms through technologically advanced civilizations.

During the next millennium we may not only establish a permanent human presence throughout our solar system, but also begin interstellar migration. As we prepare to move beyond our solar system over the next few centuries, it will be essential to understand the nature and distribution of life within our part of the galactic neighborhood.

Depending on what we find, our discoveries could be crucial for averting disasters ranging from back-contamination and disease through conflict with extraterrestrial spacefarers. The sheer discovery of any form of life would have profound effects on philosophy, science, and religion. The ability to communicate freely with a technologically and perhaps spiritually advanced civilization would intensify and augment those effects, altering our culture in both straightforward and subtle ways.

As we look to the distant future, we should realize that the dominant microwave search strategy is only one way that we could discover extraterrestrial life (Tough, 1999). At some point we may switch to active SETI (sending encoded signals rather than passively receiving them), or major advances in such areas as transportation and communication may give rise to new search strategies. New scientific discoveries could generate scientific interest in strategies (such as UFO studies) that are now largely discredited or, like planetary archaeology, seem unlikely to work. We must even be open to the possibility that contact has occurred in the past and we are living with the consequences of this contact. Right now, not one of these strategies has yielded scientific proof.

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At the conceptual level, our search for extraterrestrial life is based on a hunger for knowledge and a desire to find new purpose in the universe. At the procedural level, our search depends upon our current understanding of interstellar travel and communication and the technologies that are available to us. While we may expect interest in ETI to persist, we can expect search strategies and technologies to change, and with these the nature of the post-contact world.

Common Assumptions about ETI

Despite widespread expectations that the discovery of ETI will have an enormous impact on humanity in AD 3000, only with very broad strokes can we paint a picture of the future. The consequences of contact for our descendants will depend upon the nature of ETI culture; the specifics of the contact scenario; and human psychology, institutions, and cultures.

Perhaps the greatest deterrent to accurate predictions is that since scientists have yet to observe ETI we can only guess what it will be like. Furthermore, attempts to make such guesses are fraught with hazard. We are sensitive to cross-species and cross-cultural variability on Earth. How much greater could this variability be if we were to extend our observations to biological entities whose genetic and cultural backgrounds have nothing in common with our own? Another risk is our tendency to anthropomorphize, that is, wrongly impute human characteristics to nonhumans and even inanimate objects. There are many hypotheses about ETI, but until we actually make contact, we will not know which (if any) of these hypotheses are correct.

There are at least three ways that these hypotheses have come about. Some reflect a process called *imaginative production* and express human wishes and fears. Imaginative production is evident in preconceptions of benevolent space brothers arriving to solve Earth's problems, and in evil space invaders who want to take over our planet. Some of these images are contemporary renditions of the angels and devils that people have imagined since much earlier times (Thompson, 1991). These images can be very powerful and have been used to good effect in science fiction (Billingham et al., 1999). Michael Michaud eloquently expressed the role of psychological factors in our thinking about ETI:

In our thinking about alien intelligence, we reveal ourselves. We are variously hostile, intolerant, hopeful, naïve: influenced by science fiction, we see the aliens as implacable, grotesque conquerors, or as benign, altruistic teachers who can save us from ourselves. Usually we think of them as superior to us in some way: either their miraculous but malevolently applied technology must be overcome by simpler virtues, or we must accept them as gods who will raise humanity from its fallen condition. Here we display fear, insecurity, wishful thinking, defeatism, even self-loathing, everything but the calm maturity appropriate for our emergence into the galactic community. We are not ready (Michaud, 1974, 33).

Reverse engineering is a second process that generates expectations about ETI. We begin by acknowledging that ETI *could* be almost anything: a giant gas bag, creatures reminiscent of those portrayed in *Alien* or *Star Wars* movies—perhaps even free-floating consciousness. However, we then note that our search procedures will not lead us to all conceivable life forms, only a small subset—such as life forms that transmit microwaves. Once these constraints are in place, we can infer what ET "must" be like, just as we might make an inference about an automobile engine on the basis of its acceleration and top speed. Compared to the process of imaginative production, which is almost entirely emotional, reverse engineering has elements of rationality and logic.

Neither reverse engineering nor the search for universal principles of behavior can give us more than an educated guess about ETI…

Universal principles of behavior are the third avenue to generating hypotheses about ETI. If successive discoveries imply universal principles in the physical and biological sciences, it is conceivable that there are universal principles in the behavioral sciences also (Harrison, 1993, 1997). Perhaps there are deep laws of individual and social behavior that hold true for all species, all times, and all cultures. If so, our knowledge of biological and social entities on Earth gives us a starting place for organizing our thinking about intelligent life elsewhere. Although Earth is only one case, nested within it is a multitude of examples—millions of species, thousands of cultures, hundreds of nations spanning a written history extending back over 5,000 years. Neither reverse

engineering nor the search for universal principles of behavior can give us more than an educated guess about ETI, but they help move us beyond the sheer fantasy of imaginative productions.

What are the chances that we could identify, never mind understand, such a society? It might be much easier for prehistoric man to grasp cellular telephones, computers, lasers, and jet transports.

Perhaps the most common expectation is that ET civilizations will be technologically advanced (White, 1990). Given present search procedures, we are unlikely to encounter a civilization that is below our current technological level, since such a civilization is unlikely to use powerful radios, engage in space travel, or undertake other activities that we can detect. It seems statistically unlikely that we would encounter a civilization that is exactly at our level of technological maturity; hence, we expect to encounter civilizations that, compared to us, are technologically advanced. Astronomer Ray Norris (1998) calculates that the average civilization may be *two billion years* older than our own. Human experience suggests that technological advances accelerate over time; we have seen more technological advances during the last one hundred years than in the preceding two million years. What are the chances that we could identify, never mind understand, such a society? It might be much easier for prehistoric man to grasp cellular telephones, computers, lasers, and jet transports.

In our attempts to envision ETI science and technology we must be wary of slipping from science to science fiction. As we look into the future, we should ask if our projection conflicts with known theories and facts. Years of conditioning by science fiction may lead us to expect technologies that are not only beyond our own current grasp, but are forever beyond anyone's grasp.

We should distinguish between technologies that are possible in principle (but beyond our current engineering capabilities) and those that conflict with known laws of physics. For example, at the turn of the 20th century there was no scientific principle that precluded humans from flying beyond the speed of sound, but 50 years had to pass before we had the necessary technology. Similarly, it may be possible in principle to construct a wormhole to facilitate travel between remote parts of the universe, but it is currently beyond our capability to do this. Or, we may be able to alter the perception of the passage of time through space travel at relativistic speeds, but never exceed the speed of light.

There are two ways by which technology that currently strikes us as impossible may become available to an advanced civilization or to ourselves later on. One possibility is that as we continue to collect and refine data, seemingly impossible technologies will prove consistent with our current laws of nature (Haisch, Rueda, and Puthoff, 1998). The other possibility is that our current scientific framework is faulty or incomplete. True, science has progressed rapidly during the past century or two, but another two billion years or so would leave ample time for improvement. Past discoveries took us beyond Newtonian dynamics to relativity. Will future discoveries take us beyond relativity? We must walk a fine line here. On the one hand, we must avoid assumptions that confuse the public about such matters as interstellar or time travel, or divert our attention from proven options. On the other hand, we would do well to remember the overworked patent officer who, at the turn of the 20th century commented that everything that could be patented had been patented.

Another expectation is that ETI will be prosperous. This extrapolation is based on the association between technological development and quality of life on Earth. Despite millions of hungry people, the average person, at least in technologically advanced societies, eats better and lives better than his or her ancestors, even 50 years ago (Berry, 1996). The amount of discretionary income—that is, money not required for subsistence—has risen steadily to approximately 40 percent and will rise further in the first decades of our new millennium. The ability to tap the immense resources of space should contribute to ET's wealth.

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A third common assumption is that ETI's civilization will be stable. It will not have succumbed to runaway technology, environmental disasters, or war. Many people expect ET to have full control of its technology, show sensitivity to its environment, and, as we shall see, to be peaceful.

Another common assumption is that extraterrestrial societies will be willing to share information with Earth. Giovanni Vulpetti suggests that acting

under a cosmic imperative, intelligent and self-aware societies will explore the universe. As a part of the natural course of social evolution, such societies will feel compelled to diffuse high-level life outside of the areas where they originated (Vulpetti, 1998). Allen Tough points out that interactive communication would allow ETI to satisfy its own curiosity, especially in the humanities and social sciences where it may be interested in comparative data (Tough, 1998b). An outward orientation would allow ETI to detect potential dangers (such as astrobiological hazards, war-like societies, and problematic alliances), and form collaborative partnerships (Tough, 1998). Moreover, ETI may be willing to share information in order to perpetuate its values and endow its ideas with a degree of immortality (Harrison, 1993, 1997). Historical precedents on Earth show that there is no guarantee that a technologically advanced society would reach outward (Matloff, Schenkel, and Marchan, 1999), but SETI social scientists find many reasons that ETI will be forthcoming.

