

The Tragedy of the Commons
Garrett Hardin (1968)

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At the end of a thoughtful article on the future of nuclear war, J.B. Wiesner and H.F. York concluded that: "Both sides in the arms race are...confronted by the dilemma of steadily increasing military power and steadily decreasing national security. *It is our considered professional judgment that this dilemma has no technical solution.* If the great powers continue to look for solutions in the area of science and technology only, the result will be to worsen the situation." [1]

I would like to focus your attention not on the subject of the article (national security in a nuclear world) but on the kind of conclusion they reached, namely that there is no technical solution to the problem. An implicit and almost universal assumption of discussions published in professional and semipopular scientific journals is that the problem under discussion has a technical solution. A technical solution may be defined as one that requires a change only in the techniques of the natural sciences, demanding little or nothing in the way of change in human values or ideas of morality.

In our day (though not in earlier times) technical solutions are always welcome. Because of previous failures in prophecy, it takes courage to assert that a desired technical solution is not possible. Wiesner and York exhibited this courage; publishing in a science journal, they insisted that the solution to the problem was not to be found in the natural sciences. They cautiously qualified their statement with the phrase, "It is our considered professional judgment..." Whether they were right or not is not the concern of the present article. Rather, the concern here is with the important concept of a class of human problems which can be called "no technical solution problems," and more specifically, with the identification and discussion of one of these.

It is easy to show that the class is not a null class. Recall the game of tick-tack-toe. Consider the problem, "How can I win the game of tick-tack-toe?" It is well known that I cannot, if I assume (in keeping with the conventions of game theory) that my opponent understands the game perfectly. Put another way, there is no "technical solution" to the problem. I can win only by giving a radical meaning to the word "win." I can hit my opponent over the head; or I can falsify the records. Every way in which I "win" involves, in some sense, an abandonment of the game, as we intuitively understand it. (I can also, of course, openly abandon the game -- refuse to play it. This is

what most adults do.)

The class of "no technical solution problems" has members. My thesis is that the "population problem," as conventionally conceived, is a member of this class. How it is conventionally conceived needs some comment. It is fair to say that most people who anguish over the population problem are trying to find a way to avoid the evils of overpopulation without relinquishing any of the privileges they now enjoy. They think that farming the seas or developing new strains of wheat will solve the problem -- technologically. I try to show here that the solution they seek cannot be found. The population problem cannot be solved in a technical way, any more than can the problem of winning the game of tick-tack-toe.

What Shall We Maximize?

Population, as Malthus said, naturally tends to grow "geometrically," or, as we would now say, exponentially. In a finite world this means that the per-capita share of the world's goods must decrease. Is ours a finite world?

A fair defense can be put forward for the view that the world is infinite or that we do not know that it is not. But, in terms of the practical problems that we must face in the next few generations with the foreseeable technology, it is clear that we will greatly increase human misery if we do not, during the immediate future, assume that the world available to the terrestrial human population is finite. "Space" is no escape. [2]

A finite world can support only a finite population; therefore, population growth must eventually equal zero. (The case of perpetual wide fluctuations above and below zero is a trivial variant that need not be discussed.) When this condition is met, what will be the situation of mankind? Specifically, can Bentham's goal of "the greatest good for the greatest number" be realized?

No -- for two reasons, each sufficient by itself. The first is a theoretical one. It is not mathematically possible to maximize for two (or more) variables at the same time. This was clearly stated by von Neumann and Morgenstern, [3] but the principle is implicit in the theory of partial differential equations, dating back at least to D'Alembert (1717-1783).

The second reason springs directly from biological facts. To live, any organism must have a source of energy (for example, food). This energy is utilized

for two purposes: mere maintenance and work. For man maintenance of life requires about 1600 kilocalories a day ("maintenance calories"). Anything that he does over and above merely staying alive will be defined as work, and is supported by "work calories" which he takes in. Work calories are used not only for what we call work in common speech; they are also required for all forms of enjoyment, from swimming and automobile racing to playing music and writing poetry. If our goal is to maximize population it is obvious what we must do: We must make the work calories per person approach as close to zero as possible. No gourmet meals, no vacations, no sports, no music, no literature, no art...I think that everyone will grant, without argument or proof, that maximizing population does not maximize goods. Bentham's goal is impossible.

In reaching this conclusion I have made the usual assumption that it is the acquisition of energy that is the problem. The appearance of atomic energy has led some to question this assumption. However, given an infinite source of energy, population growth still produces an inescapable problem. The problem of the acquisition of energy is replaced by the problem of its dissipation, as J. H. Fremlin has so wittily shown. [4] The arithmetic signs in the analysis are, as it were, reversed; but Bentham's goal is unobtainable.

The optimum population is, then, less than the maximum. The difficulty of defining the optimum is enormous; so far as I know, no one has seriously tackled this problem. Reaching an acceptable and stable solution will surely require more than one generation of hard analytical work -- and much persuasion.

We want the maximum good per person; but what is good? To one person it is wilderness, to another it is ski lodges for thousands. To one it is estuaries to nourish ducks for hunters to shoot; to another it is factory land. Comparing one good with another is, we usually say, impossible because goods are incommensurable. Incommensurables cannot be compared.

