

The Diminished Charge on the Intellectual Electric Fence

by John Cairns, Jr.

Abstract

The divide between the two cultures (scientific and inductive/literary and deductive) identified by C. P. Snow has diminished appreciably in the last 40 years. Cultural exchanges may not be as effortless as they were in much earlier periods, but they have improved and are still improving. At its worst, the separation of the two cultures was unfortunate, but not a threat to the survival of human society. Toward the end of this century, two new cultures have emerged with dramatically different views of the relationship that *Homo sapiens* has with natural systems. The "environmentalists" believe that humans are a part of natural systems and depend upon them to keep the planet habitable. The "exemptionalists" believe that intelligence, creativity, and technology can free human society from the biophysical laws of nature that restrict other species. Economic and political forces tend to keep these two new cultures farther apart than the cultures described by Snow. A position of compromise seems very unlikely. The general public and political leaders seem mostly unaware of these two cultures, but global practices are dominated by the economic growth exemptionalist model. At the very least, literacy on these issues should be raised to the degree essential for an informed choice.

This time, like all times, is a very good one, if we but know what to do with it.

— Ralph Waldo Emerson

Introduction

John Cairns, Jr. is University Distinguished Professor of Environmental Biology in the Department of Biology at Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

For over half a century, I have been a cautious traveler through the zealously defended specialized tribal units of academe. This exciting, but often stressful, journey was not initially of my own choice. I began by majoring in a conventional tribal unit (biology) with a minor in two reasonably friendly tribes (chemistry and physics). In graduate school, I enrolled in a major sub-tribe (zoology). At the end of my first year of graduate school, Ruth Patrick offered me a position as a protozoologist on one of her two river survey teams at the Academy of Natural Sciences in Philadelphia, Pennsylvania. The study covered the effects of pollution upon an entire river system rather than just a particular species, genus, or family of organisms. The team interacted with engineers, chemists, and regional planners, as well as industrial personnel, elected officials, regulatory officials and even the news media. Reducing environmental pollution was socially valuable and scientifically challenging! In an era where graduate assistantships were almost unheard of, I was even paid. What more could one want? As a bonus, my efforts were considered quite satisfactory for an M.S. thesis. C.P. Snow's seminal volume on the two cultures had not yet appeared, so it was a great shock to find that many of my peers did not congratulate me on my good fortune. I was shocked further when I encountered the view that research was either "pure" or "applied."

Cross Culturalists

Moving from one culture to another (scientific to literary/inductive to deductive) is easier than one might think. However, one must project the new tribal role convincingly. The Society of Friends (Quakers) distinguishes between birthright members and convinced members, which is an appropriate but not prejudicial view of a cultural change. Unlike the Quakers, those who have changed academic disciplines are often more aggressive champions of disciplinary purity than those who remain

in their original disciplines. I know and respect individuals who have switched from economics to urban and regional planning, law to economics, etc. but who are quite tolerant, even supportive, of those exploring the interfaces between and among disciplines, however, these individuals seem to be the exception rather than the rule. Many people who have switched disciplines are stalwart defenders of disciplinary purity (in the new discipline) despite the illogic of this position.

Pseudo-Cross Culturalists

The increased flow of extramural funding into interdisciplinary programs, particularly those related to the environment, has resulted in a number of classical disciplines hiding behind an interdisciplinary facade in order to acquire grants. One of the classic forms of this deception has been to add a descriptor to the original designation -- Department of X and Environmental Sciences. To distinguish between facade and an enlarged scope, one must examine each faculty member's publications and professional memberships to determine how many are in a specialized discipline and how many are in professional journals that are predominantly environmental. In some cases, there is substance behind the name change, but the device of adding to an existing name is generally easier than launching a new department in an era of decreased educational funding. Regrettably, this maneuver is often a panic response to declining enrollment and it is often temporarily "successful" because prospective students and their parents do not investigate the department and the facade serves its purpose.

Another variation in an era of austere funding is to collect a group of small disciplinary entities under an umbrella of "interdisciplinary studies." Again, prudence requires a check of each faculty member's publications, professional memberships, and the like to determine the percentage of participants who are truly interdisciplinary. An aggregation of individuals with strong disciplinary bias does not an interdisciplinary center make. On the other hand, most such entities must start small and develop gradually. They deserve encouragement and support, and those designed as graveyards for out-of-favor disciplines will soon fade away.