Perhaps some ETI societies will be interested in sharing their ideas and others won't. It is the former societies that would help shape humanity in 3000, and it is the former societies that are likely to aggregate into a large supranational entity known informally as a Galactic Club (Bracewell, 1975).

OVERVIEW OF SEARCH OUTCOMES

One thousand years from now the Search for Extraterrestrial Intelligence will be associated with one of three outcomes. These are: (1) no evidence of extraterrestrial intelligence, (2) confirmation of the existence of extraterrestrial intelligence but with little or no additional information, and (3) confirmation of the existence of extraterrestrial intelligence coupled with significant, perhaps rich and detailed information about our interstellar neighbors. Under the third outcome, we may have entered into interactive communication and perhaps earned membership in the Galactic Club.

If we view these outcomes as sequential stages, right now we are 40 years into Stage 1 (no evidence of extraterrestrial intelligence). We do not know if and when we will enter Stage 2, or how long we would remain in Stage 2 before entering Stage 3, or even if we will enter Stage 2 before entering Stage 3 (which could occur if our initial contact is with a member of the Galactic Club). A thousand years from now, we could be at any stage of the search process.

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No Confirmation

If the search continues for centuries, perhaps to the dawn of the next millennium, then we will live with the implication that we are alone in the universe. We will conclude that the circumstantial evidence assembled during the 20th century was misleading. Ben Finney suggests that if we do not find ETI, we ourselves may be encouraged to spread the universe with intelligent life:

However sobering [no confirmation would be] for cosmic evolutionists, those interested in human space expansion would certainly take the apparent absence of extraterrestrials in our galactic neighborhood as a green light for humanity spreading throughout that region. Let us further imagine that through learning how to settle in and around various planets and smaller bodies of our solar system and the development of powerful space drives and multigeneration spaceships, humans would eventually be able to migrate to nearby star systems and found viable communities there. Then frustrated would-be students of independently evolved extraterrestrials would have the opportunity to study how our descendants evolve culturally and biologically as they scatter through space… (Finney, 1999)

Would we ever concede that we are alone in the universe? Given that beliefs in extraterrestrial life have persevered for centuries, it is doubtful that all citizens of our solar system would accept this conclusion. As new generations are born, as new search rationales are developed, and as new search technologies come on line we might expect sporadic searches into the indefinite future.

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Confirmation

At the end of a thousand years, we may have detected unequivocal evidence of ETI but have few or no additional details. This is a standard SETI detection scenario: our interception of a carrier wave or "dial tone" from somewhere else in the galaxy. Another way that unadorned confirmation could come about

is through some types of optical detections: for example, patterns of energy use suggestive of a Type III civilization (Kardashev, 1964) or of an interstellar rocket exhaust. Or, we could discover an alien probe or artifact that we could not understand.

Maybe we will intercept a communication that has high information content but that is indecipherable to us. Given that our two civilizations may be separated by millions of years of evolution, translation and interpretation could be very difficult. Perhaps whole careers and institutes will be devoted to these processes, but with very little progress and very little impact on our descendants' daily lives. How well could we communicate with humanity of the year 3000, much less with even more advanced beings from entirely different genetic and cultural backgrounds?

There may be ethical as well as linguistic barriers to communication. Among the many reasons listed for our current "absence of evidence" are that ETI civilizations consider it unethical to alter the course of a developing civilization, or consider it desirable to preserve some civilizations for future study (Ball, 1973). Our ability to learn from ETI may depend on their perception of our readiness to acquire advanced information or to meet entrance-level requirements for the Galactic Club. We must be prepared for the possibility that we are not considered worth talking to, or that we will receive limited information that does not put the continuity of our physical, scientific, and moral evolution at risk.

Despite the fact that we may have little or no information beyond knowledge that the other civilization exists, confirmation would have two profound implications. First, it would tell us that we are not alone in the universe, that the rise of intelligent life is not a unique event. This, by itself, could have a major impact on our philosophy, science, religion, and views of ourselves. Second, confirmation would tell us that civilizations can survive their period of technological adolescence and achieve a level of technology that makes interstellar communication possible. It would strengthen hope that we can work our way through population growth, environmental decline, war, and the other threats that cloud humanity's future.

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Confirmation and Information Exchange

Instead of an information-poor "dial tone" type of signal, we might receive an "information-rich" signal that is easily understood by us. Earth's first contact might be with a highly experienced civilization that has procedures for communicating with civilizations such as our own. Perhaps they will teach us a universal language, or send a multilayered communication that includes different levels of complexity geared to different recipients. Perhaps a probe that has been studying us for years will know our language and communicate immediately in forthcoming and detailed ways.

If first contact is relatively uninformative, we will not be content with the sheer fact that we share the universe; we will work very hard to learn more. As a result of many years of hard work, we may partially if not fully decode the information. Discovery of life of any type, ranging from an indisputable fossil on Mars to a distant Type III civilization, would accelerate the search process and perhaps lead to the detection of different civilizations with which we could communicate. ETI encountered late in the search process may help us communicate with otherwise mysterious civilizations that we had detected earlier. In a thousand years, we may have considerable knowledge of many different extraterrestrial life forms and cultures.

On the whole, our ability to enter into a rich and varied dialogue with ET will depend on several factors. One will be the availability of interactive communication technologies such as translating supercomputers. Presumably it will be easier to communicate with a probe that is already within our solar system, or with a civilization that has communication technology that exceeds the speed of light, than with a civilization whose messages take years to reach us.

Ultimately, our ability to enter into full interactive communication will depend on our respective similarities and differences. ETI's information-processing capacities may be so great that we cannot keep up. Given an objective reality, humans and ETI may have such different sensory and information-processing systems that they evolve contrasting conceptions of reality. If reality is socially constructed, or in

the eye of the beholder, the lack of a common reference point may make it impossible to communicate.

At the heart of the matter is shared knowledge. Possibilities include a complete overlap in knowledge (Case 1), partial overlap in knowledge (Case 2), and no overlap in knowledge (Case 3). It will be increasingly difficult to communicate as we decrease the proportion of shared knowledge. We tend to assume Case 1 or Case 2, perhaps because if Case 3 proves true, communication would be impossible. We have already encountered many situations that fall within the very broad Case 2 category (for example, when cultural and linguistic barriers make it difficult to communicate with someone from another society) and even some Case 3 situations (for example, certain dead languages, and people whose pathological states make it impossible for them to communicate verbally).

It may be that we would uncover important differences, if, for example, they had difficulty explaining to us their concepts of space and time.

If and when we try to communicate with ETI, we may believe our dialogue is based on objective reality. Yet our "understanding" may be based more heavily on our own culture, on our collective unconscious, or on other sources that are shared by humans but have little or no basis in ETI's construal of the universe. A test "conversation" might be necessary to determine if our two societies have similar epistemologies or "ways of knowing." It may be that we would uncover important differences, if, for example, they had difficulty explaining to us their concepts of space and time. This should make us very wary of the possibility of further communication. Or, maybe each species can see only a tiny slice of reality; trying to communicate by sharing different "slices" of reality could be frustrating and confusing. If their message originates from very far away, we will learn about their past, not their current circumstances. If information arrives via a probe, our understanding may be based on a time capsule from a long-dead civilization.

If we are lucky, we will not be stymied by such problems. If we are unlucky, humanity in 3000 may have had as much as a thousand years to work around them. At the dawn of the Third Millennium, if multiple contacts have occurred, humanity's primary task may be to synthesize the knowledge of many worlds. This itself raises some interesting questions, given our problems integrating terrestrial knowledge in our current information age.

POST-CONTACT SOCIETY

Short-term effects of contact will be measured in days, weeks, and months. Long-term effects will be measured in decades, centuries, and perhaps millennia. Short-term effects will be evident in sharp and intense focus in the media, organizations scrambling to redefine themselves and cope with a new reality, and collective behavior. Long-term effects could permeate all aspects of our culture and its institutions. Yet we should not take "an assumption of maximum impact" (White, 1990) for granted, because major scientific discoveries have not necessarily impacted average people who are grappling with the problems of everyday life. It may be that the only people who are really interested are academics and the intellectual descendants of those who are now involved in SETI.

If contact is delayed for centuries, it will impact people who may be very different from us. Recent years have seen enormous changes in philosophy, science, and popular beliefs. Certainly, we expect that, compared to people who believed that the Sun circles the Earth, who never heard of evolution, and who never read science fiction, the people of today would respond very differently to ETI. Similarly, the people of tomorrow may have values, interests, and technologies that differ substantially from our own and for this reason react to ETI in ways that we cannot imagine.

According to Freeman Dyson, on a time scale of a thousand years, we can predict neither technology nor politics (Dyson, 1997). He expects that a thousand years from now, there will still be a diversity of languages, cultures, and religions. Humanity's migration to the high frontier will make it possible to preserve, even expand diversity—in essence, vast physical distances among populations will prevent conflict among very dissimilar peoples. Both natural selection and genetic engineering will increase the genetic differences among people, and will have initiated the process of speciation, the division of our species into many varieties.