Theoretically this may be true; but in real life incommensurables *are* commensurable. Only a criterion of judgment and a system of weighting are needed. In nature the criterion is survival. Is it better for a species to be small and hideable, or large and powerful? Natural selection commensurates the incommensurables. The compromise achieved depends on a natural weighting of the values of the variables.

Man must imitate this process. There is no doubt that in fact he already does, but unconsciously. It is when

the hidden decisions are made explicit that the arguments begin. The problem for the years ahead is to work out an acceptable theory of weighting. Synergistic effects, nonlinear variation, and difficulties in discounting the future make the intellectual problem difficult, but not (in principle) insoluble.

Has any cultural group solved this practical problem at the present time, even on an intuitive level? One simple fact proves that none has: there is no prosperous population in the world today that has, and has had for some time, a growth rate of zero. Any people that has intuitively identified its optimum point will soon reach it, after which its growth rate becomes and remains zero.

Of course, a positive growth rate might be taken as evidence that a population is below its optimum. However, by any reasonable standards, the most rapidly growing populations on earth today are (in general) the most miserable. This association (which need not be invariable) casts doubt on the optimistic assumption that the positive growth rate of a population is evidence that it has yet to reach its optimum.

We can make little progress in working toward optimum population size until we explicitly exorcise the spirit of Adam Smith in the field of practical demography. In economic affairs, *The Wealth of Nations* (1776) popularized the "invisible hand," the idea that an individual who "intends only his own gain," is, as it were, "led by an invisible hand to promote...the public interest." [5] Adam Smith did not assert that this was invariably true, and perhaps neither did any of his followers. But he contributed to a dominant tendency of thought that has ever since interfered with positive action based on rational analysis, namely, the tendency to assume that decisions reached individually will, in fact, be the best decisions for an entire society. If this assumption is correct it justifies the continuance of our present policy of *laissez faire* in reproduction. If it is correct we can assume that men will control their individual fecundity so as to produce the optimum population. If the assumption is not correct, we need to reexamine our individual freedoms to see which ones are defensible.

Tragedy of Freedom in a Commons

The rebuttal to the invisible hand in population control is to be found in a scenario first sketched in a little-known Pamphlet in 1833 by a mathematical amateur named William Forster Lloyd (1794-1852). [6] We may well call it "the tragedy of the commons," using the word "tragedy" as the philosopher Whitehead used it [7]: "The essence of dramatic tragedy is not unhappiness. It resides in the solemnity

of the remorseless working of things." He then goes on to say, "This inevitableness of destiny can only be illustrated in terms of human life by incidents which in fact involve unhappiness. For it is only by them that the futility of escape can be made evident in the drama."

The tragedy of the commons develops in this way. Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy.

As a rational being, each herdsman seeks to maximize his gain. Explicitly or implicitly, more or less consciously, he asks, "What is the utility *to me* of adding one more animal to my herd?" This utility has one negative and one positive component.

1. The positive component is a function of the increment of one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly + 1.
2. The negative component is a function of the additional overgrazing created by one more animal. Since, however, the effects of overgrazing are shared by all the herdsmen, the negative utility for any particular decision-making herdsman is only a fraction of - 1.

Adding together the component partial utilities, the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another.... But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit -- in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all.

Some would say that this is a platitude. Would that it were! In a sense, it was learned thousands of years ago, but natural selection favors the forces of psychological denial. [8] The individual benefits as an individual from his ability to deny the truth even though society as a whole, of which he is a part, suffers. Education can counteract the natural tendency to

do the wrong thing, but the inexorable succession of generations requires that the basis for this knowledge be constantly refreshed.

A simple incident that occurred a few years ago in Leominster, Massachusetts shows how perishable the knowledge is. During the Christmas shopping season the parking meters downtown were covered with plastic bags that bore tags reading: "Do not open until after Christmas. Free parking courtesy of the mayor and city council." In other words, facing the prospect of an increased demand for already scarce space, the city fathers reinstated the system of the commons. (Cynically, we suspect that they gained more votes than they lost by this retrogressive act.)

In an approximate way, the logic of the commons has been understood for a long time, perhaps since the discovery of agriculture or the invention of private property in real estate. But it is understood mostly only in special cases which are not sufficiently generalized. Even at this late date, cattlemen leasing national land on the Western ranges demonstrate no more than an ambivalent understanding, in constantly pressuring federal authorities to increase the head count to the point where overgrazing produces erosion and weed-dominance. Likewise, the oceans of the world continue to suffer from the survival of the philosophy of the commons. Maritime nations still respond automatically to the shibboleth of the "freedom of the seas." Professing to believe in the "inexhaustible resources of the oceans," they bring species after species of fish and whales closer to extinction. [9]

The National Parks present another instance of the working out of the tragedy of the commons. At present, they are open to all, without limit. The parks themselves are limited in extent -- there is only one Yosemite Valley -- whereas population seems to grow without limit. The values that visitors seek in the parks are steadily eroded. Plainly, we must soon cease to treat the parks as commons or they will be of no value to anyone.

