SETI, Consilience, and the Unity of Knowledge

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ABSTRACT

E. O. Wilson's recent plea for employing consilience to achieve knowledge unification focuses on linking the biological and social sciences/humanities, yet admits to only minimal progress. If and when SETI succeeds in making contact with extraterrestrial civilizations, a comparative study of these could provide a means for overcoming current barriers to linking the natural and cultural realms, and thereby promote the unity of knowledge. Keywords: consilience, unity of knowledge, SETI, extraterrestrial civilization.

Forty years ago, the physicist-turned-novelist C. P. Snow published *The Two Cultures and the Scientific Revolution*,[1] in which he complained how intellectual life was increasingly being split between two cultures, that of the natural sciences and that of the literary disciplines. One of the main criticisms of Snow's work was not that he exaggerated the intellectual fragmentation of his day, but that he oversimplified it by focusing on literature to stand for all the humanities, and, above all, by ignoring the social sciences.[2] Recently the distinguished biologist Edward O. Wilson has revisited the gulf between academic cultures in *Consilience: The Unity of Knowledge*,[3] a book in which he makes an earnest plea for a return to the Enlightenment ideal of the unity of knowledge by building bridges across the divide between the natural sciences on the one hand, and the social sciences and humanities on other hand.

Consilience, the means Wilson chooses for working toward unity, is an obscure term coined in 1840 by William Whewell, a Victorian polymath who has also been credited with introducing, or at least popularizing, such better-known neologisms as *physicist* and *scientist*.[4] Wilson describes consilience as "literally a 'jumping-together' of knowledge by the linking of facts and fact-based theory across disciplines to create a common groundwork of explanation." He also quotes Whewell's more formal explanation: "The Consilience of Inductions takes place when an Induction, obtained from one class of facts, coincides with an Induction, obtained from another class of facts. This Consilience is a test of the truth of the theory in which it occurs."[5] As a "modest example" of consilience, Wilson offers his own work from the 1950s, in which he collaborated with a chemist and a mathematician to establish the chemical means by which ants communicate alarm signals.

To test the hypothesis that ants transmit the signals chemically rather than by sight or sound, Wilson first dissected freshly killed worker ants to obtain organs that might contain chemical releasers, now known as pheromones. He then presented the crushed organ tissue to groups of worker ants, and learned that two particular glands were active in the sense that the worker ants were galvanized into action by pheromones apparently released from the tissue. Wilson then recruited a chemist to analyze the extremely small organic samples that presumably contained the pheromones.

Using gas chromatography and mass spectrometry, the chemist identified the active substances as a medley of compounds. He then obtained samples of identical compounds that had been synthesized in the laboratory to guarantee their purity, and these were presented in minute quantities to the ants. That the same responses were obtained as in the first experiments confirmed that the compounds identified were the alarm pheromones. The next step was to involve a mathematician to construct physical models of the diffusion of the pheromone molecules, and then to use both the models and experiments to measure the rate of spread of the molecules and the sensitivity of the ants to them in order to establish with some certainty that workers release evaporated pheromones in order to communicate.[6] To Wilson,

reductionism is the cutting edge of science, involving "the breaking apart of nature into its natural constituents" and then the folding of "the laws and principles of each level of organization into those at more general, hence more fundamental, levels."[7] In isolating the pheromone compounds, and then tracing how these are diffused to transmit alarms, he and his colleagues were able to reduce the communicative behavior of ants to the molecular level, bringing it into the realm of physics and its laws.

Wilson considers that a high degree of consilience has been achieved only in the natural sciences, notably in physics, chemistry, and some branches of biology, and he points out that among these fields such hybrid domains of research as chemical physics, physical chemistry, molecular genetics, and chemical ecology are becoming commonplace. Although he laments that consilience has yet to link the natural sciences with the social sciences and humanities, he nonetheless views the boundary between them "not as a territorial line but as a broad and mostly unexplored terrain awaiting cooperative entry from both sides."[8] Given his previous work in advocating the new discipline of sociobiology, as well as the study of gene-culture coevolution,[9] it is not surprising that he believes that biology is best situated for bridging the gap between academic cultures:

We know that virtually all of human behavior is transmitted by culture. We also know that biology has an important effect on the origin of culture and its transmission. The question remaining is how biology and culture interact, and in particular how they interact across all societies to create the commonalties of human nature. What, in the final analysis, joins the deep, mostly genetic history of the species as a whole to the more recent cultural histories of its far-flung societies? That, in my opinion, is the nub of the relationship between the two cultures. It can be stated as a problem to be solved, the central problem of the social sciences and the humanities, and simultaneously one of the great remaining problems of the natural sciences.

