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The Bridge of Language

Northrop Frye

Summary. The elements of human culture, including literature and the sciences, grow out of a basis in social concern. As they develop, their inner structures begin to emerge and those practicing them make discoveries within those structures. When tensions arise with the concerns of society a divided loyalty arises. In the past, social concerns which resisted science or censored literature were usually wrong, but there are very intense concerns today, such as environmental pollution, which appear to be bringing us to a common meeting point.

As I understand it, my chief qualification for addressing you here is my total ignorance of everything you know. That gives a certain detachment to one's perspective, but it does not provide many other clues. I think that, broadly speaking, the "two cultures" situation described by C. P. Snow some 20 years ago still holds in most respects. Lord Snow, you will remember, suggested that humanists and scientists did not see much of one another's point of view, and that humanists in particular tended to be intellectual Luddites or machine-breakers, probably members of a secret right-wing organization devoted to carbon power and the destruction of silicon chips. The literary critic F. R. Leavis, you will also remember, undertook to refute this case by asserting that in his opinion Lord Snow was a bad novelist. It seemed to me that what I hope might be a more civilized and pertinent statement of the humanist attitude, Ludditism and all, might be of interest to you. Although this article is called "The bridge of language," I am not a linguist but a literary critic, and that has led me into a different area of study concerned with the social use of words.

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Progressive Science, Primitive Arts

Lord Snow remarked that scientists "had the future in their bones." I take it that this is a reference to the fact that a progressive element is built into scientific method, so that any freshman today may know facts in physics or chemistry unknown to Newton or Lavoisier. As far as knowledge is concerned, this is equally true of the humanities: any freshman can also learn more about drama before Shakespeare or music before Mozart than Shakespeare or Mozart ever knew. But the arts themselves (to quote the title of a famous essay on the subject) are not progressive. They have been assumed to be the ornaments of a highly developed civilization, and of course they are that; but they seem to have a curious affinity too with everything that is most primitive and archaic in human society. Poetry thrives on superstition and fantasy; the formulas of popular fiction are the formulas of the folk tales of preliterary cultures; the structures and stock characters of romance or comedy have persisted with astonishingly little change in 2000 years. Science is generally assumed to have something to do with the pursuit of truth, but the poet, as Aristotle pointed out, is not directly concerned with truth because he says nothing in particular, and only particular statements can be true. So while the mad scientist may be a stock figure of popular fiction, it is perhaps significant that one of the great characters of literature should be Don Quixote, a mad humanist trying to make the world over in the pattern of his books.

This primitive quality of literature means, among other things, that the humanist has the past in his bones: his focus of study is the classic, the definitive masterpiece which may be many centuries old. Research in the humanities, however new in itself, always has an aspect in which it is more light on square one. In caricature, and to some extent occupationally as well, the humanist seems to resemble that heroic if somewhat confused bird mentioned by Borges, who always flies backward because he doesn't care about where he's going, only about where he's been.

Social Context of Scientific and Cultural Developments

Because of the progressive element in science, questions of science and technology are closely bound up with questions of the future of society, and of how society is going to adjust to the discoveries and techniques that have developed within it. We soon realize, however, that not everything that is technically feasible is going to happen; what will happen is only what society is capable of absorbing. That in turn depends on society's present situation, more particularly that of its power structures, and its inherited habits. Any such subject as "futurology," in short, is based on the fact that we know nothing of the future except by analogy with the past; hence the perspectives on the past, including the perspectives of the historian and the humanist, are inseparable from the future-directed concerns of science. Further, we notice that we hear much less about future shock and the like than we did a few years ago. One reason is that a widened horizon capable of taking in some speculation about the future is a by-product of economic expansion and political détente. Such conditions of clearing weather are not habitual to human life, however, and before long we are back in the recessions and political storm warnings that seem to be the normal lot of mankind.