What shall we do? We have several options. We might sell them off as private property. We might keep them as public property, but allocate the right to enter them. The allocation might be on the basis of wealth, by the use of an auction system. It might be on the basis of merit, as defined by some agreed-upon standards. It might be by lottery. Or it might be on a first-come, first-served basis, administered to long queues. These, I think, are all objectionable. But we must choose -- or acquiesce in the destruction of the commons that we call our Na-

tional Parks.

Pollution

In a reverse way, the tragedy of the commons reappears in problems of pollution. Here it is not a question of taking something out of the commons, but of putting something in -- sewage, or chemical, radioactive, and heat wastes into water; noxious and dangerous fumes into the air; and distracting and unpleasant advertising signs into the line of sight. The calculations of utility are much the same as before. The rational man finds that his share of the cost of the wastes he discharges into the commons is less than the cost of purifying his wastes before releasing them. Since this is true for everyone, we are locked into a system of "fouling our own nest," so long as we behave only as independent, rational, free enterprisers.

The tragedy of the commons as a food basket is averted by private property, or something formally like it. But the air and waters surrounding us cannot readily be fenced, and so the tragedy of the commons as a cesspool must be prevented by different means, by coercive laws or taxing devices that make it cheaper for the polluter to treat his pollutants than to discharge them untreated. We have not progressed as far with the solution of this problem as we have with the first. Indeed, our particular concept of private property, which deters us from exhausting the positive resources of the earth, favors pollution. The owner of a factory on the bank of a stream -- whose property extends to the middle of the stream -- often has difficulty seeing why it is not his natural right to muddy the waters flowing past his door. The law, always behind the times, requires elaborate stitching and fitting to adapt it to this newly perceived aspect of the commons.

The pollution problem is a consequence of population. It did not much matter how a lonely American frontiersman disposed of his waste. "Flowing water purifies itself every ten miles," my grandfather used to say, and the myth was near enough to the truth when he was a boy, for there were not too many people. But as population became denser, the natural chemical and biological recycling processes became overloaded, calling for a redefinition of property rights.

How to Legislate Temperance?

Analysis of the pollution problem as a function of population density uncovers a not generally recognized principle of morality, namely: *the morality of an act is a function of the state of the system at the time it is performed.* [10] Using the commons as a

cesspool does not harm the general public under frontier conditions, because there is no public; the same behavior in a metropolis is unbearable. A hundred and fifty years ago a plainsman could kill an American bison, cut out only the tongue for his dinner, and discard the rest of the animal. He was not in any important sense being wasteful. Today, with only a few thousand bison left, we would be appalled at such behavior.

In passing, it is worth noting that the morality of an act cannot be determined from a photograph. One does not know whether a man killing an elephant or setting fire to the grassland is harming others until one knows the total system in which his act appears. "One picture is worth a thousand words," said an ancient Chinese; but it may take ten thousand words to validate it. It is as tempting to ecologists as it is to reformers in general to try to persuade others by way of the photographic shortcut. But the essence of an argument cannot be photographed: it must be presented rationally -- in words.

That morality is system-sensitive escaped the attention of most codifiers of ethics in the past. "Thou shalt not..." is the form of traditional ethical directives which make no allowance for particular circumstances. The laws of our society follow the pattern of ancient ethics, and therefore are poorly suited to governing a complex, crowded, changeable world. Our epicyclic solution is to augment statutory law with administrative law. Since it is practically impossible to spell out all the conditions under which it is safe to burn trash in the back yard or to run an automobile without smog­control, by law we delegate the details to bureaus. The result is administrative law, which is rightly feared for an ancient reason -- *Quis custodiet ipsos custodes?* -- Who shall watch the watchers themselves? John Adams said that we must have a "government of laws and not men." Bureau administrators, trying to evaluate the morality of acts in the total system, are singularly liable to corruption, producing a government by men, not laws.

Prohibition is easy to legislate (though not necessarily to enforce); but how do we legislate temperance? Experience indicates that it can be accomplished best through the mediation of administrative law. We limit possibilities unnecessarily if we suppose that the sentiment of *Quis custodiet* denies us the use of administrative law. We should rather retain the phrase as a perpetual reminder of fearful dangers we cannot avoid. The great challenge facing us now is to invent the corrective feedbacks that are needed to keep custodians honest. We must find ways to legitimate the

needed authority of both the custodians and the corrective feedbacks.

Freedom to Breed Is Intolerable

The tragedy of the commons is involved in population problems in another way. In a world governed solely by the principle of "dog eat dog" --if indeed there ever was such a world--how many children a family had would not be a matter of public concern. Parents who bred too exuberantly would leave fewer descendants, not more, because they would be unable to care adequately for their children. David Lack and others have found that such a negative feedback demonstrably controls the fecundity of birds. [11] But men are not birds, and have not acted like them for millenniums, at least.