A third ploy for appearing interdisciplinary is to establish an applied journal with a title that does not sound too applied. This rather transparent maneuver

benefits both cultures. The applied authors who publish in the journal acquire more status and theoreticians do not lose face. I regard this as a sound move to make the transition to consilience less traumatic.

Closet Multiculturalists

At a national and international level, it is amazingly easy to avoid cultural conflicts. For my entire career, I have been fascinated by protozoan community structure and function. Publications in this field are read by those with similar interests but usually by few others. I recently received a letter from a colleague at another institution commenting how one's interests change with retirement. He had just encountered a publication of mine in toxicology -- a field in which I have been publishing since the early 1950s. Even when this cultural anomaly is discovered, the discoverer finds a charitable explanation -- in this case that my interests have changed after retirement. But in order to be accepted in a specialized journal, one must usually maintain the focus of that publication. In short, one must invest time in acquiring the tribal language and rituals of each culture. Some months ago, I was invited to submit a manuscript for a major anniversary of a particular interest journal. It seemed appropriate to show the consilience of this field with a number of issues of importance to human society. One reviewer thought the manuscript satisfactory and recommended publication. The second strongly opposed publication and remarked that the paper appeared to be an address (possibly at a banquet) to a learned society. I regarded this as a compliment, but it was clearly not so intended. The second reviewer concluded that, if published, the article might do no harm. Clearly, the second reviewer felt the article had some merit--it was viewed as an address to a learned society. But it was clearly outside of that journal's culture, at least in the second reviewer's opinion. The editor chose to publish the article. But such an article is definitely not appropriate for someone wishing to remain a closet academic multiculturalist. It is possible to appear to have a specialized approach, while promotion and/or tenure are a problem, and still function in an interdisciplinary mode if one is careful.

Consilience and Sustainable Use of the Planet

As Cellini (1993) notes, the topics raised by Snow

are not the exclusive property of any one discipline. Arguably, the most effective solution for most for the world's major problems precludes confining any one of them to academic pigeonholes. This need for interdisciplinary thinking is particularly true of the quest for sustainable use of the planet, which reached public consciousness with the report of the World Commission on Environment and Development (1987). But predictably, special interests have dominated the field as evidenced by the reports on sustainable agriculture, transportation, energy, cities, fisheries, water supply, and the like. An uncharitable person might assume that the primary purpose was to ensure the perpetuation of the special interests rather than leaving a habitable planet for future generations. Some books on subsidies (e.g., Myers and Kent, 1998), which document the large amounts of money involved, provide persuasive economic evidence to support this view. Perhaps in such cases, the financial motivation is more important than cultural differences.

Proliferation of the Cultures

Collini (1993) remarks that, in place of the old apparently confident empires depicted by Snow, the map shows many smaller states with networks of alliance and communication between them that crisscross in complex and sometimes surprising ways. I agree with this statement entirely, hence the rifle of this paper. These largely self-contained "tribal" units each has its own language, rites of passage, journals, annual meetings, and geographic territory on an academic campus that preclude cultural exchanges. The tribal identities are both acknowledged and preserved by the use of the terms "multidisciplinary" and "interdisciplinary" rather than "transdisciplinary." One hope is that students would rebel against the resultant compartmentalization, but colleagues in many institutions tell me that students focus on the courses they perceive will result in a professional position and tend to ignore the other courses. Of course, some exceptional students have broad interests, but these are hampered in large introductory courses by diminished civility toward both fellow students and faculty as evidenced by talking in class, late arrivals, early departures, and other distracting behaviors. The biggest threat to cultural barriers is an awareness of and respect for the attributes of other cultures. An uncivil environment does not facilitate development of such awareness and respect.

For faculty, other difficulties also exist. Effective communication with those in other disciplines is hard, time-consuming work. More emphasis on increased teaching does not encourage learning about other disciplines. Of course, some faculty would not bother with other academic cultures, however much time was available. But others would. Academic institutions must find some way to permit communication among disciplines for those who wish to do so without penalizing those who do not. Perhaps this would be an effective use of the traditional sabbatical, which is increasingly threatened in a variety of institutions.