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A future-directed perspective is, in itself, very natural to the young, but it also is dependent on what for them is a well-functioning economy. Anyone who taught students during the 1950's and is still teaching is aware how their time perspective lifts during expansive periods and how it shrinks again in times like ours. During the 1960's the "activists" looking for revolutionary social change were mainly students of middle-class background, who seldom realized how much they had been conditioned by the assumptions of that background. These were largely the assumptions of American progressivism, the feeling that as their society had been moving ahead like an express train for two centuries, it was in the nature of the historical process for it to continue to do so, except that it ought to speed up. The students of the 1970's, and probably of most of the 1980's as well, have been forced into an involuntary caution like that of Cardinal Newman's hymn:

> . . . I do not ask to see
> The distant scene: one step enough for me.

In my own student days much the same thing happened: a native bourgeois progressivism was checked by the depression, and collided with Marxist views about how a socialist economy would avoid such setbacks. We were assured, in a great deal of Marxist propaganda, that once man stopped wasting his energies in exploiting his fellow men the way would be open for the release of those energies in transforming nature. The assumption was that nature was still an unlimited field of exploitation, and the Marxist literature of 50 years ago resounded with hymns of praise to the tractors and hydro plants of the Soviet Union. But it is now painfully obvious that nature, at any rate as far as this planet extends, is finite too, and that the industrializing of human life is not an endless vista either.

It seems strange that the human race took so long to make a serious effort to develop its science and technology. The technology of the most advanced parts of the world in the early 18th century was closer to the neolithic age than it is to us. Even in the 19th century, with the Industrial Revolution fairly started, the speed and extent of the transformation of the world that a concentrated effort at technology would make was still beyond the most far-out imaginations. Edgar Allan Poe had about as far-out an imagination as the century produced, and used it partly to invent the modern forms of detective and science fiction. Yet in his story laid in the future, "Mellonta tauta" (the things about to be), people are crossing the Atlantic in balloons at 100 miles an hour, 1000 years after his own time, and even the balloon in which the story is supposed to be written falls into the Atlantic instead of landing.

The obvious answer is that for most of his history man has been preoccupied with small-scale social coherence. Once the essential needs of life and survival are met for a sufficient number of people, the rest of human energy has to be reserved for intensifying the strength of a particular social unit. We can understand the past on this point well enough from the present, even though the social units are much bigger. Our governments feel that if they spent as much on science and technology as they do on armaments, they would create a political vacuum that other powers would be prompt to fill. At present there are certain kinds of scientific projects that only the United States or the Soviet Union can attempt, and it is obvious that some kind of global unity and cooperation is a necessary condition for the unfettered growth of science in the future. Science and technology thus follow the great centralizing movements of economics, which will eventually, we may hope, transform the world into a global unity. The contrast with cultural developments, in literature and the arts, is curious and striking.

The more a country's arts develop, the more they tend to decentralize, to break down into smaller units, or, more positively, to bring increasingly smaller areas into articulateness. We speak of American literature, but a great deal of what we learn about America through its literature we learn by adding up what Faulkner tells us about Mississippi, Robert Frost about New Hampshire, Hemingway about expatriates in Paris or Spain, John Steinbeck about southern California, Peter De Vries about New York. A similar decentralizing movement has been very marked in Canada in the last 20 years, and whatever "Canada" may mean politically, "Canadian literature" means very largely a group of regional developments. It is a mysterious law of literature that a very specific and local setting often goes along with universality of appeal: Faulkner confines himself to an unpronounceable county in Mississippi and gets the Nobel Prize for literature in Sweden. One hopes that this decentralizing movement will gradually loosen its grip on political activities, where it is mostly a nuisance, and confine itself to cultural ones, where it belongs. In some respects, clearly, the world should be a single unit; in other respects it should be a mass of small communities, where people can be aware of others as people.