If each human family were dependent only on its own resources; *if* the children of improvident parents starved to death; *if* thus, over breeding brought its own "punishment" to the germ line -- *then* there would be no public interest in controlling the breeding of families. But our society is deeply committed to the welfare state, [12] and hence is confronted with another aspect of the tragedy of the commons.

In a welfare state, how shall we deal with the family, the religion, the race, or the class (or indeed any distinguishable and cohesive group) that adopts over breeding as a policy to secure its own aggrandizement? [13] To couple the concept of freedom to breed with the belief that everyone born has an equal right to the commons is to lock the world into a tragic course of action.

Unfortunately this is just the course of action that is being pursued by the United Nations. In late 1967, some thirty nations agreed to the following: "The Universal Declaration of Human Rights describes the family as the natural and fundamental unit of society. It follows that any choice and decision with regard to the size of the family must irrevocably rest with the family itself, and cannot be made by anyone else." [14]

It is painful to have to deny categorically the validity of this right; denying it, one feels as uncomfortable as a resident of Salem, Massachusetts, who denied the reality of witches in the seventeenth century. At the present time, in liberal quarters, something like a taboo acts to inhibit criticism of the United Nations. There is a feeling that the United Nations is "our last and best hope," that we shouldn't find fault with it; we shouldn't play into the hands of the archconservatives. However, let us not forget what Robert Louis Stevenson said: "The truth that is suppressed by friends is the readiest weapon of the enemy." If we

love the truth we must openly deny the validity of the Universal Declaration of Human Rights, even though it is promoted by the United Nations. We should also join with Kingsley Davis [15] in attempting to get Planned Parenthood-World Population to see the error of its ways in embracing the same tragic ideal.

Conscience Is Self-Eliminating

It is a mistake to think that we can control the breeding of mankind in the long run by an appeal to conscience. Charles Galton Darwin made this point when he spoke on the centennial of the publication of his grandfather's great book. The argument is straightforward and Darwinian.

People vary. Confronted with appeals to limit breeding, some people will undoubtedly respond to the plea more than others. Those who have more children will produce a larger fraction of the next generation than those with more susceptible consciences. The differences will be accentuated, generation by generation.

In C. G. Darwin's words: "It may well be that it would take hundreds of generations for the progenitive instinct to develop in this way, but if it should do so, nature would have taken her revenge, and the variety *Homo contraciens* would become extinct and would be replaced by the variety *Homo progenerativus*." [16]

The argument assumes that conscience or the desire for children (no matter which) is hereditary-but hereditary only in the most general formal sense. The result will be the same whether the attitude is transmitted through germ cells, or exosomatically, to use A. J. Lotka's term. (If one denies the latter possibility as well as the former, then what's the point of education?) The argument has here been stated in the context of the population problem, but it applies equally well to any instance in which society appeals to an individual exploiting a commons to restrain himself for the general good -- by means of his conscience. To make such an appeal is to set up a selective system that works toward the elimination of conscience from the race.

Pathogenic Effects of Conscience

The long-term disadvantage of an appeal to conscience should be enough to condemn it; but it has serious short-term disadvantages as well. If we ask a man who is exploiting a commons to desist "in the name of conscience," what are we saying to him? What does he hear? -- not only at the moment but also in the wee small hours of the night when, half

asleep, he remembers not merely the words we used but also the nonverbal communication cues we gave him unawares? Sooner or later, consciously or subconsciously, he senses that he has received two communications, and that they are contradictory: 1. (intended communication) "If you don't do as we ask, we will openly condemn you for not acting like a responsible citizen"; 2. (the unintended communication) "If you *do* behave as we ask, we will secretly condemn you for a simpleton who can be shamed into standing aside while the rest of us exploit the commons."

Every man then is caught in what Bateson has called a "double bind." Bateson and his co-workers have made a plausible case for viewing the double bind as an important causative factor in the genesis of schizophrenia. [17] The double bind may not always be so damaging, but it always endangers the mental health of anyone to whom it is applied. "A bad conscience," said Nietzsche, "is a kind of illness."

To conjure up a conscience in others is tempting to anyone who wishes to extend his control beyond the legal limits. Leaders at the highest level succumb to this temptation. Has any president during the past generation failed to call on labor unions to moderate voluntarily their demands for higher wages, or to steel companies to honor voluntary guidelines on prices? I can recall none. The rhetoric used on such occasions is designed to produce feelings of guilt in noncooperators.

For centuries it was assumed without proof that guilt was a valuable, perhaps even an indispensable, ingredient of the civilized life. Now, in this post-Freudian world, we doubt it.

Paul Goodman speaks from the modern point of view when he says: "No good has ever come from feeling guilty, neither intelligence, policy, nor compassion. The guilty do not pay attention to the object but only to themselves, and not even to their own interests, which might make sense, but to their anxieties." [18]

One does not have to be a professional psychiatrist to see the consequences of anxiety. We in the Western world are just emerging from a dreadful two centuries-long Dark Ages of Eros that was sustained partly by prohibition laws, but perhaps more effectively by the anxiety-generating mechanisms of education. Alex Comfort has told the story well in *The Anxiety Makers*; [19] it is not a pretty one.

