

EXTENSIONAL ORIENTATION AND THE ENERGY PROBLEM

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LANGUAGE HABITS can outlast the circumstances that produce them. This can impede adaptation to changed circumstances. When homo sapiens was a much less numerous species and when our ability to exploit the resources upon which our lives depend was much less developed than today, word-maps arose that now obstruct recognition of the way we have painted ourselves into a corner. Mankind has an urgent need to grasp the serious discrepancy between certain obsolete language habits and the true characteristics of the situation they misrepresent just as truly, however, there is a need to avoid the opposite error. We must not suppose that all would be well for mankind if we could just learn to say the right words to each other. That misconception, too, has obscured for some of our contemporaries the situation actually facing mankind today. It is folly to suppose that Charles Reich's "Consciousness III" (13) or some other purely mental reorganization will suffice to achieve revolutionary improvement of man's lot in this world. The task of general semantics is a

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delicate one; it must focus on the power of language to shape perception and behavior, but it must avoid an obsessive supposition that linguistic factors are exclusive determinants of human experience.

The reason our use of language is such a fundamental fact about our species is that it gives us a more intricate capacity than any other species has for sharing the facilities of each other's nervous systems and for evolving and using a cultural heritage, or what Korzybski called "time binding." (7) This capacity is what has enabled man to elaborate his *intraspecific* division of labor (and thus his power to transform the world) beyond anything achieved by any other single species — and almost beyond the most complex *interspecific* webs of symbiosis observed in nature. The most sophisticated students of general semantics have understood this and have not dealt merely with the pitfalls of verbalization.

Semantic failures do occur, but they are best seen as malfunctions — a form of social pathology whose causes, consequences, and varying incidence merit serious study. But when general semantics is pursued with a cult-like interest, there often develops a more supercilious attitude toward language, implicit in the apparent belief of some that word-maps are *inherently* dysfunctional, that all words always deceive.

In an age of increasingly pressing ecological constraints, *Homo sapiens* is ill-served (and so is general semantics) by supposing that the fallibility of word-maps implies that any choice among them is purely and inevitably arbitrary (and that the territory mapped out is therefore essentially fictitious). Yet that solipsistic sort of philosophy seems alarmingly fashionable among university students in the 1970s. It is one expression, perhaps, of an anti-intellectualism fostered partly by the social disillusionment of the Vietnam War years and, more subtly, by the discovery of facts we are reluctant to face about man's relation to the biosphere.

Nature's Dictionary

When we come to grief from following an obsolete word-map, it is more rational to seek an updated word-map than to over-generalize and deplore the apparent futility of word-mapping. When we say language habits can become obsolete, we must remember that obsolescence is a relation, and relations can exist only between two (or more) entities. Thus a word-map can be obsolete only in relation to some specifiable territory having specifiable features. It is as important to study the changed circumstances constituting the territory as to study the social history of the word-map that has lost whatever correspondence it once had with reality.

Both sides of the relation are considered in the following suggestive statement: “Words like *limitless*, *inexhaustible*, and *boundless* figure prominently in the present debate about the earth and its resources. They are persistently used despite the fact that they would not exist in a Dictionary of Nature [p.xi.]”(1) Western man formed habits of using such words during the centuries of expansion into a “New World” whose carrying capacity at first exceeded his originally small numbers so much that such words seemed plausible.

Now, of course, the world’s carrying capacity no longer exceeds our greatly increased numbers” (1, 2, 5, 17) and continued use of such words and such thoughtways has no such justification. They persist nevertheless. “Americans of good will,” following word-maps based on such habits, “have advocated an American standard of living, or something approaching it, for the entire world. ‘Freedom from want’ was the carrot held before the noses of less prosperous peoples, to enlist their support during the [Second World] war. What a monstrous deception this was, of ourselves and them, should be clear to anyone who thinks in terms of the carrying capacities of the world’s lands [p.44]. (15)

Our conventional word-maps portray “developed countries” like the United States as a model for the supposed future condition of today’s “underdeveloped countries.” For most people it has been unthinkable that instead the trend might go in the other direction — that the now prosperous industrial nations may in future decades descend to conditions more akin to the present poverty of the UDC’s. There has been almost no public comprehension of the reasons why this might be so.