Kinds and Uses of Language

One reason for the difference in social context is the kind of language literature uses, in contrast to the language of science or philosophy. In science or philosophy there is an underlying international language of subject matter, so that abstracts of articles in foreign journals can be read even with a limited command of their languages. But literature enters into all the accidents and nuances of language, similarities in sound that make certain rhymes possible, associations in the meanings of words that one language may have and another may not, colloquial idioms that can be rendered into another tongue only by the most complete rephrasing of them. Science and philosophy remind us that language is a total human effort at communication; literature reminds us that language is also one of the most fragmented of human activities, so that it is a life's work to master completely more than one or two.

The word science, I assume, describes primarily a method, used wherever such a method is appropriate. A method involves the use of language, and so far as science uses the language of words in addition to the language of mathematics, it is committed to a certain kind of verbal style. Its language is descriptive and, of necessity, highly technical, and except in popularized science, it avoids metaphors and similar figures of speech. It also avoids ambiguity, or using the same word in different senses. The language of poetry is a complete contrast: it is largely based on figurative and metaphorical language, and it thrives on manifold meanings and puns of all kinds. Poetry has a very limited tolerance for the abstract language of philosophy or the technical language of science, not because poets dislike these subjects—many poets are deeply interested in them—but because the language poetry uses has a limited power of assimilating their modes of language. The normal language of poetry is a language of color and sound and movement, of immediate sense perception and concrete experience, of the existential rather than the contemplative or practical sides of human life, of the appearances of things rather than their underlying form.

In the 18th century, the work of Isaac Newton had a powerful impact on poets and humanists of all kinds. The sense of a regular and uniform natural law was like a new world to those tired of the anomalies and injustices of civil law, and his obviously sincere religious attitude was deeply reassuring too. So a great deal of poetry was written on the assumption that this new science could

inspire a new kind of poetry, and we get such expressions of enthusiasm as this:

> Let curious minds,
> who would the air inspect,
> On its elastic energy reflect.

The 18th century was also the age of Jenner's discovery of vaccine, and another poem of the period begins: "Inoculation, Heavenly Maid, descend!" But this does not seem to be the kind of thing poetry can do. Obviously, a more tactful and skillful poet would do a more convincing job, but it is the failures that point up the real problem.

What is involved is not a matter of vocabulary or subject matter but of the inner structure of the discipline used. If we set a poem to music, we are putting two arts together, but each art communicates within its own conventions: we are not merging the structures of poetry and music. Similarly, poet and scientist may use, up to a point, the same language, or even treat the same themes, but the structure of poetry and the structure of science remain two things. The scientist quantifies his data; the poet, so to speak, qualifies his: he expresses its whatness, its impact on concrete experience, and at a certain point they start going in opposite directions. "I do not frame hypotheses," said Newton, meaning, I suppose, that he did not take anything seriously until he had verified it. But literature is a hypothesis from beginning to end, assuming anything and verifying nothing.

The same principle applies to science fiction, which is a form of romance, continuing the formulas of fantasy, Utopian vision, Utopian satire, philosophical fiction, adventure story, and myth that have been part of the structure of literature from the beginning. What the hero of a science fiction story finds on a planet of Arcturus, however elaborate and plausible the hardware that got him there, is still essentially what heroes of earlier romances found in lost civilizations buried in Africa or Asia. The conventions of literature have to take over at some point, and what we see, in science fiction no less than in Homer or in Dante, is, in the title of a 17th-century satire set on the moon, *mundus alter et idem*, another world, but the same world.

There are different ways in which language can be used, three of them of particular importance. One is the descriptive way that we find in science and everywhere else where the aim is to convey information about an objective world. Then there is the language of transcendence that we find in large areas of philosophy and religion, an abstract, analogical language that expresses what by definition is really beyond verbal expression. And there is the language of immanence, the metaphorical language that poetry speaks, where anything can be identified with anything else, where natural objects can become images of human emotions. These are different languages, which accounts for the differences in structure I speak of; but they are mutually intelligible languages, so I should like to look at their relation again from a different point of view.