Since proof is difficult, we may even concede that the results of anxiety may sometimes, from certain points of view, be desirable. The larger question we should ask is whether, as a matter of policy, we should ever

encourage the use of a technique the tendency (if not the intention) of which is psychologically pathogenic. We hear much talk these days of responsible parenthood; the coupled words are incorporated into the titles of some organizations devoted to birth control. Some people have proposed massive propaganda campaigns to instill responsibility into the nation's (or the world's) breeders. But what is the meaning of the word conscience? When we use the word responsibility in the absence of substantial sanctions are we not trying to browbeat a free man in a commons into acting against his own interest? Responsibility is a verbal counterfeit for a substantial quid pro quo. It is an attempt to get something for nothing.

If the word responsibility is to be used at all, I suggest that it be in the sense Charles Frankel uses it. [20] "Responsibility," says this philosopher, "is the product of definite social arrangements." Notice that Frankel calls for social arrangements -- not propaganda.

Mutual Coercion Mutually Agreed Upon

The social arrangements that produce responsibility are arrangements that create coercion, of some sort. Consider bank robbing. The man who takes money from a bank acts as if the bank were a commons. How do we prevent such action? Certainly not by trying to control his behavior solely by a verbal appeal to his sense of responsibility. Rather than rely on propaganda we follow Frankel's lead and insist that a bank is not a commons; we seek the definite social arrangements that will keep it from becoming a commons. That we thereby infringe on the freedom of would-be robbers we neither deny nor regret.

The morality of bank robbing is particularly easy to understand because we accept complete prohibition of this activity. We are willing to say "Thou shalt not rob banks," without providing for exceptions. But temperance also can be created by coercion. Taxing is a good coercive device. To keep downtown shoppers temperate in their use of parking space we introduce parking meters for short periods, and traffic fines for longer ones. We need not actually forbid a citizen to park as long as he wants to; we need merely make it increasingly expensive for him to do so. Not prohibition, but carefully biased options are what we offer him. A Madison Avenue man might call this persuasion; I prefer the greater candor of the word coercion.

Coercion is a dirty word to most liberals now, but it need not forever be so. As with the four-letter words, its dirtiness can be cleansed away by exposure to the light, by saying it over and over without apology or

embarrassment. To many, the word coercion implies arbitrary decisions of distant and irresponsible bureaucrats; but this is not a necessary part of its meaning. The only kind of coercion I recommend is mutual coercion, mutually agreed upon by the majority of the people affected.

To say that we mutually agree to coercion is not to say that we are required to enjoy it, or even to pretend we enjoy it. Who enjoys taxes? We all grumble about them. But we accept compulsory taxes because we recognize that voluntary taxes would favor the conscienceless. We institute and (grumblingly) support taxes and other coercive devices to escape the horror of the commons.

An alternative to the commons need not be perfectly just to be preferable. With real estate and other material goods, the alternative we have chosen is the institution of private property coupled with legal inheritance. Is this system perfectly just? As a genetically trained biologist I deny that it is. It seems to me that, if there are to be differences in individual inheritance, legal possession should be perfectly correlated with biological inheritance—that those who are biologically more fit to be the custodians of property and power should legally inherit more. But genetic recombination continually makes a mockery of the doctrine of "like father, like son" implicit in our laws of legal inheritance. An idiot can inherit millions, and a trust fund can keep his estate intact. We must admit that our legal system of private property plus inheritance is unjust -- but we put up with it because we are not convinced, at the moment, that anyone has invented a better system. The alternative of the commons is too horrifying to contemplate. Injustice is preferable to total ruin.

It is one of the peculiarities of the warfare between reform and the status quo that it is thoughtlessly governed by a double standard. Whenever a reform measure is proposed it is often defeated when its opponents triumphantly discover a flaw in it. As Kingsley Davis has pointed out, [21] worshipers of the status quo sometimes imply that no reform is possible without unanimous agreement, an implication contrary to historical fact. As nearly as I can make out, automatic rejection of proposed reforms is based on one of two unconscious assumptions: (1) that the status quo is perfect; or (2) that the choice we face is between reform and no action; if the proposed reform is imperfect, we presumably should take no action at all, while we wait for a perfect proposal.

But we can never do nothing. That which we have done for thousands of years is also action. It also

produces evils. Once we are aware that the status quo is action, we can then compare its discoverable advantages and disadvantages with the predicted advantages and disadvantages of the proposed reform, discounting as best we can for our lack of experience. On the basis of such a comparison, we can make a rational decision which will not involve the unworkable assumption that only perfect systems are tolerable.

Recognition of Necessity

Perhaps the simplest summary of this analysis of man's population problems is this: the commons, if justifiable at all, is justifiable only under conditions of low-population density. As the human population has increased, the commons has had to be abandoned in one aspect after another.

First we abandoned the commons in food gathering, enclosing farm land and restricting pastures and hunting and fishing areas. These restrictions are still not complete throughout the world.