Dyson adds that the human population (broadly defined) will reach staggering size. Our current two percent per year growth could continue if we spread out within the solar system. By his calculations, this rate of growth, over a thousand years, would

"increase our population and resources and living space by a factor of five hundred million" and there would still be ample reserves for continued growth.

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Long before that time, we will be capable of modifying our bodies, our own existence. The human genome will be completely mapped. There will be a meld of biotic and abiotic parts, creating organisms endowed with the capacity to thrive in the current lethal and improvident environments of outer space. Bioengineered hybrids may set forth on interstellar flights or undertake new kinds of searches for extraterrestrial life. A thousand years from now, first contact with new extraterrestrial civilizations could occur so regularly as to evoke little notice, apart from latter-day anthropologists and government bureaucrats.

ETI's impact on us will depend on the specific scenario that reveals ETI's presence. The interception of an impersonal broadcast from a neighboring galaxy will have less effect than the discovery of a probe within our solar system. Low-level electromagnetic communication could have very little effect on us because of the steady stream of terrestrial global problems inevitably confronting humankind.

In a recent discussion of astrobiology and SETI, Harrison proposed a fourfold classification system for detection scenarios (Harrison, 1999b). He began by noting that the NASA Astrobiology Program and SETI share interests in life in the universe, but that there are also important differences. Astrobiologists lean heavily towards the preliminary terms in the Drake Equation (stars, planets, habitability, initiation of life) and tend to search for life's precursors and for simple forms of life within our solar system. SETI scientists' interests extend to the final terms of the Drake Equation (evolution of intelligence, longevity) and seek advanced technological civilizations elsewhere in the galaxy. Thus, astrobiology and SETI differ along two major dimensions: where they concentrate their search (within or outside of our solar system) and the level or complexity of the living system that they seek (simple or complex). Combining the two levels of the two dimensions that differentiate astrobiology and SETI yields four detection scenarios. These were assigned the working titles of *Distant Dust* (distal and simple), *Microbes on Mars* (proximal and simple), *ET Calling* (distal and complex), and *Space Visitors* (proximal and complex). This classification captures the weakest possible case (evidence of life's precursors in distant galaxies) and the strongest possible case (robot probes, UFOs, and extraterrestrial visitations) as well as the intermediate cases favored in astrobiology and SETI.

The unfolding of any of these detection scenarios would represent a great scientific discovery and could have profound effects on our intellectual and emotional lives. Nonetheless, it should prove more challenging easing humanity through some of these scenarios (*Space Visitors* and *ET Calling*) than others (*Microbes on Mars* and *Distant Dust*). Furthermore, each scenario has different implications for our science and technology, our religion and arts, and our everyday lives. This framework was designed as a useful heuristic for organizing various hypotheses about long-term and short-term reactions to human life. It should be useful also for developing scenario-contingent strategies for managing contact and its aftermath.

Let us sharpen our focus on a future world where we are able to learn about extraterrestrial life forms and cultures. In an informal survey of approximately 200 people from 12 countries, Allen Tough (1997) asked, "If a radio dialogue with an extraterrestrial civilization occurs someday, what questions do you hope to ask, and what topics do you hope we discuss? From this wise, knowledgeable civilization, what do you want to learn most of all?" This resulted in over a thousand questions addressing everything from everyday practical matters to profound questions about science, religion, and the arts.

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Practical Information

Tough's respondents hoped that through communicating with advanced extraterrestrial societies we will gain practical information that will help us solve contemporary problems, improve the quality of human life, and secure our own future as a species. We imagine ETI as having made technological advances that we seek in our own future: increasingly miniaturized and powerful information processing devices; cheap and inexhaustible sources of power; gentle chemical procedures that replace the surgeon's scalpel; workable means for interstellar travel; pro-

longed life; and cyborgs endowed with near-immortality. Perhaps we will be coached in faster-than-light communication, interstellar travel, and other technologies that appear at the cusp between science and science fiction. If contact leads to the transfer of technology, and if we understand how to use this technology and are able to cope with the full range of environmental, social, and psychological consequences, we may become empowered to solve some of our biggest problems, improve the quality of human life, and accelerate our own evolution.

Interaction with many ETI societies would expose us to unprecedented levels of diversity and stimulation. Over time, knowledge gained from an extraterrestrial civilization could shape human leisure-time or recreational activities. For example, at some point people may embrace extraterrestrial costumes, dances, foodstuff, and customs. At first, these might be mimicked at "trendy" social events. Theme parks or museums could convey a sense of what it might be like to live within ETI society. Amusement park rides could be based on ETI conveyances (even as imagined spaceships shape many amusement park rides today). And, if interstellar travel proves to be much less daunting than it appears right now, then it is conceivable that in a thousand years extraterrestrial societies could become desirable tourist destinations. Already, there are energetic efforts to develop space tourism, including suborbital and orbital flights, space hotels, and luxury cruises around the moon.

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On the other hand, we might question whether or not advanced civilizations would have, or at least use, some of the technology that we impute to them. For example, Dyson spheres and omnidirectional beacons may be avoided because they constitute needless expense, squander resources, and manufacture pollution as well as being irrelevant to their life forms. Additionally, we may not be judged "ready" to receive such information. After all, would you give a child the secret code of ballistic missiles just so he or she could enjoy playing with them? Finally, information that is practical to them may or may not be practical to us, especially if they were radically different from us, such as would be the case if they were "machine intelligence." Their ideas may seem very "academic" to us, depending on the problems that confront us at that future time.

Perhaps the most exciting prospect is that we will learn how ET civilizations survived their technological adolescence. Perhaps they will have a developed empirical field of study that can define critical bottlenecks in civilizational advances and elaborate ways of navigating them (Tough, 1986). In the very long run, the challenge will be outliving one's star, by building one's own "world" or using giant transports to migrate to another solar system. As far as we can tell, there are no phenomena suggestive of astroengineering in the vicinity of stars about to become red giants.

Answers to Major Questions

Information from ETI may help us grapple with some of the greatest scientific and existential questions of all time. We, and they, may have a bias towards expecting scientific discourse in part because advanced technology is a prerequisite for interstellar communication and in part because science is a convenient reference point for languages that transcend different cultures. On the other hand, the primacy that we accord math and logic may reflect the fact that on Earth the search is conducted by physical scientists. If we restrict our discourse to science, we will eliminate broad spectra of human activities: philosophy, humanity, religion, and the arts.

Science

The discovery of extraterrestrial life would have profound implications for physical, biological, and social science. This discovery would either validate or challenge our beliefs in the wide-scale applicability of our own scientific principles. One view is that although ETI will necessarily have to deal with the same physical universe that we do, their science may be unrecognizable because they will come from different environments, will have different methods of sensing their environments, and will apply different techniques to different scientific topics (Rescher, 1985). Another view is that ETI will think like we do despite their different origins. They will be subjected to the same general space, time, and materials constraints that we are, and hence forced to devise simple and effective ways of thinking about the universe. As a result, their science will be easily recognized by us (Minsky, 1985).

Post-contact humanity may be privy to partial or full answers to questions about such things as the origin and fate of the universe…

Contact with ETI may expose us to new metaphysics and epistemologies. Post-contact humanity may be privy to partial or full answers to questions about such things as the origin and fate of the universe and the course of evolution and of civilization. We dream of learning "comparative cosmologies," contrasting theories of the ultimate origin of the universe. We dream also of learning the mathematical theory unifying all known forces of nature, or perhaps a theory of the superstrings or a unified theory of science of a type that we have not yet conceived.

Ben Finney points out that one of the reasons that the social sciences lack the maturity of the physical sciences is that so far we have had only one opportunity to study the development of consciousness, intelligence, and culture (Finney, 1999). That is the opportunity available on Earth. He points out that astronomy, for example, would have not progressed very far if astronomers had been forced to develop a theory of planetary evolution based solely on knowledge of our own planet. We need extraterrestrial civilizations "to introduce us to an array of possibilities and variations beyond our experience, and also to shock us out of such parochial views as regarding ourselves as the summit and final goal of evolution…."

Information about other civilizations would confer opportunities for comparative scientific studies of cultures, life forms, and psychologies. By the year 3000, under an information-rich detection scenario, we may have assembled a database containing hundreds, perhaps thousands of societies that endured from decades to millions or billions of years. We might have, for tomorrow's social scientists, the equivalent of anthropology's Human Relations Areas Files that facilitate cross-cultural studies for anthropologists. Historians would be able to do quantitative research on comparative civilizations.

Multiple opportunities, notes Finney, could move us in the direction of consilience, or the unification of knowledge (Wilson, 1998). So far, only physics and chemistry have achieved consilience to any appreciable degree. The chance to study extraterrestrial civilizations may help us build bridges among the physical sciences, natural sciences, social sciences, and humanities. Finney adds that SETI is one of the endeavors led by physical and natural scientists that has welcomed the participation of social scientists and humanists.

Spirituality is not inconsistent with science, and it is evident in discussions of design, order, and beauty in the universe.