Social and Historical Conditioning

Even in the smallest social units, man does not live directly and nakedly in nature like the animals. Human societies live within a semitransparent envelope that we call culture or civilization, and they see nature only through it. Societies vary a good deal in the extent to which their cultural assumptions distort their view of nature, but all views of nature are conditioned by them. There are no noble savages, in the sense of purely natural men for whom this cultural envelope has disappeared, nor any form of human life that does not restructure the world in front of it into some kind of human vision.

I am concerned here with the role of words in this situation. In most societies, at least, there seem to be traditional verbal structures that are particularly important for the members of that society, or some of its members, to become acquainted with. Laws, including rituals and customs, are at the center of this material; myths and stories about the traditional gods and heroes, magical formulas, proverbs and the like also enter into it. In some communities much of it is a secret knowledge, sometimes imparted to boys in initiation ceremonies. In its higher developments it comes closer to what in Judaism is meant by "Torah," the instruction of primary importance for the social identity of the student, which includes the law, but a good many other things as well. We may call this a structure of concern or social coherence, and it is usually a mixture of the religious and the political. Religious concerns, Christian, Moslem, Jewish, or Hindu, invariably operate in some political context; political concerns, democratic, Marxist, or fascist, always have a religious dimension to them as well.

This structure of concern is often called an ideology, but I think that that is a rather limited and inflexible term, one that does not allow for all its variety and its capacity for growth. I prefer to call it a mythology, in spite of all the misleading emotional reactions to that word. We tend to think of such words as myth, fable, or fiction as meaning something not really true. This is partly because they are literary words, and literature is often thought of as a form of socially acceptable lying. Even more important, they are words for verbal structures, and there is a long-standing habit of mind that associates truth with a content that can be separated from structure. Thus we often say of a doubtful proposition that there may be some truth in it. We mean that if it were restated in a different structure it might become true, but we speak as though the truth could be extracted from the structure, like grains of gold from river mud. Both of these attitudes, in my view, are products of prejudice and sloppy thinking, so I shall keep the word mythology.

I speak of a religious or political concern rather than belief, because the conviction of its truth is less important than the sense of the social necessity of accepting it. In practice, this means that everybody should say that they accept it, or at least refrain from saying that they do not. For some societies, perhaps, the only really essential doctrine that holds them together is the conviction of their superiority to all other societies. For others, heresy, revisionism, or skepticism may become criminal or subversive attitudes.

The social crisis of a battle is a good example of the way in which questions of truth or falsehood are ignored in order to meet the crisis. In the battle of Agincourt there was an English army with a war cry addressed to St. George and a French army with a war cry addressed to St. Denis. Neither saint had a very solid existence: one developed out of a folk tale and the other mostly out of a pious fraud. Even if they had existed, the question of whether they were still available for invocation, or would automatically respond if they were, might still remain open. But if one were present at the battle, one would be well advised to ignore all such doubts and shout with the rest.

The Conflict with Mythology

The creative arts grow up in most societies mainly as vehicles for carrying the central messages that society regards as primarily important. Hymns of praise to the recognized gods or epics and tragedies about traditional heroes appear early in literature; sculpture developed in Greece because a polytheistic religion needs statues to distinguish one god from another; in the Middle Ages painting and sculpture and stained glass were largely

absorbed in producing icons for Christianity. But this introduces a complication into culture: the arts turn out to have structural principles of their own, so a tension arises between what the artist wants to say as an artist and what he is obliged to say as an artist commissioned by a church or government or other agent of social concern.

No art ever gets completely away from its social and historical conditioning; nevertheless it has two poles, the pole of concern, or what society wants from its arts, and the pole of style, or what the poet or painter or composer is discovering within his art. Concern is what makes the artist socially responsible and gives him a social function; style is what demonstrates the coherence, power, and influence of the art itself, style being, as Wallace Stevens says in a remarkable poem on the subject ("Description without place"), the quality that makes everything in Spain look Spanish.