Somewhat later we saw that the commons as a place for waste disposal would also have to be abandoned. Restrictions on the disposal of domestic sewage are widely accepted in the Western world; we are still struggling to close the commons to pollution by automobiles, factories, insecticide sprayers, fertilizing operations, and atomic energy installations.

In a still more embryonic state is our recognition of the evils of the commons in matters of pleasure. There is almost no restriction on the propagation of sound waves in the public medium. The shopping public is assaulted with mindless music, without its consent. Our government has paid out billions of dollars to create a supersonic transport which would disturb 50,000 people for every one person whisked from coast to coast 3 hours faster. Advertisers muddy the airwaves of radio and television and pollute the view of travelers. We are a long way from outlawing the commons in matters of pleasure. Is this because our Puritan inheritance makes us view pleasure as something of a sin, and pain (that is, the pollution of advertising) as the sign of virtue?

Every new enclosure of the commons involves the infringement of somebody's personal liberty. Infringements made in the distant past are accepted because no contemporary complains of a loss. It is the newly proposed infringements that we vigorously oppose; cries of "rights" and "freedom" fill the air. But what does "freedom" mean? When men mutually agreed to pass laws against robbing, mankind became more free, not less so. Individuals locked into the logic of the commons are free only to bring on uni-

versal ruin; once they see the necessity of mutual coercion, they become free to pursue other goals. I believe it was Hegel who said, "Freedom is the recognition of necessity."

The most important aspect of necessity that we must now recognize, is the necessity of abandoning the commons in breeding. No technical solution can rescue us from the misery of overpopulation. Freedom to breed will bring ruin to all. At the moment, to avoid hard decisions many of us are tempted to propagandize for conscience and responsible parenthood. The temptation must be resisted, because an appeal to independently acting consciences selects for the disappearance of all conscience in the long run, and an increase in anxiety in the short.

The only way we can preserve and nurture other and more precious freedoms is by relinquishing the freedom to breed, and that very soon. "Freedom is the recognition of necessity" -- and it is the role of education to reveal to all the necessity of abandoning the freedom to breed. Only so, can we put an end to this aspect of the tragedy of the commons.

Notes

1. J. B. Wiesner and H. F. York, *Scientific American* 211 (No. 4), 27 (1964).
2. G. Hardin, *Journal of Heredity* 50, 68 (1959), S. von Hoernor, *Science* 137, 18, (1962).
3. J. von Neumann and O. Morgenstern, *Theory of Games and Economic Behavior* (Princeton University Press, Princeton, N.J., 1947), p. 11.
4. J. H. Fremlin, *New Scientist*, No. 415 (1964), p. 285.
5. A. Smith, *The Wealth of Nations* (Modern Library, New York, 1937), p. 423.
6. W. F. Lloyd, *Two Lectures on the Checks to Population* (Oxford University Press, Oxford,

"There has developed in the contemporary natural sciences a recognition that there is a subset of problems, such as population, atomic war, and environmental corruption, for which there are no technical solutions.

"There is also an increasing recognition among contemporary social scientists that there is a subset of problems, such as population, atomic war, environmental corruption, and the recovery of a livable urban environment, for which there are no current political solutions. The thesis of this article is that the common area shared by these two subsets contains most of the critical problems that threaten the very existence of contemporary man." [p. 53]

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ASSUMPTIONS NECESSARY TO AVOID THE TRAGEDY

"In passing the technically insoluble problems over to the political and social realm for solution, Hardin made three critical assumptions:

- (1) that there exists, or can be developed, a 'criterion of judgment and system of weighting . . .' that will 'render the incommensurables . . . commensurable . . . ' in real life;
- (2) that, possessing this criterion of judgment, 'coercion can be mutually agreed upon,' and that the application of coercion to effect a solution to problems will be effective in modern society; and
- (3) that the administrative system, supported by the criterion of judgment and access to coercion, can and

will protect the commons from further desecration." [p. 55]

ERODING MYTH OF THE COMMON VALUE SYSTEM

"In America there existed, until very recently, a set of conditions which perhaps made the solution to Hardin's subset possible; we lived with the myth that we were 'one people, indivisible. . . .' This myth postulated that we were the great 'melting pot' of the world wherein the diverse cultural ores of Europe were poured into the crucible of the frontier experience to produce a new alloy -- an American civilization. This new civilization was presumably united by a common value system that was democratic, equalitarian, and existing under universally enforceable rules contained in the Constitution and the Bill of Rights.

"In the United States today, however, there is emerging a new set of behavior patterns which suggest that the myth is either dead or dying. Instead of believing and behaving in accordance with the myth, large sectors of the population are developing lifestyles and value hierarchies that give contemporary Americans an appearance more closely analogous to the particularistic, primitive forms of 'tribal' organizations in geographic proximity than to that shining new alloy, the American civilization." [p. 56]

"Looking at a more recent analysis of the sickness of the core city, Wallace F. Smith has argued that the productive model of the city is no longer viable for the purposes of economic analysis. Instead, he develops a model of the city as a site for leisure consumption, and then seems to suggest that the nature of this model is such is such that the city cannot regain its health because the leisure demands are value-based and, hence do not admit to compromise and accommodation; consequently there is no way of deciding among these value-oriented demands that are being made on the core city.