Time management problems are not new despite efforts of many professionals to act as if they have just appeared. As Wilson (1998) remarks, an academic career requires 40 hours each week for teaching, advising, committee service, and the like. An additional 20 hours are needed to conduct respectable research, and another 20 hours will result in really important research. Merely putting in the time does not ensure success. Creativity requires focus, even addiction, in order to make an important discovery. Time management is difficult enough, even within a subdiscipline, and requires massive effort to achieve desired results even in a modest multidisciplinary outlook, which is why Wilson's observation on time is so important. What might inspire individuals to aspire to an operational level of competence in more than one academic culture?

As Collini (1993, p. iv) observes, outsiders tend to see uniformity in other groups and find distinctions within their own. Legislators and the general public often view faculty of institutions of higher learning in this way (e.g., high pay, little work). Wilson (1998), viewing the system from the inside, characterizes it as a series of petty fiefdoms. Both views **have** merit. Even religious organizations espousing racial, economic, and other forms of diversity end up being predominantly all white or all black and of a relatively modest economic range. It is simply too much work to convert "creed" to "deed." Even when a predominantly black and a predominantly white congregation agree to a "sister congregation" relationship, the outcome is usually unsatisfactory. Achieving desired results is simply too much of an effort on a continuing basis for most people. This statement is not intended to denigrate such efforts, but rather to recognize that individuals feel most comfortable with others of their own "culture,"* whatever that might be,

because they can relax most completely with those sharing a common experience base. This division is why most academics cannot communicate well with the general public. Those who can, such as Carl Sagan, are often accused of shallow scholarship by their colleagues (e.g., Diamond, 1997a).

Given these obstacles, why are there so many examples of consilience (e.g., Wilson, 1998)? The most important reason is almost certainly simple curiosity -- the creative mind is usually not confined by tribal boundaries. Second, the rewards are always greater, per unit of time spent, in relatively unexplored territory. However, publishing a discovery made in the comparatively unexplored area between disciplines is another matter entirely, as I found when working with an optical physicist, Silvero P. Almeida, on the use of laser holography to identify diatoms (e.g., Almeida et al., 1978, Cairns et al., 1982). Journals in each field thought there was too much "extraneous" material from the other field. Once the basics were published, it was easier for future publications to cater to specialized interests.

A third reason for transdisciplinary work is funding. It is generally easier to get funding to solve problems of interest to a wealthy someone else than to solve problems primarily of interest to the researcher only. A high percentage of such problems transcend disciplinary boundaries. Most research requires extramural funding. When asked to define academic freedom, Isaac Asimov is reported to have replied "extramural funding." Outside funding protects one, to a degree, from local tribal politics and, if it does not, it at least enhances mobility. Funding definitely enables a researcher to attract the cream of the graduate student crop, who can always find someone to pay for their thesis or dissertation research. All other aspects being equal, graduate students are more likely to pick a major professor who can also pay for page charges, reprints, trips to professional meetings, and other means to make potential employers and the larger academic community aware of their research. This attraction is enlightened self-interest and increases the probability that the graduate student will be a credit to the major professor. In my opinion, funding can also dramatically speed up the development of a collegial relationship between graduate student and major professor, since both have a high stake in the outcome of the funded research. It is worth noting that much funding that once went to interdisciplinary teams is now going to

multidimensional professionals who are capable of the interfaces between disciplines.

A significant portion of my research (and, of course, student research under my direction) for half a century was funded by people who had problems they wanted solved. The ones I agreed to tackle were fascinating ones that would otherwise not have occurred to me. For example, would fish avoid heated wastewater discharges from a steam-electric power plant (late 1940s and 1950s)? Or decades later, how does one keep an exotic species (the Asian clam) from fouling a power plant cooling system? Both involved various kinds of engineers, attorneys, regulating personnel, chemists, corporate executives, fishermen, toxicologists, fisheries and wildlife professionals, journalists, and local citizens. Cultural and disciplinary differences were not obstacles to gathering evidence on a problem of interest to all. Of considerable importance to me was the written assurance that the results could be submitted to a peer-reviewed professional journal -- whatever the outcome. This assurance required a considerable amount of mutual trust, which developed gradually over years of working together. The main point here is that only a few such relationships are possible at any one point in time. Furthermore, the trust was personal, not institutional, and had to be developed accordingly when new people appeared. New movements in biotechnology, where patents etc. are involved, are rapidly reducing these agreements. This scenario, regrettably, is true of other areas as well.