Religion

We draw a distinction between spirituality and organized religion. Spirituality is an almost mystical sense of purpose and meaning in the universe, perhaps accompanied by feelings of awe, reverence, and transcendence. Spirituality is not inconsistent with science, and it is evident in discussions of design, order, and beauty in the universe. Spacefarers have reported spiritual experiences after viewing the Earth from a distance. These "overview effects" often include a sense of transcendence, oneness with the cosmos, and universal brotherhood. For example, in an interview with Frank White, astronaut Eugene Cernan reported:

When I was the last man to walk on the moon in December 1972, I stood in the blue darkness and looked in awe at the Earth from the lunar surface. What I saw was almost too beautiful to grasp. There was too much logic, too much purpose—it was just too beautiful to have happened by accident. It doesn't matter how you choose to worship God… He has to exist to have created what I was privileged to see (Eugene Cernan, quoted in Frank White, 1987, p. 26).

Astronaut Ed Gibson stated: *You can see how diminutive your life and concerns are compared to other things in the universe. Your life and concerns are important to you, of course. But you can see that a lot of the things that you worry about don't make much difference in an overall sense. The result is that you enjoy the life that is before you; you don't sweat the next milestone.… It allows you to have inner peace* (Ed Gibson, reported in White, 1987, p. 43).

Organized religion often includes social structure, highly articulated and sometimes inflexible belief systems, specific loyalties, and group rituals. Discussions of SETI and religion typically center on organized religion and emphasize concerns about sects that are characterized by high rigidity and disagreement with science. In some cases, narrow religious beliefs hold sway over objective evidence and, in this way, obstruct science. Because of this, it is tempting to expect that ETI will have moved beyond religion and that science will dominate their value system.

One might argue that longevity, a requirement for their civilization to overlap with ours, is inconsistent with organized monotheistic religions typical of Earth. Despite their positive side, such religions are also responsible for long-lasting warfare and destruction. Religious warfare, in turn, can lead to the destruction of a civilization. Hence, the absence of competing religious sects would be one more factor contributing to longevity. Yet this would not preclude spirituality.

When we review the basic principles of the religions that attract broad segments of the world population (Buddhism, Christianity, Hinduism, Islam, and Judaism), we find certain similarities. In a study of this, Douglas Vakoch (1999a) began with a pool of 200 principles drawn from the world's religions. He gave a sample of these principles to research participants and, on the basis of their responses, organized them into 13 clusters. Examples of these clusters include giving and helping, forgiving, positive actions, humility, thanksgiving, and positive attitudes. Whether or not similar principles evolve in ETI societies, knowledge of them would help give ETI a comprehensive view of humanity.

Will we be able to recognize and understand the ethics of an advanced society, or that of machine intelligence?

Contact with an extraterrestrial society could expose us to ethical principles developed by creatures that are very different from us. Will we be able to recognize and understand the ethics of an advanced society, or that of machine intelligence? As it stands, we often have difficulty understanding each other's ethics. If we can recognize ETI ethical principles, in what ways (if any) will they correspond with principles already developed on Earth? Longevity may imply a highly established code of ethics that centers on the perpetuation of individuals and all components of the natural environment.

Knowledge of extraterrestrial religious beliefs could result in a super-religion that encompasses multiple intelligent societies. Another possibility is that some ETI views will, in a sense, validate the basic tenets of some terrestrial religions. This could strengthen terrestrial religions that have shared views, but perhaps spark conflict with religions that maintain opposing views. Especially worrisome is the possibility that ETI beliefs will conflict with major world religions. Conflict may be particularly likely if extraterrestrials have a monotheistic or Adamist-type religion that differs on key points with terrestrial monotheistic religions.

The mere possibility of "saintly" aliens could eventually force a radical rethinking of Christian theology, and may cause a split in the church towards support for SETI. Even if their religion prevails, it could take generations for humans to be absorbed into their religions. Conflict would depend less on the objective properties of ETI religion than on how people interpret and reinterpret it. Various religions would look to their own past for guidance.

Surveys suggesting that religious leaders (Alexander, 1998) and followers (Ashkenazi, 1990) take a relaxed view of the possibility of ETI may be misleading. Many religions are geocentric and homocentric. This is especially true of Christianity. From the Christian point of view, the discovery might be "to the Glory of God," but there will be no consensus. On the whole, we will be challenged by the sheer discovery of extraterrestrial life; even a single bacterium on Mars would have implications for some fundamentalists. The alternative—that God became incarnate on planet after planet—has an air of absurd theatricality to it. Organized religions, however, have the capacity to change in response to new discoveries, even if historically the response has been slow. When the alternative is extinction, there is strong incentive for rapid change.

We are moving in the direction of a "cosmotheology" that accommodates a universe full of life.

Steven Dick (2000a) notes that growing belief in a biological universe is a worldview, not just another theory or hypothesis. This, by itself, is forcing us to rethink our theology. We are moving in the direction of a "cosmotheology" that accommodates a universe full of life. Among the principles of that cosmotheology are that humanity is neither physically nor biologically central to the universe; that humanity is at best somewhere midway in the great chain of intelligent beings; and that we must evolve a reverence and respect for life that includes all of the species in the universe. In addition, cosmotheology fosters a radically different conception of God—a God of the entire universe, a God whose roots are found in cosmic evolution. Dick writes, "With due respect for present religious traditions whose history stretches back four millennia, the natural God of cosmic evo-

lution and the biological universe, not the supernatural God of the ancient Near East, may be the God of the next millennium." Since we are accelerating our own progress into space and increasing our chances of encountering ETI, cosmotheology may have transformed humanity by the year 3000. ETI also will be aware of the biological universe; perhaps cosmotheology will become a shared religion.

Politics and Law

In his seminal work *Living Systems*, James Grier Miller points out a trend towards increasingly larger systems (Miller, 1978). In human history we see a shift from small communities to cities and nations, and now interstate political systems. Thus, some European city-states and principalities first joined together into nations recently have become part of the European Union. This tendency to form increasingly large sociopolitical units is noted in discussions of world government (Schenkel, 1999) and of the Galactic Club (Bracewell, 1975). The potential advantages of joining together include aggregated resources and peace.

Miller views supranational systems as relatively recent developments. Their evolution is slow and not inviolate: consider the fragmentation of states accompanying the dissolution of the Soviet Union. At this point, most supranational entities—such as the United Nations—exert only spotty control over constituents' lives. Still, movement towards supranational entities is a continuation of billions of years of evolution towards larger, more complex social systems. It points in the direction of world government and even larger sociopolitical systems.

Peter Schenkel sees two ways that we on Earth could unite to solve our planet's problems (Schenkel, 1999). The less painful is to minimize the differences among the peoples of the world and increase our efforts to develop a world government. The more painful course is for the survivors of a nuclear holocaust or other disaster of human making to find themselves compelled down the road to unification. Surviving societies that are older than ours will have followed one of these two paths and have established a stable government, eliminated war, and developed positive relationships with other species. Schenkel hypothesizes that contact with such an advanced society will inspire Earth's superpowers "to abandon ruinous rivalry and tilt the scales for a peaceful world government" (Schenkel, 1999, p. 7).

An extended legal framework that encompasses… all nations on Earth…human societies dispersed throughout the solar system and ETI elsewhere, may govern humanity by the year 3000.

An extended legal framework that encompasses not only all nations on Earth, but also human societies dispersed throughout the solar system and ETI elsewhere, may govern humanity by the year 3000. Such laws could assure orderly progress of humans into space and regulate interstellar affairs. The challenge of international law—to find a framework that is acceptable to diverse people who live under very different circumstances—will be magnified many times over as we struggle to organize radically different and widely separated species.

Simplicity rather than complexity must characterize any legal framework promulgated for galactic application. To survive, it must consist of a few principles that are at a sufficiently high level of abstraction that they can be creatively adapted to diverse "local" populations and conditions. To draw an analogy from United States law, we expect that this legal framework would bear a closer resemblance to the US Constitution than to state laws or local ordinances. An interstellar legal framework may be offered to us if we encounter civilizations that have already formed a supranational entity or Galactic Club. Or, we ourselves may contribute to its development.

Knowledge about extraterrestrial societies will allow us to evaluate Francis Fukuyama's (1992) hypothesis that the ascendance of liberal democracies on Earth rests on deep or universal principles. Some of those who venture a guess suggest that ET civilization will be peaceful, since, as noted briefly in our discussion of "Assumptions about ET," warlike societies may earn low scores on the longevity factor.

Despite frightening images of extraterrestrials and talk of evil empires, Harrison theorizes that most advanced civilizations are peaceful rather than belligerent (Harrison 1996, 1997). This thesis rests upon convergent evidence that relations among nations on Earth are becoming less warlike. First is the shift from autocratic forms of government that resolve problems through force to democratic forms of government that seek peaceful, negotiated solutions to problems (Russett, 1993). Second is a decrease in the frequency and intensity of war (Fukuyama, 1992; Keegan, 1994; Mueller, 1998), accompanied by

increased interest in nonlethal alternatives (Alexander, 1999). Third, mathematical models and game-theoretic research show that nations that refrain from belligerence and enter into defensive pacts are ecologically superior (last longer) than societies that follow aggressive foreign policies (Axelrod, 1984; Cusack and Stoll, 1994). This does not violate the principle of survival of the fittest. The aggressive skills that assure the survival of wild animals in the jungle are not the same skills that promote a society's survival within even larger social systems.