"In looking for the cause of the erosion of the myth of a common value system, it seems to me that so long as our perceptions and knowledge of other groups were formed largely through the written media of communication, the American myth that we were a giant melting pot of equalitarians could be sustained. In such a perceptual field it is tenable, if not obvious, that men are motivated by interests. Interests can always be compromised and accommodated without undermining our very being by sacrificing values. Under the impact of electronic media, however, this psychological distance has broken down and now we discover that these people with whom we could formerly compromise on interests are not, after all,

really motivated by interests but by values. Their behavior in our very living room betrays a set of values, moreover, that are incompatible with our own, and consequently the compromises that we make are not those of contract but of culture. While the former are acceptable, any form of compromise on the latter is not a form of rational behavior but is rather a clear case of either apostasy or heresy. Thus we have arrived not at an age of accommodation but one of confrontation. In such an age 'incommensurables' remain 'incommensurable' in real life." [p. 59]

EROSION OF THE MYTH OF THE MONOPOLY OF COERCIVE FORCE

"In the past, those who no longer subscribed to the values of the dominant culture were held in check by the myth that the state possessed a monopoly on coercive force. This myth has undergone continual erosion since the end of World War II owing to the success of the strategy of guerrilla warfare, as first revealed to the French in Indochina, and later conclusively demonstrated in Algeria. Suffering as we do from what Senator Fulbright has called 'the arrogance of power,' we have been extremely slow to learn the lesson in Vietnam, although we now realize that war is political and cannot be won by military means. It is apparent that the myth of the monopoly of coercive force as it was first qualified in the civil rights conflict in the South, then in our urban ghettos, next on the streets of Chicago, and now on our college campuses has lost its hold over the minds of Americans. The technology of guerrilla warfare has made it evident that, while the state can win battles, it cannot win wars of values. Coercive force which is centered in the modern state cannot be sustained in the face of the active resistance of some 10 percent of the population unless the state is willing to embark on a deliberate policy of genocide directed against the value dissident groups. The factor that sustained the myth of coercive force in the past was the acceptance of a common value system. Whether the latter exists is questionable in the modern nation-state." [p.p. 59-60]

EROSION OF THE MYTH OF ADMINISTRATORS OF THE COMMONS

"Indeed, the process has been so widely commented upon that one writer postulated a common life cycle for all of the attempts to develop regulatory policies. The life cycle is launched by an outcry so widespread and demanding that it generates enough political force to bring about establishment of a regulatory agency to insure the equitable, just, and rational distribution of the advantages among all holders of in-

terest in the commons. This phase is followed by the symbolic reassurance of the offended as the agency goes into operation, developing a period of political quiescence among the great majority of those who hold a general but unorganized interest in the commons. Once this political quiescence has developed, the highly organized and specifically interested

groups who wish to make incursions into the commons bring sufficient pressure to bear through other political processes to convert the agency to the protection and furthering of their interests. In the last phase even staffing of the regulating agency is accomplished by drawing the agency administrators from the ranks of the regulated." [p.p. 60-61]

WHO BENEFITS? WHO PAYS?

from **FILTERS AGAINST FOLLY**, Garrett Hardin (1985), Viking Penguin

Discussion of the distribution of goods and bads in society is too often unproductive because of excessive reliance on abstract nouns—democracy, communism, socialism, exploitation, rights, justice, and the like. These great abstractions have been used for so long by so many people with so many different axes to grind that their continued use leads to more cant than sense. (Pardon the use of this antique word, but it is one that should not be allowed to fade away: it is a modification of the word "chant," and aptly describes a discussion in which sacred words are chanted with little or no thought of their operational meaning. Most public discussions of "responsibility" are mere cant.)

To cut through the cant of "responsibility," we must ask the double question "Who benefits? Who pays?" This is the first question to ask when a politico-economic system of distribution is proposed. It focuses our attention on operations and their consequences rather than on words. The answer to this double question largely defines the properties of a system. We take it as axiomatic that every social action entails both gain (profit) and cost (loss). We can indicate the way profit and loss are distributed by three alternative verbs: privatize, commonize and socialize. These verbs operationally define the three major distribution paths. Privatize. Profit or loss is privatized when it accrues wholly to an individual (or, with less precision, to a collection of individuals called a legal person, e.g., a corporation). Commonize. Gains or costs that are spread out indifferently over a whole population are said to be commonized. The "commons" of the Sahel, discussed above, is an "unmanaged commons," in contrast to the type to be mentioned next.

Socialize. When profits and losses are differentially distributed by managers (bureaucrats) among the group that owns the common property we say that the property is socialized. The system that does this may be called "socialism"; it is also called a "managed commons." A managed commons, though it may have other defects, is not automatically subject to the tragic fate of the unmanaged commons.

(In passing, note that the word "communism" will not be used here because of its ambiguity. Sometimes it refers to socialism, sometimes to "commonism," a system in which losses are commonized, as defined above. In terms of their consequences socialism and commonism are radically different; we should not allow ourselves to be befuddled by the term "communism," hallowed though it be by usage.)