The arts are older than the sciences, but the development of science follows the same pattern. A mythology is not, except incidentally, a protoscientific structure: it is meant to draw a circumference around a society and face inward to its hopes and fears and imaginative needs and desires, not to face outward toward nature. But of course it is bound to make or assume statements about the natural order: these often conflict with what further observation of that order suggests, and so, because of their sacrosanct quality, they become obstacles to science when science develops. An obvious example is the doctrine of a divine creation in 4000 B.C. When such conflict occurs, a mythological view of some aspect of nature has to be replaced by a scientific one. But a conflict of science and mythology means only that the sciences, like the arts, have inner structures of their own, and are trying to follow the trends of those inner structures instead of conforming to the prevailing mythological formulations.

There is always tension between the inner growth of the arts and sciences and the anxieties of a controlling mythology. The philosopher Berdyaev complains that nobody wants a disinterested philosopher: it is felt that if he is going to philosophize he should earn his keep, that is, justify or rationalize what people want to see generally believed. In the arts, everywhere we look we see the struggle of imagination against the restrictions of mythology. Islamic countries condemn representational art; the Soviet Union condemns nonrepresentational art; some Marxist regimes, notably the so-called cultural revolution in China, maintain that no art is socially conscious unless it devotes itself entirely to proclaiming the dominant social faith; in our own countries censors to the right of us and censors to the left of us volley and thunder. As for science, there can hardly be a member of this audience who has not had to answer, perhaps many times, the question "Why should we spend money on *that*?" from someone in control of funds. Such a question, when genuine, always indicates a clash between the inner development of science itself and the social concerns connected with what I have called mythology.

The Greek satirist Lucian, writing in the second century A.D., who was apprenticed to a sculptor before becoming a writer, has a dialogue in which Zeus calls a conference of gods, who come represented by their statues. Zeus tells Hermes, who is marshaling the procession, to arrange them in order of costliness of material, gold statues in the front row, silver ones behind, bronze and marble in the back benches. Hermes protests that some consideration should be given to quality of workmanship: on Zeus' arrangement all the Greek gods would have to go to the bleachers, because only barbarians can afford gold statues. Zeus says that quality of workmanship certainly ought to come first, but preference has to be given to gold. It is not hard to see why. Giving praise and prestige to expense fosters the industry of the care and feeding of gods; and if workmanship became too important, the question would arise of the extent to which gods are really human constructs. Workmanship represents the language of culture and civilization; expense represents the language of concern, which may lag behind imagination and intelligence, but usually controls the power.

Social Concern

The arts and sciences, then, for all their obvious differences, have a common origin in social concern. In proportion as they follow their own inner structures, they become specialized and pluralistic. This is simply a condition of civilized life: they have to do this, and the degree to which an art is allowed to follow its own line of development is of immense importance in determining the level of a society's culture and, ultimately, the level of the life of its citizens. The same applies to science, and resistance to political or religious interference with the arts and sciences is the sign of a mature society. Such resistance organized on an international scale could become an essential instrument of human progress. As Thomas Pynchon points out in his brilliant novel *Gravity's Rainbow*, an exclusive devotion to a mythology shuttles between a belief that everything has been made for man's sake and a belief that man is a uniquely cursed and doomed species, both views being paranoid. At the same time it is only their common social concern, their interests as citizens of the human community of which they are equally members, that can bring artists and scientists together. They cannot be brought together by trying to learn more about one another's totally different disciplines, any more than we can bring about world peace by trying to learn all the world's languages. The reason is much the same: there are more like two hundred cultures than two. But the notion that we can do without a common sense of concern, that religion can be absorbed by literature or all mythology replaced by science, seems to me a very muddled one. Such a civilization would be at best only another Tower of Babel, an unfinishable structure worked on by people who no longer understand each other.