This type of analysis, which draws on understanding life on Earth to forecast life elsewhere, is subject to two major qualifications. First, we must be sensitive to the internal validity of the analysis. Do the data demonstrate a powerful trend, or are they nothing more than random variations that appear important because they happen at our particular point in history? Second, even if these data reflect powerful and pervasive laws of behavior on Earth, we must be cautious about extrapolation to societies that we know nothing about.

Would ET art be discernible, much less understandable to us…would it be attractive to porpoises and whales?

The Arts

All societies on Earth have both creative and performing arts, and, if we are willing to include oral traditions, a literature. These serve both an expressive and communicative function, and play on the intellect and emotions of the audience. Our emphasis on science should not obscure the possibility that ETI will have a creative flair. By the year 3000 ETI may have influenced all of the creative and performing arts. Perhaps we will be delighted by radically new art forms, either developed by ETI or collaborative projects jointly developed by ETI and humans. Perhaps human art will receive critical acclaim in other worlds.

Would ET art be discernible, much less understandable to us? Would ETI art be too complex, or different, for us to appreciate? Would ETI music validate our ideas of music from space, and would it be attractive to porpoises and whales? Will the limited number of basic plots that account for all human fiction account for all ETI fiction as well?

John Barrow is among those whose work hints that art may have universal components (1995). This is because some of the attributes that equip us for survival also nudge us in the direction of comprehending art. For example, Barrow notes that planets with conditions conducive to the evolution of life also promote good color vision. Knowledge of ETI art forms will help us evaluate theories that there are universal principles of aesthetics, including a strong relationship between music and mathematics. Indeed, in the movie *Close Encounters of the Third Kind*, humans communicated with extraterrestrial spaceships by means of tones and chords.

Even if principles of beauty are not universal, notes Douglas Vakoch, it might be possible for one civilization to teach its aesthetics to another (Vakoch, 1999b). This would require establishing a common medium—if ETI has poor vision, for example, it might be difficult to communicate pictorially—and finding ways to factor in culturally based artistic conventions. Maori artistic conventions, for instance, involve representations of people that are integrated into abstract forms. Unlike the Maori, visitors from other societies usually see beautiful abstract forms but do not understand that these forms represent people.

Through some combination of universals, analogies, and relationships, we might… help another civilization develop a sense of appreciation for our graphic arts, our sculptures, and our music.

Our strategies for communicating our science may be adapted for communicating our art. Vakoch points out that one way to convey our concepts of chemistry would be through transmitting at frequencies corresponding to a combination of spectral lines associated with a specific element. The same basic technique could convey some of our ideas about music. In this case, we could transmit at multiple frequencies that correspond to the tones that constitute well-tempered polyphonic music (von Hoerner, 1974). Through some combination of universals, analogies, and relationships, we might be able to help another civilization develop a sense of appreciation for our graphic arts, our sculptures, and our music.

Changes in Our Views of Ourselves

Post-contact society is likely to affect our views of ourselves in at least three ways. First, it will speed awareness that we are part of the biological universe (Dick, 1996). Contact, even under minimum detec-

tion scenarios, is likely to accelerate our views of ourselves as part of cosmic man or "interstellar humanity," to extend the terminology of Olaf Stapleton's "interplanetary man" (Dick, this volume). Many other factors—such as our progress in spacefaring—will contribute to our consciousness of the cosmos.

Second, knowledge of relationships among extraterrestrial subpopulations could help us gain insight into intergroup relations on Earth. We may learn, for example, from how ETI societies treat different societies as well as their own subpopulations. This discovery could cause us to reflect on how we ourselves treat people from different cultures and subcultures. By seeing how ETI manages diversity, we may learn new models for group relations on Earth.

Almost a century of work in psychology and sociology shows that other people's treatment of us shapes our views of ourselves. People who are treated as competent and worthwhile individuals tend to develop high self-confidence and perform well. Self-confidence and success tend to feed upon each other and generate an upward spiral of events. People who are treated as inferior and incompetent lose self-confidence and motivation, and perform poorly. Low self-confidence and poor performance also feed on each other, in this case creating a downward spiral.

A very large and important question is how advanced societies would treat us. Will they consider us equals, protégés, or inferiors?

A very large and important question is how advanced societies would treat us. Will they consider us equals, protégés, or inferiors? Despite technological superiority, would they maintain a sense of respect towards younger societies, and would they allow such societies to put their best foot forward? Under a high information-exchange scenario, ETI's openness, tolerance, understanding, and ability to help younger societies to gain strength would be important to us in many ways, including their contribution to our views of ourselves.

Whether or not ETI makes advanced technology available to us could be important psychologically as well as materially. Withholding advanced technology from us could be interpreted as a sign that we have failed to pass muster as well as a source of frustration and possibly tensions between the two civilizations. Offering ETI technology to us could contribute to a sense of competence and mastery, providing that we considered ourselves in control of the new technologies and understood their operation. This sense would be enhanced if we were able to see new applications or find ways to improve it. We could be affected adversely if we felt controlled by the technology or didn't really understand how it worked.

We need to address the possible adverse effects of contact—feelings of inferiority, loss of internal sense of control, learned helplessness and the like—through studies of caste systems, colonies, subjective determinants of self-esteem, and the preservation of identity following culture contact.

One such risk is domination, whether resulting from military subjugation or misguided attempts to impose their superior ways on less-advanced societies.

Risks and Concerns

Contact with powerful societies poses certain risks in addition to possible challenges to our self-confidence. One such risk is domination, whether resulting from military subjugation or misguided attempts to impose their superior ways on less-advanced societies. A perfect civilization could take pity on a poor, struggling civilization such as our own, uplift it, and in the process destroy our unique properties.

Dominance may be a natural, indeed inevitable, stance of any advanced life form. Drawing on simplistic notions of survival of the fittest, it is easy to argue that advanced life elsewhere in the cosmos will tend to control other life. Yet discussions of contact have downplayed the possibility of military subjugation. Immense interstellar distances would make it extremely expensive and difficult, if not impossible, to conduct interstellar warfare. Furthermore, we expect that many of the justifications for war will be absent (for example, an advanced spacefaring civilization would have plenty of unoccupied land for the taking). And, as repeatedly noted, many have speculated that societies with great longevity have advanced beyond war.

…the differences in technologies could be far greater than that between slingshots and thermonuclear bombs.

Of course, if these analyses are wrong, and both the physical and sociological barriers to interstellar travel evaporate, subjugation could be a risk. Given

their vast experience and highly evolved weapons systems, our contemporary military would not seem to offer much of a defense. If the discrepancy is measured in millions of years of technological development, the differences in technologies could be far greater than that between slingshots and thermonuclear bombs.

Subjugation would not necessarily require actual physical contact between their civilization and ours. As an alternative, they could deploy proxies on Earth to do their bidding. A powerful group of proxies could have the knowledge, power, and technology to control humanity, even as colonial troops controlled natives less than a century ago. People on Earth may lose the will to fight the proxies if they do not have the technology and self-confidence to succeed.

Another clear risk is culture shock, the import of technology and ideas that are so radical that they disrupt our value system and pose severe threats to social order. Culture shock occurs when technology outpaces the human capacity to adapt. Again, we must point to the great discrepancy between the two cultures. We expect ETI to be several rungs ahead of us on the ladder of civilizations (farming, industry, nuclear, computing, etc.). It is likely not just a matter of their being one step ahead of us, but many steps, each step representing hundreds or thousands of years. It could take a long time to grasp—never mind assimilate—such a radically different culture.

Possible Intercivilization Projects

Human history is studded with projects that have required immense amounts of financial and material resources and cutting-edge technologies. Such "megaprojects" (Harris, 1996) have included the pyramids, Stonehenge, the Suez and Panama canals, landing people on the Moon, and the "chunnel" that links England and France. These efforts require such a stretch of the imagination and such massive investments of resources that they seem almost impossible until they are done. In the case of ancient megaprojects such as the pyramids and Stonehenge, some people continue to invoke extraterrestrial intervention, despite the fact that engineers have mapped Earthly explanations.

Possibilities include…directed panspermia to create additional islands of life…perhaps even the creation of designer universes to create a "multiverse."

Imagine, then, the magnitude of the projects that might be undertaken by a group of advanced civilizations, including human civilization, sharing information and working in concert. Possibilities include comparative studies based upon a sharing of information, vigilance against Von Neumann self-replicating probes and other potential threats, directed panspermia to create additional islands of life, assistance with planetary engineering, and in the remote future perhaps even the creation of designer universes to create a "multiverse" (Rees, 1997; Smolin, 1997).

Interstellar collaboration could allow different societies to utilize their distinctive strengths and compensate for their idiosyncratic weaknesses. Presumably, by virtue of ecological niche and historical circumstances, different societies will have different intellectual and material resources and will have made uneven progress in different areas of endeavor. For example, a society that early in the course of its history found evidence of other civilizations within its solar system may have made rapid advances in rockets and spacecraft, while another society, threatened by a series of near-calamities, may have progressed dramatically in environmental protection. Societies with complementary strengths could find many ways to collaborate. If communication were possible, a society with brilliant theoreticians might show a society with the necessary natural resources, technicians, and laborers how to make a workable starship.