In Wilson's view, since culture is created by the communal mind, and each mind in turn is the product of the genetically structured human brain, genes and culture are inseverably linked. Nonetheless, he admits that the exact ways genes and culture interact elude us. For instance, take the incest taboo prohibiting mating with close kin. Wilson highlights it as one of the best-documented instances of gene-culture interaction, but also as an example of how we do not yet fully understand that interaction. As anthropologists have long pointed out, this prohibition is a human universal that appears to have a natural basis, though one not necessarily mediated by a conscious realization that close-kin matings are more likely to result in unhealthy children. In careful studies that took advantage of natural experiments performed in different cultures in which unrelated boys and girls were regularly reared together from infancy, anthropologists have demonstrated that when these children mature they have no sexual interest in one another, resist being forced into marriage, and if so forced, have high adultery and divorce rates. Yet the physical basis for this aversion has yet to be discovered. Also, there remains to be answered the question of why, if there is a natural basis for avoiding close-kin mating, is there any need for explicit incest taboos. Furthermore, it is apparent that these taboos are culturally molded rules that vary widely from group to group in terms of the categories of kin included, and may even be reversed in some highly stratified cultures, such as those of ancient Hawaii and Egypt, in which elites were encouraged to mate with close kin, ideally full siblings.[10]

Not only is human gene-culture interaction proving to be difficult to unravel, but many humanists and social scientists object to what they call "reductionist" attempts to "biologize" human phenomena.[11] As adherents of Descartes' mind-body dualism, they regard culture as the superorganic product of the mind and not at all reducible to biology. In addition, some biologists charge that in the rush to link culture and biology, theorists err in regarding increasing complexity as inevitable, and in attempting to analyze cultural change in terms of Darwinian evolution.[12] Furthermore, attempts to find a biological basis for human behavior are also resisted on the grounds that such research leads to the labeling of certain races or classes as genetically inferior.[13]

At first glance, SETI (the Search for Extraterrestrial Intelligence) might not seem to have anything to do with employing consilience in the quest for knowledge unification. (Historians of science will also note that Whewell was a vigorous opponent of the "plurality of worlds" hypothesis.[14]) However, even though its technical roots are in physics and astronomy, and natural scientists have led its development, I argue that SETI has the potential for playing a major role in transcending intellectual boundaries.

Consider the primary question that SETI seeks to answer: Are there extraterrestrial civilizations? This is an old concern. Hypotheses about other populated worlds can be traced at least as far back as the Democritus, Lucretius, and other early thinkers.[15] Now, with radio SETI well underway, planet discoveries becoming almost routine, and new initiatives for detecting microbial life beyond Earth in the works, the scenario of cosmic evolution—from the Big Bang through the formation of galaxies, stars, and planets to the rise of life, complex life, and intelligence—has become what historian Steven Dick calls the "cosmological worldview" of our age.[16] That we can model such a grand evolutionary sequence, and also test parts of it, would have delighted the luminaries of the Enlightenment, for cosmic evolution links physical, biological, and cultural knowledge on a truly cosmic scale.

Whereas four decades ago Snow despaired that he could find no place where the two cultures meet, a decade ago I did not hesitate to claim that SETI is one field initiated and led by natural scientists that readily invites participation by specialists from the social sciences and humanities.[17] Since then a number of anthropologists, psychologists, sociologists, historians, philosophers, theologians, and others from across the cultural divide have participated in the SETI endeavor.[18] To be sure, they have primarily worked on such activities as examining the premises behind search strategies, considering methods for interpreting any messages received, developing procedures for breaking the news of contact, and formulating a reply, and have not been directly involved in designing search instruments and algorithms, and then actually conducting the search. Nevertheless, whatever the division of labor, this participation in SETI of specialists from disciplines scattered across the two intellectual cultures could be setting the stage for a grand experiment in consilience.

At the beginning of his book, Wilson notes that although astronomy, geology, and evolutionary biology are primarily historical disciplines linked by consilience to the rest of the natural sciences, human history stands apart as a branch of learning in its own right. "But," Wilson then rhetorically adds, "if ten thousand humanoid histories could be traced on ten thousand Earthlike planets, and from a comparative study of these histories empirical tests and principles evolved, historiography—the explanation of historical trends—would already be a natural science."[19] Although Wilson did not develop this idea, as an anthropologist sometimes involved with SETI I cannot resist exploring it further. Let us assume that during the 21st century, contact is made with a number of extraterrestrial civilizations occupying star systems arrayed around our own, and that through concerted efforts lasting many generations, if not centuries, meaningful communication is eventually established with at least some of these civilizations. This would not require that extraterrestrials be humanoid in the literal sense of the word, but only that there be sufficient convergence in intelligence, technology, and epistemology so that sharing of knowledge would be possible. We would then be in a position to learn about other biologies, societies, and cultures, as well as the ways extraterrestrials do science.