What does happen, in the course of time, is that as the arts and sciences develop, religiopolitical units become larger and fewer, the unity of the world becomes a visible possibility, and so the different mythologies of concern become broader and simpler in scope. This becomes very clear when a nonhuman danger or catastrophe unites them in the sense of a common need for coexistence. Camus' novel *The Plague (La Peste)* is a brilliantly concentrated study of the way in which, in the face of a raging epidemic, all human concerns vanish into the two basic ones: survival and deliverance. Deliverance or emancipation includes all the forms of the expansion of consciousness and energy that are at the heart of the major mythologies: salvation in Christianity, enlightenment in Buddhism, equality in Marxism, liberty in democracy. If the question of survival is less urgent, these decline into various donkey's carrots of reward and punishment, either coming immediately from social authority or associated with a future life of some kind, either for ourselves in another world or our posterity in this one. But in the limit situation of crisis, all human mythologies reduce to a very elementary basis: that life is better than death, freedom better than bondage, health better than disease, happiness better than misery.

The 20th century has seen a growth of a sense of common crisis in which the essential concerns of survival and emancipation have slowly moved into the foreground. It is unnecessary to rehearse the major elements in this sense of cri-

sis—the atom bomb, the shrinking of natural resources, the feeling that central economic forces, such as the value of money, have gone out of control, the overcrowding of the earth by the one organism too irresponsible to play the game of natural selection fairly. Long before in literature, in Blake, Ruskin, and Morris in the 19th century and Eliot, D. H. Lawrence, Ezra Pound, and others in the early 20th, there had been a strong attack on the ugliness that modern civilization was creating out of its surroundings. Writers looked at the blasted and blighted outskirts of cities, at once beautiful landscapes buried in tombs of concrete, and felt that even if nature were the whore that she is said to be in some of our earlier mythologies, there was no excuse for treating her like that. This was what produced the "two cultures" situation that Lord Snow misrepresented so grossly. For even at its most wrongheaded this protest was not a merely aesthetic one, and it was not a Luddite attack on science or technology as such. It was a protest in the name of human concern for survival and freedom against what these writers felt to be a death impulse in the human mind, an impulse that they saw as trying to get control of science and technology. More important, they saw the exploitation of nature to be essentially the same evil thing as the exploitation of other men that has produced all the slavery and tyranny of history.

Snow speaks of Orwell's *1984* as typical of the humanist's wish that the future did not exist. But it is reasonable enough to wish that *that* future would not exist. Man is quite capable of producing the hell on earth that that book records: to deny or refuse to face this is to be a far more reckless Luddite than the most reactionary of poets. We are very near to the chronological 1984 now, and if the particular fear that Orwell's book expresses is no longer our primary one, at least for ourselves, it is mainly because a new element has entered the picture: the sense that human survival depends on the well-being of the nature from which humanity has sprung. The days when a scientist could use his scientific detachment and the artist his freedom of expression as excuses for withdrawing from this concern are long past.

At the beginning of the 20th century there was a strong sense that reality was divided into the subjective and the objective, and that science was concerned only with the latter. But even in the physical sciences it soon became clear that the observer himself was a part of the scene to be observed, and of course the social sciences are entirely based on this principle. The corresponding development has taken place in the arts: such a movement as abstract expressionism in painting, for example, does not mean that the painter has gone on an ego trip of "self expression": it means that he is studying the expressing process in himself as a part of his pictorial vision of the world.

In the 20th century Einstein has had an impact on the popular consciousness rather similar to that of Newton in the 18th century. Like Newton's, this impact was based on his obvious concern with the implications of his work in physics for human survival and emancipation. He made several cryptic, even mystical, utterances in this area, and Niels Bohr is said to have urged him, rather impatiently, to stop telling God what to do. On closer inspection, however, he seems to have been talking less about God than about the way in which nature, though with no language of its own, nonetheless makes humanly intelligible responses to the mind. The inference is that the structures of physical nature and the human mind are linked in a common destiny, discoveries in nature being also discoveries in human nature. I suspect that this is as central an intuition for us as the sense of the regularity of natural law was for the contemporaries of Newton. Further, it is an intuition that the metaphorical language of poetry, where natural objects and human emotions are so often identified with each other, can help to express.