The new word-maps needed for living with the new circumstances must give prominence to the not yet widely familiar concept, “carrying capacity.” They must take into account the finiteness of the world and must recognize the inverse relation that ultimately holds between standard of living and numbers in a finite habitat with finite resources.

Facts of Life Inverted

When settlement of the New World by Europeans began, the fundamental fact of life for European man was that his newly enlarged habitat had a potential carrying capacity greatly exceeding his numbers. This fact shaped his outlook on life.

Now, however, the old New World is more densely populated than Europe was at the time the great migration began, and each of its inhabitants has more mobility and gadgetry so that he uses far more of its natural resources in his prolonged lifetime than did the average inhabitant of sixteenth-century Europe. Today’s most fundamental fact of life is that our world’s carrying capacity is not

unlimited. In our daily lives we are increasingly feeling the effects of the limits, though we usually still do not understand that that is what is happening to us.

Moreover, in the first century or two after Columbus, even European man was still living very largely by the use of renewable resources. Now, however, man's activities depend upon the use of some ten times as much energy derived from fossil fuels as we currently derive from organic sources. An updated word-map would thus have to include the information that less than ten percent of the energy base for modern man's activities comes from renewable resources. The new word-map should make clear that a "developed" country is one that has staked its future on continuing use of exhaustible resources, whereas an "underdeveloped" country is one that has not so far been able to make that prodigal commitment.

No recent American president has escaped the delusion that results from ignoring the concepts in nature's dictionary; all have failed to comprehend this change. When the United Nations Charter was signed in 1945, President Roosevelt said, "Our earth is only a little star twinkling in the universe — yet we can make of this — if we care to — a planet undisturbed by wars, unperturbed by want or fear." President Truman expressed a similar faith through his Point Four program. President Eisenhower told throngs in New Delhi in 1959: "We have today the scientific capacity to abolish from the world at least this one evil. We can eliminate hunger... [pp.335-6] (1). President Kennedy sought to revitalize traditional optimism in the United States with his concept of a "New Frontier" and in the hemisphere by launching an "Alliance for Progress." President Johnson echoed his predecessor by exhorting his grieved countrymen, "Let us continue!" and by envisioning imminent achievement of a "Great Society."

President Nixon has used much the same sort of rhetoric. To focus on a specific case, he has attributed "the energy problem" not to an actual depletion of resources but to the fact that "the people of the world ... are living better." Improvement of living standards, he said in a commencement address in June 1973 at Florida Technological University, has produced a "temporary problem, but long-term we have an opportunity to fill the demands of all the people of the world." This belief that in the long run the demands of all the people of the world can be filled is a relic from an era that no longer exists — the era when carrying capacity had suddenly been raised far above the level of existing population by discovery of a New World not yet filled up with voracious resource-users.

Stark Fact

In a radio address in February, 1973, President Nixon made a statement to the American people that might suggest he realized that era was ended and

wanted his constituents to realize it too. He said, "We must face up to a stark fact. We are now consuming more energy than we produce." For a nation whose customary word-maps depicted it as "independent" and "the most productive on earth," this was indeed stark, but it was also a monumental understatement of the real situation.