Such an endeavor would surely involve a wide array of specialists from a variety of disciplines, including new ones developed especially to meet the challenge of *learning* about extraterrestrials, as distinct from *detecting* them. Yet no matter how interdisciplinary this effort might be, it would have to go beyond the descriptive level if anything like the consilience Wilson calls for is to be achieved. To be sure, detailed descriptions of each civilization, natural/cultural histories if you will, would be valuable additions to any *Encyclopedia Galactica*, but without further analysis the real opportunity would be lost.

A science of civilizations is required, one that would compare and contrast a wide variety of independent cases in order to suggest hypotheses, which then could be multiply tested in order to investigate how diverse societies and cultures developed from their respective biological bases and how these in turn are linked to fundamental physical laws and principles. That might seem like a tall order for a species that is making such slow progress in unifying knowledge on its home planet. Yet one main reason for this may be simply that we are seriously handicapped by having only one case to study of the origin of life and then the development of complexity, intelligence, culture, consciousness, and all that. How far would the study of stellar evolution have proceeded if we could have investigated only our own star? Or the study of the planetary formation if Earth was the only planet we knew? 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 parochialisms as regarding ourselves as the summit and final goal of evolution, or resisting the exploration of links between human culture and

its biological roots. But would such a brave new metadiscipline be able to analyze dispassionately civilizations that might be repugnant to basic human values and experience?

Consider, for example, the possibility of encountering post-biological civilizations. Those who look forward to the day when humans will be replaced by immortal electronic machines would, of course, be delighted to learn from any civilizations composed of such creations—if they indeed exist. In contrast, most humanists, and—judging from Wilson's last sentence in *Consilience* wherein he warns against surrendering our genetic nature to "machine-aided ratiocination"—many biologists as well, would probably be repelled by machine ETs.[20] Just as anthropologists had to overcome ethnocentrism and adopt a stance of cultural relativism in order to study the myriad of human cultures and societies here on Earth, so may those who would dare to compare and contrast all nature of extraterrestrials have to be prepared to recognize and suspend their own biocentrism.

What about the shock of discovering extraterrestrials so far in advance of us that they seem godlike in their powers and intellect? When in the 1970s the Nobel laureates Wald, Ryle, and Lederberg warned that radio contact with advanced civilizations would devastate the human spirit, what they really seem to have had in mind was that learning all the secrets of nature from mature extraterrestrials would ruin the game for scientists.[21]

Such a view leaves out exobiologists, as well as adventurous anthropologists, political scientists, and other social scientists who would probably delight in having advanced civilizations to study, and perhaps also to assess as models, good and bad, for charting our own future development. Furthermore, those physical scientists willing to swallow their pride and undertake comparative science studies would be in a position to answer such fundamental questions as whether there is only one way of doing science or many. It could also turn out, as Konstantin Tsiolkovsky once optimistically suggested, that even if older extraterrestrials considered us young and childlike, they would nonetheless welcome us as newcomers who might bring to the community of advanced but jaded civilizations new solutions to the problems of existence.[22]

What if total consilience, which Wilson characterizes as the linking of all knowledge on the basis that "nature is organized by simple universal laws of physics to which all other laws and principles can eventually be reduced," proves to be an unattainable dream? He himself readily admits that consilience is a transcendental worldview rather than a science, and that it is probably an oversimplification and one day may even be proven to be wrong.[23] Perhaps, as many social scientists and humanists suspect, there are limits to the reductionism that has been so central to progress in the physical sciences. Although Wilson calls for multiple forays from both sides into the uncharted territory between the two cultures, he rejects entry by one of the main methodological contributions of social science, that of the holistic approach to sociocultural phenomena.[24] Yet at least one natural scientist also interested in unifying knowledge, Eric Chaisson, has pointed out that proposed research on cosmic evolution embodies a holistic approach that refreshingly contrasts with the myopic tendencies of reductionist science.[25]

Finally, what if all SETI efforts, from current radio and optical searches to future interstellar probes and piloted reconnaissance missions, fail to turn up any signs of advanced extraterrestrial life in our sector of the galaxy? However sobering such a discovery 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's spreading throughout that region. Let us further imagine that through learning how to settle on and around various planets and smaller bodies of our solar system, and the development of powerful space drives and multigenerational 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.

Such an endeavor might not have all the cosmological glamour and consilient potential of a discipline devoted to analyzing autochthonous civilizations. But it would have the advantage of methodological control, for each new outpost would spring from the common biocultural base of terrestrial humanity. Moreover, it would also provide good practice for if and when extraterrestrials living elsewhere in the galaxy are eventually contacted.[26]

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