A Common Meeting Point

If we split the world into subject and object, we tend to assume that the objective is real, the world of waking consciousness that we can agree we are seeing, and that the subjective world is one of dreams and resentments and wishes and desires and similar products of illusion. This was the view, 50 years ago, of Freudian psychology with all its hydraulic metaphors of blocks and drives and channels and cathects, and with its assumption that we retreat every night into a world of dream and futile wish-fulfillment, waking up again to face the real world. But this distinction between reality and illusion arises only when we stare at the world passively. For the 1980's, I think, we need different assumptions. First, practically all the reality we wake up facing is a human construct left over from yesterday. Second, some of that construct is rubbish, and needs to be cleared away. The important difference is not between reality and illusion, but between what we can make real and what it is time to get rid of.

When we think of things this way, we can see that the arts and sciences, though they have different functions, have essentially the same kind of place in the human scene. If we think in terms of reality and illusion, we may concede that science deals with reality, but we don't know what kind of status to give the arts, because they are so concerned with subjective elements of desire and other products of the dream world. But when we think of reality in terms of a world to be remade, we find that we need a model or imaginative vision of what we are trying to achieve. The world of dream and fantasy can be a source of models as well as illusions, and models are the first product of the chaos of hunch and intuition and guesswork and free association out of which the realities of art and science are made. This is the starting point of all creative work in any area, however different the products may be.

If we go to the theater, the show we see on the stage is, we may say, an illusion. But we could search the wings and dressing rooms forever without finding any reality behind it. The reality-illusion distinction clearly does not work for plays: the illusion *is* the reality. If the play is, let us say, a comedy of Shakespeare, there are things inside it that look like real things, such as law courts, and other things, like fairies and love potions and magic rings, that look impossible. What is important is where all this is going. At the end of the play a new society is created: four or five couples get married, and things which looked strong and threatening at first, like Shylock, get left behind. We look back over the play, and see that what we thought was just fantasy and wish-thinking was actually a force strong enough to impose itself on things that looked so well established at first, and transform them into a quite different shape and direction. The comedy is a miniature example of that drive toward deliverance that has fostered all the great myths of emancipation in the world, and is still capable of fostering the great emancipation myths of the future.

It is not for nothing that dramas are called plays: in fact Shakespeare's contemporary Ben Jonson came in for some ridicule when he published his dramas in 1616 under the title of *The Works of Ben Jonson*. In his endlessly suggestive book *Homo Ludens*, the Dutch scholar Huizinga distinguishes play and work on the basis, more or less, that work is energy expended for a further end in view, and that play is energy expended for its own sake, or as a manifestation of what the end in view is. A chess or tennis player

may work hard to win a game or improve his skill, but chess and tennis are forms of play. An artist may work hard to perfect a work of art, but the work perfected is an expression of play, an energy complete in itself that shows what the work has been done for. Science and technology work hard to help achieve what would be, once achieved, a life of play, where nature is no longer conquered territory held down by man but is lived in as his home, and where the mental work of solving problems has become *scientia* or *philosophia*, the love of knowing, the play at the heart of all genuine work.

The Book of Proverbs in the Bible describes wisdom as a female principle who was a part of God's mind at the creation. The King James translation speaks of her as "rejoicing," but this is a very weak form of the tremendous Vulgate phrase *ludens in orbe terrarum*, playing throughout the earth. This world of play or spontaneous energy is the deliverance to which all religious and political ideals point, and some glimpse of it is accessible to any artist or scientist at any moment. The ordinary division of our lives into work and play makes work the endless pursuit of a donkey's carrot into the future, and play a relaxation from this that reminds us of the carefree days of our childhood. But the genuine human energy of the arts and sciences converges on a world where work and play have become the same thing. A gathering together of such people with such interests, including this one, would be in the deepest and most serious sense a play *ground*, a common meeting point where all forms of language are interchangeable, all statements of identity, whether metaphors or equations, balance out, and scientists and humanists shake the past and the future out of their bones and join together in a present life.