THE NEXT STEPS

The past century has been marked by growing evidence for the "many worlds" hypothesis and increasing enthusiasm for the idea that "we are not alone." We have the reason and the technology to expand the search. At the same time, we must prepare ourselves for the possibility that the search will be successful. This includes finding ways to communicate with ETI, better assessing the impact of detection on humanity, and developing a reply policy.

Accelerating the Search

Confirmation of extraterrestrial intelligence could come about in any of a number of ways, but given our known laws of nature and current technology, some search procedures seem more promising than others. At present, the favored approaches of most scientific searchers are radio SETI, which involves using radiotelescopes to detect electromagnetic patterns that are of extraterrestrial but intelligent origin, and optical SETI, based on searching other segments of the electromagnetic spectrum for laser communications or signature patterns of energy use.

Radio astronomers could increase the chances of success further by building an observatory on the Moon…

Proponents of these dominant strategies note that moving information around the universe is incredibly more economical than moving matter, and that whereas radio and optical signals move at the speed of light, spaceships or probes can move at but a tiny fraction of that speed. From this perspective, expanding the search means involving more radiotelescopes, engaging them in the search a greater percentage of their time, including more areas of the sky in the survey, and scanning a greater number of channels. Radio astronomers could increase the chances of success further by building an observatory on the Moon, and analyzing anomalous data that are normally locked in bottom desk drawers.

We can expand the search further by bringing new search strategies on line. For example, we might try looking for small robot probes (Tough, 1998a, 1998b). As a result of advances in rocketry and miniaturization, we are able to send small, sophisticated interplanetary probes that collect and return much more scientific data than could their larger and more expensive predecessors. Whereas seminar participants expressed little enthusiasm for the existence of self-replicating probes, it is conceivable that following remote detection of intelligent life on Earth, a highly advanced civilization could send a probe to our region. To the extent that this is plausible, it would be worthwhile to broaden the search to look for probes or other artifacts in our solar system.

Gregory Matloff and associates raise the intriguing possibility of ETI spaceships or habitats within our solar system (Matloff, 1999; Matloff, Schenkel, and Marchan, 1999). He suggests that, as their stars leave the main sequence and expand towards the giant phase, residents of neighboring solar systems could unfurl giant solar sails and set forth on world ships to our own solar system (Matloff, 1999). Such a journey could be measured in centuries rather than millennia: since life emerged in Earth's seas, hundreds of other stars have come within one or two light-years of our Sun (Matloff et al., 1999). Stars may pass within this range every 300,000 years or so.

If ETI silently orbits our Sun, and has done so for millennia, it would be up to us to initiate contact.

Certain features make this scenario more attractive than others suggesting that ETI is hiding within our solar system. Solar sails are more consistent with our current understanding of physics than are some of the other means envisioned for interstellar travel (Matloff et al., 1999). We do not have to wait for breakthrough propulsion to explain how ETI got here. Furthermore, Matloff's hypothesis is testable. A particular type of infrared signature and the properties of the orbit could tip off the presence of an alien habitat within our solar system (Matloff et al., 1999). Finally, this hypothesis raises many provocative questions about managing contact. If ETI silently orbits our Sun, and has done so for millennia, it would be up to *us* to initiate contact. Why have they remained silent, and how would they react if we tried to communicate with them?

Generally, the possibility of face-to-face encounter is left to science fiction writers and UFOlogists. Given our present level of knowledge, a face-to-face encounter would depend upon both interstellar travel and life support systems that could keep the spacecraft inhabitants alive under all-but-impossible conditions. Furthermore, unless one wishes to strengthen the assumptions by presuming that ETI will set forth in vast armadas, given the vastness of space a chance encounter would be all but impossible. Most reports of encounters with extraterrestrial entities or their artifacts are dismissed as misidentification of natural phenomena (planets, airplanes), deliberate hoaxes, or hallucinations. Given this, scientists see such reports as a waste of time. If they still have interest, they are likely to be deterred by ridicule from the intellectual community. The underlying reason that many SETI scientists are unwilling to consider the possibility of ETI in our solar system, writes Michael A. G. Michaud, is "fear that their enterprise will be discredited by association with UFO advocates" (Michaud, 1998, p. 174).

If we become capable of faster-than-light travel, for example, it is a good bet that a much older civilization would also be capable of this feat.

We see two areas in which massive changes in our own science could lead to rapid adjustments in our search strategies and perhaps force us to rethink the consequences of contact. The first of these would be developments in breakthrough propulsion physics, which could facilitate interstellar travel. If we become capable of faster-than-light travel, for example, it is a good bet that a much older civilization would also be capable of this feat. Speculation that "they" could appear in our solar system would be much less far-fetched.

The second revolutionary development would be breakthroughs in mental telepathy, leading to a reassessment of consciousness as a vehicle for interstellar communication. Freeman Dyson suggests that, in a thousand years, humans may become more interested in mental activities, perhaps experimenting with radiotelepathy, communication through means that are presently unavailable to us, and creating, in effect, a larger entity, a true group mind (Dyson, 1997). Could we ourselves be part of an even greater consciousness, one that includes beings not like us? Could we at some point—perhaps following additional evolution—find ourselves communicating with creatures from other places, other times? Perhaps rightfully we tend to put such suggestions on an equal footing with reports of a reincarnated Elvis Presley in the parking lot at the local mall. Yet, parapsychologists are employing tight experimental methodology, including double-blind procedures, to put remote viewing, mental telepathy, and related phenomena on a firm scientific footing (Radin, 1997). Certainly, success rates have been high enough to generate spirited discussion in mainstream psychology journals—and to attract research support from national security agencies, the military, and even the business community (Radin, 1997). Asked in 1992 why SETI did not use some sort of altered state of consciousness as well as radiotelescopes to search for extraterrestrial intelligence, MIT physicist Philip Morrison responded that consciousness was "messy" and that he and his associates were having enough trouble with their equipment as it was without adding consciousness into the mix (Mack, 1999, p. 27).

Messy indeed. Most of the carefully conducted research suggests that psychic abilities at best produce only a small performance edge—for example, boosting chance performance of 25% "hits" to something on the order of 35% "hits," a small but highly reliable gain given metanalyses of scores of studies, each encompassing an enormous number of trials. Given the small magnitude of these effects, parapsychologists suspect that people's expectations and wishes would completely overpower any psychic communications that might emanate from many light-years away. Nonetheless, there *are* acceptable ways to validate claims of psychic contact with extraterrestrial beings, such as by soliciting information that is not known by us but can be verified using present scientific procedures. For example, any "ET" that is "channeling" information to someone could draw our attention to an astronomical event that we had not yet noticed but that we could confirm with our telescopes. So far, no such claims have been verified.

As a corollary of expanding the search, we should make ourselves a more attractive target for ETI. For example, if we suppose that an extraterrestrial civilization were to monitor Earth (using either remote or up-close surveillance techniques) with the intent of self-manifestation following signs of humanity's "readiness," then we could try to signify this. This might be accomplished, for example, through self-preparation or an open invitation such as the "Invitation to ET" that a group of 60 people, primarily scientists, has placed on the internet.

Increased knowledge of intelligence and behavioral diversity on Earth will position us better to understand ETI.

Understanding Extraterrestrial Life

Increased knowledge of intelligence and behavioral diversity on Earth will position us better to understand ETI. Psychologists, animal behaviorists, and other researchers have already conducted studies that would be of some use for understanding extraterrestrial intelligence, but it is doubtful that many have thought of their work in this context. Black and Stull (1977, p. 100) suggest a direction for such studies:

Our goals should be (1) to catalog and classify behavioral patterns and cultural differences; (2) to determine how these are related to the environment, physiology, and evolutionary history of each species studied; (3) to determine what traits, if any, appear common to all intelligent animals; (4) to gain experi-

ence in communication and other extraterrestrial species; and (5) to develop theoretical models that will allow extrapolation to extraterrestrial cultures, and allow us to evaluate at least semi-quantitatively the uncertainties in such an extrapolation. To the extent that this might enable us better to understand human behavior, it could result in one of the most important benefits of the SETI program.

There is a promising model for extrapolation from terrestrial to extraterrestrial life (Harrison, 1993, 1997) and it is James Grier Miller's Living Systems Theory or LST (Miller, 1978). Terrestrial and extraterrestrial life reside in the same universe. They are constructed of the same elemental building blocks, and governed by the same natural laws. The same assumptions (empiricism, determinism, monism) and methods that make it possible to conduct scientific studies of humans should be equally forceful when applied to ETI.

Any theory that is potentially applicable to ETI must have a broad perspective and have wide-scale applicability on Earth. It must offer proven principles that are extrapolated easily to new situations. LST is a universal theory of behavior in the sense that it cuts across species, forms of behavior, and historical epochs. An outgrowth of Open Systems Theory, with its widely known concepts of inputs, throughputs, outputs, feedback, homeostasis, and entropy, LST is an interdisciplinary framework that integrates all of the biological and social sciences from cellular biology to international relations. LST is biological, social, evolutionary, and applicable to individual organisms as well as a spectrum of social entities.