American energy consumption is so enormous that this nation annually converts about 1.4×10^9 tons of carbon into carbon dioxide through combustion of petroleum products, natural gas, and coal [p.64]. (16) On the production side, it is fairly easy to calculate approximately how fast natural processes have been extracting carbon from atmospheric CO_2 and storing it away as underground deposits of substances we myopically call "fossil fuels" (a phrase from our conventional word-maps that presupposes these substances are meant for burning). The calculation takes account of the fact that free oxygen now exists in the earth's atmosphere only by virtue of the photosynthesis carried on by green plants over approximately the last billion years. The earth's total surface area is approximately 500 million square kilometers, its sea level atmospheric pressure is approximately one kilogram per square centimeter, and hence the total weight of air on this planet is on the order of five times 10^{15} metric tons. About one-fifth of this is oxygen. So, if about 10^{15} tons of oxygen have been released to the atmosphere in about 109 years, the average rate of release has been about 10^9 tons per year. If chlorophyll-bearing plants extracted this oxygen from CO_2 , then the respective atomic weights of the two elements tell us that for each ton of oxygen added to the atmosphere, $12/32$ of a ton of carbon had to be stored away as "fossil fuel." Thus, for the last billion years, an average of about 375,000 tons of carbon was annually put into storage in the earth's crust. Only about 1.84 percent of the earth's surface is United States territory. So only about 6,900 tons (.0184 times 375,000) of carbon were stored away yearly within American boundaries.

If Americans are now burning the earth's stored carbon at the rate of 1.4 billion tons a year, dividing by 6,900 we see that Mr. Nixon's "stark fact" should have read: "We are now consuming 'fossil fuels' *more than 200,000 times as fast* as they are produced for us by nature's processes." Even that would understate the imbalance. The present rate of carbon storage almost surely is less than the average rate since the beginning of the carboniferous era.

The United States uses roughly one-third of all the nonorganic energy used by the whole world. *Homo sapiens* at large, therefore, can be said to be consuming the "fossil fuels" at least 11,200 times as fast as nature produces them (multiply 3 times 1.4 billion and divide by 375,000). When we combine this fact with the fact that less than ten percent of mankind's activity the world over is based on organic energy sources, we arrive at a realization of just how stark

“stark” can be. Over 90 percent of what human beings are now doing is done by withdrawing nature’s savings 11,200 times faster than they accumulate.

The new word-map must accept the fact that all activity involves transformation of energy. (3) Less than one-tenth of what humans do is done with this year’s income (solar energy captured by contemporary photosynthesis in our crops, timber, etc.). More than nine-tenths of what we do in a given year we do with solar energy stored up during at least 11,000 past years. If we are to understand the most pressing dilemmas facing us today, it seems high time to broaden the concept of “time binding” to take into account modern man’s dependence on ancient photosynthesis. An updated word-map should make one thing perfectly clear: *Homo sapiens* imports more than nine-tenths of his energy *from antiquity*. The ratio for “advanced” nations is much higher than this world average. Americans are trying to stay afloat with the illusion that a nation could be “self-sufficient” by importing from antiquity at 200,000 times the rate of indigenous current production whereas importing “foreign” fuels must spell disaster.

“Modernization” has increased our dependence on past photosynthesis, eliminating any trace of “sustained yield” from our total relation to our resource base. The nations most inclined to imagine that they “have it made” are the ones most committed to a way of life that is physically certain to be temporary. However, these nations’ commitment affects the whole world. Importing from antiquity has given the modern world very temporarily the illusion of a carrying capacity several times larger than the world’s permanent carrying capacity would be without such imports. So the world’s population has already overshoot the number (and living standard) this planet could realistically support from contemporary vegetation on a long-term basis. (11)

Unavailing “Ifs”

Much of what has been said above must be meaningless to readers thoroughly conditioned to traditional word-maps. To those whose predispositions were traditional but who may nevertheless have begun reluctantly to grasp the significance of new insights, it will be natural to attempt rebuttal — to seek some way of insisting that the new word-map is at least as faulty as the old, and to reassure oneself that its ominous implications need not be taken seriously.

It might occur to such a reader that the quantitative argument presented here can be very simply answered in its own terms. If Americans are consuming “fossil fuel” energy 200,000 times as fast as it was stored up, won’t it still take 5,000 years to run out, since we are drawing from a billion years’ accumulation? With the United States barely two centuries old and only recently modernized,

doesn't this mean we have more than 96 percent of our national life span ahead of us?

The answer to such questions could be affirmative only (1) *if* all deposits of coal, petroleum, and gas were as accessible to man as the ones already extracted, (2) *if* there were to be no further growth of population or technology, and (3) *if* complete exhaustion of these deposits were the only life-inhibiting consequence of their use as fuel.