What we call private enterprise or "privatism" is a system which, in its pure form, privatizes both profits and losses. Since the decision maker "answers to" himself for the consequences of his decisions, he is responsible in the operational sense. In pure privatism the system may be said to benefit from intrinsic responsibility. (But, as we shall see, pure privatism is rare.)

In sharp contrast to privatism, commonism privatizes the gain but commonizes the losses. The herdsman keeps the gain (increase in his herd) for himself while pushing the losses (in the form of environmental degradation) off onto the entire community. Such a system fails to meet the operational criterion of positive responsibility.

Criticism of the commons may be made even stronger by enlarging the concept of responsibility, following an example set in mathematics more than two thousand years ago. The power of the number system was greatly increased when the human mind conceived the paradoxical idea of negative numbers. The real world presents us with no example of a negative quantity of things or substances. Negative numbers may not be "real," but they are a great aid in thinking about practical affairs. How would we manage financial transactions without the concept of debt? A debt can be thought of as a negative amount of wealth. We have been so long accustomed to this insubstantial concept that it takes imagination to picture the mental distress of the people who were first confronted with the newly invented negative numbers. The history of mathematics shows that each significant expansion of the idea of number was met with passionate resistance.

The idea of negative responsibility is likewise a paradoxical concept, but an immensely useful one. The unmanaged commons exhibits negative responsibility, since it actually pays the individual decision maker to make the wrong decision. It is this negative responsibility that generates the tragedy.

In socialism both gains and losses are socialized. At first glance this system might appear to be almost identical with private enterprise, with the community replacing the individual as both the actor and the acted-upon. In practice, however, the properties of this system are different, because "the community" is an abstraction, and abstractions can neither make decisions nor be rewarded.

"The state," "the nation," or "the community" cannot make decisions: only individuals can. Under socialism, individuals have to be delegated to carry out tasks for the community. That being so we must ask, are the motives of the delegates identical with the desires of the rest of the community? We dare not assume this identity. The uncertainty is basic to socialism. [p.p. 96-98]

THE WEDDING OF COMMONIZED COSTS TO PRIVATIZED PROFITS

What is the free enterprise system? Our stereotype of it is of fair competition in the marketplace, in which enterprisers win or lose on the basis of their efficiency in running factories, effectiveness in managing labor relations, ingenuity in devising sales campaigns, and honesty in delivering quality. Some enterprisers win, some lose. Calling the system a "profit system" is misleading, because it is truly a "profit-and-loss system" as far as the competitors are concerned. The general public wins because competition ensures low prices. The great fortunes made by some enterprisers can be viewed as commissions for helping to keep prices down for everyone.

Unfortunately, the truth is not always so simple. A comprehensive history of great business fortunes would show a disconcertingly large number that were made in a quite different way: the enterpriser devised a silent way to commonize costs while continuing to privatize the profits. We will encounter this explanation repeatedly as we probe deeper into the workings of society. The system just described needs a label.

The hidden rules of the game are these: Commonize Costs and Privatize Profits. The result we may refer to as the "Double C-Double P Game," or even more briefly as the CCPP Game. Such a union of privatism and commonism is not even hinted at in the official apologies for free enterprise. Those who cling to an exalted view of free enterprise should view this union

as something of a morganatic marriage. Though unblessed by authority, it is rich in consequences.

Enterprisers never broadcast the information that they are playing the Double C-Double P Game: it would not be in their interest to do so. It generally takes an outside observer to be aware of the truth. An early exception to this rule may be found in the 1556 work of Georgius Agricola, who, in *De re Metallica*, gave a fair summary of the arguments against mining (from which activity Agricola himself profited). The following translation is by Herbert Hoover:

The strongest arguments of the detractors [of mining] is that the fields are devastated by mining operations, for which reason Italians were formerly warned by law that no one should dig the earth for metals and so injure their very fertile fields, their vineyards, and their olive groves. Also, they argue that the woods and groves are cut down, for there is need of an endless amount of wood for timbers, machines, and the smelting of metals. And when the woods and groves are felled, then are exterminated the beasts and birds, very many of which furnish a pleasant and agreeable food for man. Further, when the ores are washed, the water which has been used poisons the brooks and streams, and either destroys the fish or drives them away.

Commonize costs and privatize profits—but don't tell anyone. This has been a formula for success for centuries. Though Agricola was not aware of it, some of the most distressing costs of mining are health costs. Until the development of nationalized schemes of compensation in the twentieth century the costs of deteriorated health were "paid" by the miner himself, partly in medical bills but even more in reduced capacity to work and enjoy life.

Premature death has characterized the vocation of mining from the earliest days. Particular causes include chronic lead poisoning, mercury poisoning, the "black lung disease" of coal miners, and poisoning by radon gas in uranium mines. The list is a long one. From prehistoric days to the present, mining enterprisers have prospered at the expense of those who did the actual work. This is true in countries like the United States, where subsurface resources are private property, as well as in countries like Mexico, where the federal government claims all wealth beneath the surface. [p.p. 106-10]