Convergence

As Eisenstadt and Schluchter (1998, pp. 2) note, theories of modernization and of modernity, as formulated in the 1950s and 1960s, were based on the assumption of convergence. It was believed that modernization would wipe out cultural, institutional, structural, and mental differences and, if unimpeded, would lead to a uniform modern world. As human society nears the end of this century, there is much to diminish the confidence in the principle of convergence. Worse yet, there is a dangerous paradigm in its place.

The Economic Growth Paradigm

Human society has essentially turned to the economic growth model to solve all problems related to the human condition such as poverty, malnutrition,

overpopulation (higher income families have fewer children), housing, cultural differences, education, and the like. Absent military conquest, economic growth is perceived as the only viable means for a country to sustain increases in national wealth and living standards. Some developing countries feel that a 7 percent annual economic growth rate, for the next decade at least, is the minimum necessary to provide enough jobs and improve the human condition. This growth rate means doubling the economic level in 10 years in countries where environmental damage is already severe. Nevertheless, people in developing countries aspire to the level of affluence in developed countries, most notably the United States. However, the ecological footprint (i.e., the productive land needed to support each individual with existing technology) is 5 hectares (1 hectare is 2.5 acres) in the United States and 3.5 hectares in Europe. In many developing countries, the figure is less than 0.5 hectare per individual. Raising the entire world to levels of affluence in the United States would require three planet Earths. But, optimistic economists state that human ingenuity and technology make resource limitations obsolete (e.g., Myers and Simon, 1994). According to them, carrying capacity applies to other species, not humans. Those espousing infinite growth on a finite planet have ignored a very important component of risk analysis. The precautionary action principle espouses precautionary action even in the face of high uncertainty if the consequences are likely to be unacceptable or severe.

The Precautionary Principle

Over the last decade, the principle of precautionary action has been emerging. On January 23-25, 1998, an international group met at Wingspread in Racine, Wisconsin, and formulated four parts to the principle of precautionary action.

1. People have a duty to take anticipatory action to prevent harm.
2. The burden of proof of the harmlessness of a new technology, process, activity, or chemical lies with the proponents, not with the general public.
3. Before using a new technology, process, chemical, or starting a new activity, people have an obligation to examine 'a full range of alternatives,' including the alternative of doing nothing.
4. Decisions applying the precautionary principle

must be 'open, informed and democratic' and 'must include affected parties.'

These parts can be less elegantly stated as "Better safe than sorry," "Look before you leap," and "An ounce of prevention is worth a pound of cure." The compartmentalization of "the two cultures" identified by Snow, or Wilson's (1998) petty academic fiefdoms, will likely continue -- possibly somewhat weakened -- until some extraordinarily compelling reason exists to make consilience essential; for example, the destabilization of human society as it is presently known.

Dominance or Esteem

The degree of dominance that *Homo sapiens* has achieved over natural systems in the last century is dramatically greater than when humans first successfully domesticated biota in a few parts of the planet (e.g., Diamond, 1997b). In evolutionary time, this degree of dominance is a new situation. Moving beyond dominance of nature to respect for the integrity of natural systems in the absence of perceived consequences for not doing so will require a dramatic change in the relationship between academic cultures. If unmistakable consequences are required to precipitate this change, both human society and natural systems will suffer greatly. If irreversible damage has not occurred, human society will have the opportunity to progress in its relationship with natural systems.

What if the Exemptionalist Model is Wrong?

In science, the validation process is a *sine qua non*, but there is no comparable assurance that "humans are exempt from the laws of nature" is a valid assumption! Exemptionalists believe that human technology, creativity, and ingenuity exempt our species from the iron biophysical laws of nature that limit other species. Wilson (1998) has even facetiously named this new species "Homo proteus" or "shapechanger man." Wilson lists these among the cultural attributes: "Indeterminately flexible, with vast potential. Wired and information driven. Regrets the current loss of nature and all those vanishing species, but it's the price of progress and has little to do with our future anyway." There is no robust validation of the assertion that human society is not dependent upon other creatures for the services provided

by the ecological life support system. Continuing most forms of exponential growth on a finite planet almost certainly involves serious risks. If the global average of children per woman dropped to 2.1, there would still be nearly 8 billion people on the planet in 2050 and 8.5 billion in 2150. At 2.2, population would peak at 12.5 billion in 2050. And, at present, approximately 1.3 billion (or 1 in 5) people have cash incomes of less than US \$1.00/day. The slightly more affluent group of 1.6 billion above them would have incomes of US \$1-3.00/day. These two groups are already a destabilizing force because of starvation, malnutrition, and discontent. They represent over 0.4 of Earth's population, and a global recession could vastly increase their proportionate numbers.