Manifestly, none of these "ifs" is true. Regarding "if" number 1: the most accessible deposits have already been used [p.1801. (6) We are already feeling at least the economic and some of the social consequences of turning to resources that are harder to extract. This issue is confused, though, by political boundaries; instead of facing the reduced geological availability of "our own" deposits, we let ourselves dwell on the human factors impeding availability of "Arab oil" for our use. When our shortage-reducing efforts focus on "suspending import restrictions" and trying to "ensure peace in the Middle East," they obscure the fact that the finite stock in the global storehouse is being depleted.

Moreover, a substantial fraction of that stock (perhaps the major part) may conceivably be forever inaccessible to us for utterly nonsocial and apolitical reasons. Our old word-maps may have given us faith to remove mountains (of coal), but the new word-map reminds us it takes prodigious quantities of energy to do so. Much of the world's fossilized energy may be stored in forms or places that would require more energy for extraction than would be obtained from subsequent combustion. When nuclear physicist Edward Teller envisioned the use of a thousand underground nuclear blasts a year in Colorado alone to stimulate the flow of natural gas (in response to critics of the handful of experimental blasts set off there so far), traditional word-maps made the suggestion appear to be just another expression of the assumption that "technology will provide." From the new perspective, however, Teller's glib faith can be seen as an indication of what exorbitant expenditures of energy could be required for obtaining energy in years to come.

Nor are more "labor saving devices" an automatic answer. Regarding "if" number 2: by increasing per capita energy use, technological progress aggravates our commitment to living off the earth's savings deposits. What the old word-maps portray as a solution is recognized by the new word-map as part of the problem. Many people persist in dismissing the problem from thought by insisting that technological advancement (which our old word-maps depicted as "inevitable") will surely "keep pace" with our "growing energy needs." When the problem-producing rather than the problem-solving consequences of technology are borne in mind, then it becomes possible to recognize that the world's carrying capacity for people may be inversely related to its tolerance

for their equipment. With fewer people, the world could accommodate more fuel-using machinery per capita. With less advanced technology, the present number of people would have less impact on the world.

Regarding “if” number 3: we should remember that an organic system can be fatally ill or mortally wounded even though it is more than 96 percent intact. The removal of mountains of “overburden” standing between us and “the fuels we must have” can seriously interfere with agriculture and other necessary aspects of human life long before absolute exhaustion of the total underground deposit is approached. Extraction of any significant fraction of the “fossil fuels” stored under seabottoms will, as a side-effect, reduce the carrying capacity of sea waters for the marine life upon which an increasing portion of human subsistence is expected to depend (by those who see in the old word-maps no limits to growth). Carrying capacity of the oceans has already been diminished by tanker traffic between the continents. (10)

Also, in regard to “if” number 3, carrying capacity on land has already been reduced both by soil erosion and air pollution. “Modernization” has increased our power to destroy our lands. (14, 1) and it has concentrated *Homo sapiens* (and his energy-using activities) in cities that constitute a small fraction of the earth’s surface. This concentration aggravates in these localities the combustion product accumulations from the fuels already extracted and burned. Such concentration means, moreover, that accumulated heat (and all energy after use ends up as heat) can begin to modify wind patterns, and eventually jet streams and ocean currents (12), with potentially disastrous impact on existing human communities. Disaster can long, long precede complete replacement of atmospheric oxygen by CO₂ from total exhaustion of the billion years of savings.

For all these reasons, the beliefs that “There’s plenty left” and “We can get it out if prices go high enough to make it profitable” are almost as misleading as the anachronistic use of “unlimited” or “inexhaustible.”

Destructive “Production”

The semantic malfunction that accounts for the president’s enormously inadequate recognition of “stark fact” was pointed out a generation ago. William Vogt said, “One of the chief causes of our ecologic imbalance is our economic thinking. We identify the symbolic dollar with real wealth.... We extract oil, and iron ore, and fine timber, and canvasbacks, and call it production [p.146].” (15)

The word “production” was not unusual. Most words have multiple meanings. Context usually sorts them out. This, and the fact that the different meanings of a given word are usually related, normally enables communication to proceed,

but there is a risk of spill-over of one meaning into an inappropriate context. When this happens, the consequences may or may not be serious; in the present instance they have been deadly.