…there are parallel structures and processes as we move up the scale from the cell to the organization of societies.

According to LST, after life originated on Earth 3.8 billion years ago, it evolved from single-celled organisms to increasingly complex biological and social forms. These are, in ascending order: cells, organs, organisms, groups, organizations, communities, societies, and supranational systems. In the course of this evolution certain structures and functions maintained their identities, although specific manifestations changed. LST proposes that the same terms and principles can describe systems at each level, although higher-order systems may have distinctive emergent properties that are not found at lower levels. Consequently, complex systems of different scales can be disassembled into the same constituent subsystems and analyzed in terms of the same concepts and relationships. Thus there are parallel structures and processes as we move up the scale from the cell to the organization of societies. Living systems comprise 20 specialized subsystems that have distinctive structures and process matter, energy, and information. Such reductionistic building blocks seem plausible for unknown life forms.

Harrison applied a simplified version of LST involving two generic processes (matter-energy and information) to three system levels (individual, society, and supranational system) (Harrison, 1993, 1997). He used this framework to organize past hypotheses about ETI, and generate new ones. Many of the hypotheses advanced by astronomers, astrobiologists, and other SETI scientists are fully consistent with LST and are occasionally expressed in terms that are reminiscent of LST terminology. It is not entirely coincidental that Davoust (1991, p. 72) defines life as a "complex, organized open system" and that Seielstad (1989, p. 140) describes subsystems, systems, and suprasystems as a set of nested Russian dolls. Living systems theorists and SETI scientists are interested in the same phenomena and apply similar intellectual tools. Researchers from both traditions are accustomed to thinking in terms of energy, matter, and information; in terms of interconnections and systems; and in terms of microcosm and macrocosm.

As Molton (1989) points out, in the absence of probes and radio signals we are limited to what we can deduce from ourselves and our terrestrial experience, and without a logical framework we will have only random data. We can deduce a great deal from ourselves, and LST is a logical and credible framework for organizing our thinking.

Will attempts to anticipate ETI be so much wasted effort if ETI doesn't exist, or is never found? By considering the possible natures of the universe, we come to understand the actual nature of the universe. Similarly, by considering the possible nature of ETI we may understand more fully the characteristics that make us what we are (Ruse, 1985, p. 71):

Exploring the possibility of life elsewhere in the universe is full of philosophical interest. Such exploration puts a bright light on our own powers and limitations…. By speculating on what other life forms would be, we see more clearly the nature and extent of our own knowledge. Such fairy-story telling does not prove anything empirically that we do not already know, but it does force us to think again about ourselves from a novel perspective.

Our current limited success in communicating with chimpanzees and dolphins bodes ill for successful communication with off-world beings.

Preparing Communication Strategies

How can we hope to communicate with an advanced and distant society whose languages have nothing in common with ours? How can we communicate with a radically different species? Our current limited success in communicating with chimpanzees and dolphins bodes ill for successful communication with off-world beings.

Further research on interspecies communication would expand our overall knowledge of behavior as well as contribute to SETI (Baird, 1987). Similar advantages might be gained from studies of people who for neurological or psychological reasons have extreme difficulty communicating with other humans.

We should also accelerate research on interstellar languages. This work was initiated by mathematicians and physical scientists, who suggest that logic, mathematics, and the physical world offer shared reference points that will facilitate human-ET communication (Freudenthal, 1985; DeVito and Oehrle, 1990). Learning one another's languages via radio could involve very long and repetitious sequences of messages with the two cultures trading facts that they both already know long before moving the discussion into broader areas such as art, history, and social science. Yet there may be ways to speed the process of acquiring a mutual language or to initiate discussion outside of physics and math. As already noted, psycholinguist Douglas Vakoch is working on means to communicate spiritual principles (Vakoch, 1999a) and aesthetics (Vakoch, 1999b). Additionally, we might entertain the possibility of translating supercomputers, working at the highest levels of logic and currently known as "theorem proving."

Anticipating the Post-Contact World

Contact with an extraterrestrial civilization is not preordained, but it could occur at any time and with the speed of light. Contact could be a high-impact event, and, as such, it deserves serious prior thought. Anthropologist Ashley Montagu presents the case well (Berenzden, 1973):

I do not think we should wait until the encounter occurs; we should do all in our power to prepare ourselves for it. The manner in which we first meet may determine the character for all our subsequent relations. Let us never forget the fatal impact we have had upon innumerable peoples on this Earth—peoples of our own species who trusted us, befriended us, and whom we destroyed by our thoughtlessness and insensitivity to their needs and vulnerabilities.

By developing a reply policy before the fact, we will maximize our chance of framing a message that preserves our security…

We need preparation *before* confirmation of extraterrestrial intelligence. For example, it would be useful to develop reply strategies prior to intercepting an initial message. By developing a reply policy before the fact, we will maximize our chance of framing a message that preserves our security, has the support of broad segments of the population, and (if interactive communication is available) encourages a favorable response. In the absence of advance planning, anyone who has access to a powerful transmitter may attempt to speak in behalf of humanity.

Advanced preparation must proceed beyond the usual tiny groups of search advocates. Different people look to different types of leaders to ease humanity through detection and its aftermath, so it makes sense to involve politicians, military leaders, business leaders, and religious leaders as well as scientists in the planning effort. Since contact will involve all of humanity, planning groups should have broad international representation. It might make sense for the United Nations to be involved, or to convene a World Council.

Often we hear that when it comes to extraterrestrial intelligence, the only thing that we can expect is the unexpected! For this reason, it makes sense to plan for many different contingencies. Our planning efforts should include a range of search technologies (radio SETI, optical SETI, interstellar probes), openness to many different forms of intelligence, and an awareness that contact could unfold in many different ways. For example, the consequences for humanity would be very different if ETI were located in the solar system rather than in a remote part of the galaxy, or if recognition of ETI's existence took the form of a sudden insight or a slow dawning awareness. Other variables include "the other's" technological capabilities, whether or not ETI took a familiar or unfamiliar form, and our perception of ETI's perceived posture (benevolent, neutral, malevolent) toward humankind.

Failure to plan could exact a substantial price.

Failure to plan could exact a substantial price (Harrison, 1999a). The less planning, the more stress detection will place on human decision-makers. If there are few time pressures, the result may be "defensive avoidance," symptomatized by ignoring potentially important information, procrastinating, disowning responsibility, and "passing the buck" (Janis and Mann, 1985). We might expect some agencies to simply retreat beyond a veil of secrecy, "sit on the matter," and engage consultants who are better known for their demonstrated loyalty to the agency than for their expertise in shaping post-contact civilization. While these agencies dither, self-appointed groups may attempt to manage relations between human and extraterrestrial life.

On the other hand, if there are intense pressures to "do something," the response is likely to be one of hypervigilance, rather than defensive avoidance. This consists of panicky, ineffective decision-making (Janis and Mann, 1985). Under this intense pressure, decision-makers are likely to see only a small part of the overall picture. They focus on some cues and ignore others. It becomes difficult to explore a full range of alternatives and think through all of the implications. They turn first to those solutions that have worked in the past, and, once having chosen a course of action, stick with it despite growing evidence of a mistake. Hypervigilant people do not make sufficient allowance for contingencies, nor make complete plans for implementing their decisions.

Despite the advantages of planning for low-probability but high-impact events, we see very little activity. In many quarters, there is strong reluctance to take the possibility of "contact" seriously. This is understandable. Only recently have scientists assembled evidence that we may encounter intelligent extraterrestrial life. Many leaders in science, government, and industry are either unaware of this evidence or fail to appreciate its credibility. Decades of unverified reports (including honest mistakes, delusions, and deliberate hoaxes) have tainted views of the search enterprise and cooled receptivity on the part of those who should lead the effort. Even individuals who have strong personal interests may refuse to discuss the topic openly because of expected adverse reactions from their colleagues. The possibility of encountering ETI must be acknowledged more widely, and more scholars need to be brought into the loop. Panelists consider it important to involve scholars with strong backgrounds in futures studies, decision theory, decision analysis, game theory, and utility theory, as well as a broad range of social sciences and humanities (see "The Role of the Social Sciences in SETI," this volume).

…the humanities provide us with a vast set of social experiments useful for any assessment of potential impacts of contact.

Keeping in mind that human response will be scenario-specific, and that some scenarios seem more likely than others do, several areas are ripe for systematic study. First, the humanities provide us with a vast set of social experiments useful for any assessment of potential impacts of contact. Although direct physical, cultural contacts are one form of analogue often cited, the long-term impact of high-information contact provided by electromagnetic signals is more analogous to intellectual contact between terrestrial civilizations. Particularly relevant is the transmission of knowledge from the ancient Greeks to the Latin West via the Arabs in the 12th and 13th centuries (Dick, 1995), an event that led to the European Renaissance. More generally, if one accepts the claim that the biological universe is very different from the physical universe, we can study the effect changing worldviews have had on society (Dick, 1995). We can also ask how humans have reacted to past false alarms of extraterrestrial life, whether the canals of Mars, Orson Welles' broadcast of *War of the Worlds* in 1938, the mistaken belief that quasars and pulsars were interstellar navigation beacons, and reports of UFOs (Harrison, 1997). Such analogies, cautiously used, can serve as a starting point for discussion of likely similarities and differences between terrestrial and extraterrestrial experiences.