Further Diminishing the Charge on the Intellectual Electric Fence

Anyone paying modest attention to the history of World War II is well aware of interservice rivalries that persisted, even when the outcome was uncertain (e.g., Astor, 1995). Those willing to transcend petty territorial conflicts and take great risks can achieve results dramatically disproportionate to their numbers (e.g., Lord, 1977). Sustainable use of the planet, if possible, will not be achieved in a climate of cultural or disciplinary isolation. Consilience has occurred and is occurring, but not to a degree adequate for addressing problems of the human condition in the first half of the next century. Consilience cannot flourish in a climate of ethnic and religious conflict and other forms of social unrest. Exponential growth and the consequent rapid doubling times bring on crises more rapidly than the social system can handle them. Money, energy, and resources then flow to address the symptoms rather than the causes. Floods, for example, are caused by such factors as deforestation, loss of wetlands, increases in impervious surfaces, and climate change. The effects are exacerbated because humans colonize flatland flood plains and attempt technological solutions (e.g., levees, channelization) rather than developing new social contracts.

Snow's lectures and writings on the two cultures have provoked much academic debate and discussion. Wilson's *Consilience*, a search for a common system of knowledge, provides hope that human society may achieve sustainable use of the planet in the next century. It has been 40 years since Snow's ideas appeared, and

human society has, arguably, 40 years to achieve sustainability.

The way humans manage the use of natural resources is a paradigm for the way they structure their societies. The way they respond to the extinction of life forms is a reflection of the value they place on the quality of life of future generations. Arguably, the determining feature of the time is the way in which humans preserve resources and ecological capital for future generations. Links exist between justice and human society's relationship with natural resources.

[Acknowledgements: I am indebted to Amy Ostroth for transcribing the handwritten first draft of this manuscript into the word processor and to Darla Donald for editing it for this journal. indebted to Alan Heath and Bruce Wallace for comments on the first draft.]

REFERENCES

- Almeida, S. P., Case, S. K., Dallas, W. J., Lai, P. F., Fournier, J. M., Cairns, S., Jr., Dickson, K. L., and Pryfogle, P. 1978. "Pattern recognition of biological specimens via matched spatial filtering." *J. Appl. Photogr. Eng.* 4(1):28-30.
- Astor, G. 1995. *Operation Iceberg: The Invasion and Conquest of Okinawa in World War II*. New York: Donald L. Fine, Inc., 480 pp.
- Cairns, J., Jr., Almeida, S. P., and Fujii, H. 1982. "Automated identification of diatoms." *Bioscience* 32(2):98-102.
- Collini, S. 1993. "Introduction." In C. P. Snow, *The Two Cultures*. Cambridge, United Kingdom: Cambridge University Press, pp. xiii.
- Diamond, J. 1997a~ "Kinship with the stars." *Discover* 18(5):44-45.
- Diamond, J. 1997b. *Guns, Germs and Steel*. New York: W. W. Norton & Company, 480 pp. Eisenstadt, S. N. and Schluchter, W. 1998. "Introduction: Paths to early modernities -- A comparative view." *Daedalus* 127(3): 1-18.

Lord, W. 1977. *Lonely Vigil: Coastwatchers of the Solomans*. New York: The Viking Press, 272 pp.

Myers, N. and J. L. Simon. 1994. *Scarcity or Abundance: A Debate on the Environment*. W. W. Norton & Company, New York.

Myers, N. and J. Kent. 1998. *Perverse Subsidies: Tax \$s Undercutting Our Economies and Environments Alike*. International Institute for Sustainable Development, Winnipeg, Manitoba, Canada.

Wilson, E. O. 1998. *Consilience: The Unity of Knowledge*. New York: Alfred A. Knopff Publishers, 332 pp.

World Commission on Environment and Development. 1987. *Our Common Future*. Oxford University Press, Oxford.