“Producing” means to the farmer “growing a crop,” transformation of material substances (soil, water, air) and energy (sunlight) by horticultural methods. “Producing” something in the manufacturing sense also means giving form, shape, or being to a product — *making* something by assembling components or by transforming raw materials. For the dramatist, “producing” a play refers to presentation of a work of art to an audience. It involves stage props, actors, scripts, costumes; but the word in this context has less reference to the manipulation of substances except as symbols. Use of the term to refer to *symbolic* manipulation becomes even sharper in a mathematical context, where to “produce” the side of a parallelogram means to project or extend it. This is the top of the abstraction ladder; no transformation of any substance is implied at all.

When a consumer of manufactured goods, farm output, artistic performances, or mathematical knowledge “produces” coins from his pocket to pay for a purchase, the meaning is just below the top of the abstraction ladder. The coins are tangible, but he did not make them. “Produce” has become synonymous in this context with *reveal* or *extract*.

It is easy to see how the mathematical and artistic meanings of the word are related to the meaning in a context of farming or manufacturing, but the difference is also apparent and it is unlikely that the word will be misunderstood in any of these contexts. However, it is not widely appreciated that companies or nations which “produce” crude oil (or natural gas, or coal) do so in the coin-from-pocket sense. They extract a substance from the earth. The substance was *formed* long before by processes of nature. Being carbon-rich and therefore oxidizable, it is rich in releasable energy. The so-called “producer,” however, did not put the energy into the substance or put the substance into the ground. To use the word “production” to denote extraction has seemed plausible because firms that extract such substances from the earth are as involved with engineering and commerce as any manufacturing concern. But this usage in reference to a process of extraction has enabled us to suppose the process could be expanded as freely as manufacturing and perpetuated as indefinitely as farming. From supposing what was untrue, we have come to grief. All of us, from petroleum prospector to consumer to president, have acted as if the rate at which we could afford to spend our coins was limited only by the rate at which we could extract them from our pockets. By ignoring other constraints we have implicitly assumed that it does not matter by what complex processes this wealth was stored away, at what rate the accumulation took place, or how these processes may be articulated with other natural processes that affect us.

Clinging to Weak Foundations

It must be said again: the quest for a better word-map arises from recognition that old word-maps inaccurately depict reality. There is a real world with which we have to keep trying to come to terms. But it must also be said again: a new word-map more accurately describing that world does not in any way guarantee that the existence of 3.6 billion or more human beings upon it can be utopian.

Acceptance of a realistic word-map implies disillusionment. If the insights of general semantics have been expected to enhance sanity, students of general semantics should therefore be among those most ready to see that there are implications for our beliefs about man's relations to his fellow man that follow from abandonment of illusions about the nature of man's relation to an environment recognized at last as finite and having palpable biogeochemical features. It will become apparent as we grow accustomed to the new word-map that full attainment of human brotherhood is impeded not only by psychological or cultural obstacles but also by obstacles of a more geophysical nature.

The "backward" nations (living mostly on *present* solar energy) have learned to desire very earnestly to "catch up" with those whose modern technology gives them an ability to devour the past. This is why, at the first United Nations Conference on the Human Environment, held in Stockholm in 1972, the belated efforts of industrialized nations to begin protecting this heavily populated planet from the consequences of industrialism met resistance from the yet-to-be-industrialized countries. "Environmentalism must not stand in the way of development" had a plausible sound to anyone still following obsolete word-maps. But the ability of conference delegates to be diplomatic and achieve some verbal reconciliation of their opposing perspectives did not make it any more realistic than before to imagine that an American or European standard of affluence for the entire world was an attainable goal.