Iron Ore: From Depletion to Abundance

Peter J. Kakela

The massive amounts of materials consumed during World War II produced a widespread fear that America was running out of certain vital natural resources. On 6 September 1945, President Truman addressed Congress (*1*):

> We have torn from the earth the copper, iron ore, tungsten, and every other mineral required to fight a war, without regard for our future supplies. We have taken what we needed. We were not able to, and we did not, take account of tomorrow. . . . [Now] we must make a diligent effort to discover new deposits. . . . And we must develop for the use of industry new technologies so that the vast deposits of low-grade ores . . . may be put to work.

Iron ore was then seen as one of the resources most vital to our industrial way of life, whether in war or peace. An iron ore depletion scare, much like our current energy crisis, developed because of a belief that our rich, easily accessible domestic ore supplies were nearing exhaustion. More than 85 percent of the U.S. iron ore consumed during World War II came from the rich open-pit hematite mines of the Lake Superior region; more than 60 percent came from just one range, the Mesabi of northern Minnesota. In December 1945, *Fortune* magazine ran an article entitled the "Iron ore dilemma" and subtitled "Unless the U.S. is to turn increasingly to foreign sources for its ore, it must give new life to the wasting Mesabi" (*2*). *Fortune*'s dramatic description of the Mesabi must have caught postwar emotions:

> Out of this tiny strip the steel-age economy has sucked like milk from the earth mother's breast, by far the largest portion of the principal food out of which its bones and muscles have been built: its machines and tools, its buildings and bridges, its railroads and automobiles and generating plants. Blasted and gouged from the strip's awesome open pits and scattered underground mines came a full two-thirds of the iron ore for the 400-odd million tons of steel out of which the U.S. fashioned the war plants, ships, planes, tanks, guns, bombs, and shells of World War II.

The Minnesota Tax Commission took a hard look at the Mesabi open-pit reserves in 1946 and estimated that 575,000,000 long tons of hematite ore remained (*3*). Republic Steel's president C. M. White then calculated the Mesabi's expected life. The *New York Times*, reporting on his 1947 speech, wrote that "at the present consumption rate the Mesabi open pits, which may not even be as large as the Minnesota Tax Commission estimated, will be exhausted within five to ten years" (*4*). After the "cream of the Mesabi" is skimmed off, White predicted, rich hematite ore in the United States will be a "rusty memory."

By 1955, newspaper headlines and magazine articles were publicizing a different tale: "Depletion danger met" (*5*) and "Worry over predicted shortage of iron ore can be forgotten," "One more 'scarcity' ends for U.S. industry" (*6*). Today there is no problem supplying domestic iron ore to U.S. steel mills. If anything, the situation is one of oversupply.

How was this iron ore scarcity reversed? What forms of government assistance, if any, brought about this dramatic turnabout? Understanding this case history may help us to think about resource scarcities we are facing now and how government policies may, or may not, help alleviate them.

Dual Response to Iron Ore Scarcity

In keeping with President Truman's 1945 suggestion, the steel industry launched a dual attack to expand iron ore reserves. First, it sought new deposits of high-grade hematite (and other rich, naturally concentrated iron ores), largely in foreign countries. Second, efforts were launched to develop new technologies capable of enriching the iron ore content of the Mesabi's abundant, but traditionally uneconomical, low-grade taconite. The government enacted policies supporting these industrial efforts, especially the development of new taconite technology.

Solution 1: Foreign ores. Initial results came from geologic explorations. Rich foreign ores exceeding 60 percent iron in the crude, with some as high as 69 percent, were developed. During the war, Bethlehem Steel Company imported iron ore from Chile, and afterward began developing large, high-grade concessions in Venezuela. U.S. Steel discovered and

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