Human imagination is a rich resource for studying the implications of contact. The best science fiction gives us detailed potential scenarios for different modes of contact, ranging from *War of the Worlds* on the negative side to Arthur C. Clarke's *Childhood's End, Rendezvous with Rama* and *2001: A Space Odyssey* on the positive side. Novels such as Stanislaw Lem's *Solaris* raise yet another scenario that must be considered: contact with intelligence so different from us that it remains beyond our understanding.

If we, in fact, encounter a technologically advanced and communicative society, then the diffusion of science and technology will be a central issue.

Many of the planning efforts so far have been geared to managing the short-term response, which may range from complete apathy to rioting mobs. So far, less attention has been paid to the long-term effects of contact. If we, in fact, encounter a technologically advanced and communicative society, then the diffusion of science and technology will be a central issue (Harrison and Elms, 1990). What more can history tell us about the introduction of advanced technologies into relatively stable "disadvantaged" cultures? What are the variables that determine the acceptance or rejection of new ways? What about the problem of "culture lag," a situation that arises when the rate of technological change exceeds the rate of cultural change, with the result that there is a growing gap between technology and its human users? Massive advances in technology can create problems as well as solve them. For example, technologies that lead to the extension of the human lifespan by many years could also generate monumental environmental, economic, and psychological problems.

Reply Policy

More thought should be given to reply policy; that is, how the Earth might respond if ETI were detected. Most of the preliminary work was conducted by SETI scientists, oftentimes in committees of the International Academy of Astronautics (Michaud, 1998). In keeping with the dominant radiotelescope search paradigm, it has proceeded under the assumption that ETI will be light-years away and unaware of our existence. Under this particular scenario, we might be able to proceed at a leisurely pace, holding our reply until we are confident that we are on safe footing.

…if we do choose to reply, who replies?

Reply policy rests on three fundamental issues. The first is, should we reveal our presence to an extraterrestrial civilization? Even if "most" advanced civilizations are peaceful and beneficent, we won't know for sure about any *individual* civilization and, if ETI doesn't already know of our existence, the safest course might be to maintain a low profile. Second, if we do choose to reply, who replies? As socially enlightened members of the international scientific community, many scientists believe that the response should be made in behalf of humanity as a whole, so supranational systems such as the United Nations loom large in the discussions. Third, what should we say? The goal here is to frame a response that guarantees our own security, reassures "the other," and sets the stage for sharing knowledge.

There are two reasons why we need to develop a reply policy before actual contact. First, a leisurely pace seems less appropriate following detection of ETI in our solar system than following interception of a dial tone at a distance. Second, even if ETI is light-years away, any individual with access to a powerful transmitter may choose to reply and may retain complete control over the message. This could create an erroneous but powerful first impression that would govern the course of future relations. To forestall this possibility, Donald E. Tarter suggests that duly designated authorities should reply instantly. In the first reply the authorities would identify themselves, state that additional information will be forthcoming, and that in the interim ETI should ignore messages from all other parties (Tarter, 1997).

…hundreds of years (or more) may pass between the time that we make our presence known and the time that we receive a response.

Closely related to the issue of reply policy is that of active SETI: deliberately proclaiming our presence to an unknown civilization. As a result of our use of energy or powerful radar broadcasts, another civilization may be aware of us already. However, deliberate action on our part should increase our visibility. If our current passive strategy is successful, we can allay lingering insecurities by simply not responding. If active SETI is successful, we may find ourselves drawing the attention of an unwelcome acquaintance. Another concern with active SETI is that hundreds of years (or more) may pass between the time that we make our presence known and the time that we receive a response. A response that would delight us today may be less welcome to humanity in the year 3000.

By the dawn of the 21st century, there had been several *ad hoc* radio broadcasts and even discussions of launching a private interstellar probe. Perhaps these efforts have a very low probability of success. Nonetheless, since any one of these could affect both present and future generations, there would be an

advantage if humanity as a whole, perhaps operating through the United Nations, were able to regulate such efforts. This is unlikely because of the large number of legal and technical problems that would have to be solved in order to do this. Free speech is a part of many cultures, and given current technology it would be difficult if not impossible to suppress "rogue" broadcasts.

By the year 3000, as a result of some mixture of careful planning, trial and error, and accident, humanity may have worked through the issues of active SETI and reply policy. We speculate that at that time humanity may be quite comfortable interacting with ETI, and not at all worried about reply policy or active SETI.

Developing Educational Programs

Advanced preparation should include educational programs for preparing people for the possibility of contact. SETI provides a wonderful "hook" for engaging people in science. Properly designed educational programs can enhance people's understanding of astronomy and life sciences, as well as acquaint them with SETI and its possible aftermath. The SETI Institute's "Social Implications" report (Billingham et al., 1999) devoted close attention to this and looked to broad partnerships including planetaria and libraries as well as schools, colleges, and universities. This report also described how SETI scientists could work with the news and entertainment media to educate people and help shape public opinion. A multimedia approach can help, for example, by using the visual arts to make the extraterrestrial presence real but in nonthreatening ways.

Several education efforts are already underway. The SETI Institute's "Life in the Universe" curriculum is noteworthy in part because it is under translation into different languages to make it more accessible to the world's population. The SETI Australia Centre also has a large educational component. Relevant also are the websites and outreach programs maintained by the NASA-Ames Astrobiology Institute.

Specific target populations include the media, opinion leaders, and children.

Specific target populations include the media, opinion leaders, and children. The media must be highly informed so that it can provide high-quality coverage even in the event of rapidly unfolding developments. Politicians, scholars, business magnates, military officers, and other opinion leaders must be informed, because they will help shape the reactions of the many people who look to them for guidance. Children are important because it is they who will carry on the search, and their generation may be the first to experience the full impact of contact. As a useful spin-off, educational efforts aimed at children will help them separate science and fiction, and nudge them toward careers in science and technology.

In addition to reaching individuals, we need to reach organizations and institutions that will have much to do with managing contact and its aftermath. These include intelligence-gathering organizations, legislative and regulatory bodies, the military, the media, and professional organizations of all sorts.

Preparing Ourselves Spiritually and Psychologically

Those of us in the SETI community are self-anointed to lead the search and help manage the consequences. But are we prepared personally? According to Zen, everyone is an enlightened individual. Are we truly ready to encounter an "alien mind"? As long as we quibble among ourselves, can we consider ourselves ready for contact?

Those of us engaged in the SETI enterprise spend substantial time addressing purely scientific issues and intellectualizing the impact of contact. Perhaps it would be useful to supplement these efforts by developing inner strengths to brave confirmation and the post-contact world.

If we can't relate to our fellow human beings, how can we expect to understand beings from another part of the galaxy?

Taking our cue from the Buddhist tradition, we might spend more time in self-contemplation, becoming more at ease with ourselves and one another. If we can't relate to our fellow human beings, how can we expect to understand beings from another part of the galaxy? The qualities we seek are openness to new experience, comfort with ourselves, and sensitivity and compassion for others.

CONCLUSION

No one is sure whether or not ETI exists, and, if it exists, whether or not it will be detectable to us.

Nonetheless, growing circumstantial evidence and accelerating search technologies have marked the past four decades. Those who are willing to guess when contact will occur couch their estimates in decades, not in centuries or millennia. If their guesses prove accurate, humanity in the year 3000 will have long since discovered extraterrestrial life.

The impact of the detection of extraterrestrial life will depend upon the nature of ETI, the unfolding of the contact scenario, and the people involved. If in fact ETI meets optimistic expectations (advanced, beneficent, communicative), we speculate that following an initial period of confusion and consternation, interstellar relations will be marked by three stages. During Stage 1, humans will have strong, positive attitudes towards ETI. This will stem in part from the benefits of receiving ETI's largesse and in part from a human tendency to become emotionally enamored of older, wiser, richer, and more powerful individuals. Inevitably, at some point, ETI will fall short of our descendants' expectations. Perhaps ETI will not have the information that they want, will not be inclined to come to humanity's rescue, or will reveal something that we interpret as a serious flaw in their character or society. Or perhaps some of ETI's advice won't work, or will have hidden, undesirable consequences.

Stage 2, then, will be predominated by suspicion, cynicism, and negative emotions—all proportional to the height of the expectations generated earlier. However, if interaction continues, Stage 2 also will pass. As future generations of humanity gain more experience, they will develop a more complex picture of ETI and enter Stage 3. At that point, people will no longer view ETI as gods or devils, but as complex creatures with unique patterns of strengths and weaknesses. Humanity in the year 3000 may have mature, Stage 3 relations with many different ETI civilizations.

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