Humanitarian attitudes to which many of us have been proud to adhere have caused us to imagine sometimes that conflicts of interest between nations have no real basis in nature, that they arise only from chauvinism or ethnocentrism, or from the historic ramifications of previous (and equally unnecessary) conflicts. These noble sentiments have made it hard for us to face a fact that should now be apparent — there is a *real* conflict of interest between nations already devouring resources at anything like 200,000 times their rate of accumulation and those nations not yet privileged to do so but already taught to covet the privilege. Struggles to keep on taking the earth's resources, to acquire the ability to take them, and to keep them from being taken, will doubtless intensify

human conflict in the decades ahead. Obsolete word-maps blind us to the reasons for this and will make a bad situation worse as long as we cling to them.

The weakness of the foundations of optimism, as exposed by the new word-map, was apparent for many years to those with informed vision. In 1908, addressing a conference on conservation, Theodore Roosevelt praised the growth attained “through the lavish use of our natural resources” but went on to say that “the time has come to inquire seriously what will happen when our forests are gone, when the coal, the iron, the oil, and the gas are exhausted, when the soil has been further impoverished and washed into the streams, polluting the rivers, denuding the fields, and obstructing navigation [p.15].” (4)

In 1929, Robert and Helen Lynd sounded like the 1970s when they wrote, in their study of a newly industrialized community, “A small river wanders through Middletown, and in 1890 when timber still stood on its banks, White River was a pleasant stream for picnics, fishing, and boating, but it has shrunk today to a creek discolored by industrial chemicals and malodorous with the city’s sewage. The local chapter of the Isaac Walton League aspires to ‘make White River white’ [p.225].” (8)

A generation ahead of his public, William Vogt wrote: (15)

Our most prodigal wastage is, perhaps, of gasoline. We are an importing nation; and every day we waste hundreds of thousands of gallons. All manner of drivers let their motors run when they are not in use. Our tensions find outlets in racing motors and in traveling at high speeds that reduce the efficiency of our cars. We build into our automobiles more power and greater gas consumption than we need. We use the press and radio to push the sales of more cars. We drive them hundreds of millions of miles a year in pursuit of futility. With the exhaustion of our own oil wells in sight, we send our Navy into the Mediterranean, show our teeth to the U.S.S.R., insist on access to Asiatic oil — and continue to throw it away at home [p.68].

Despite all such warnings, and in the face of history, capable writers continue vigorously denouncing the view that a finite earth has real limits which we have ignored at our imminent peril. John Maddox has written one such book, (9) stoutly defending the conventional word-maps, including the error of identification, mistaking symbol for referent, confusing dollars with wealth as pointed out a quarter century ago by Vogt. Maddox writes: “The usual distinction between renewable and nonrenewable natural resources is unfortunate because it is clear by now that the proper exploitation of natural resources is governed much more by economics than by the simple arithmetic of how much food can be grown with how much sunlight, or how great (or how small) may be the amounts of particular minerals locked up in the earth’s crust [p.78].”

The Lynds (8) pointed out that “it is characteristic of mankind to make as little adjustment as possible in customary ways in the face of new conditions [p.498]” Maddox (9) epitomizes this in his insistence that the present time appears to be one at which forecasts of scarcity are less valid than ever [p.7].” He says, “Famine is not a threat but a scarecrow [p.44]” and “ many of the hungry nations of the world are on the threshold of unaccustomed plenty [p.75].” He views as an illusion the idea that exhaustion of certain materials could spell civilization’s collapse [p.108]. He says, “Minerals are now more plentiful than ever, whatever the more distant prospects [p.257].” And, “The threat of a scarcity of energy, real enough in the 1950s, has already been dispelled [p.274].”

Thus do members of an intelligent species that has learned to import energy from the past and thereby proliferate far beyond the carrying capacity of its habitat try to reassure each other that 3,600 million human beings who already exist (and more to come) can realistically aspire to live as prodigally as the most prodigal 200 million have recently been doing, on an earth that is finite and whose resources and present features were provided by processes of nature now being undone by man thousands of times faster than they originally occurred.

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