

LIFE AND DEATH

Henry M. Parsons

Riverside Research Institute

A “systems study of mankind” should incorporate analyses of the cost/effectiveness of life and human factors analyses of death. Various methods have been adopted for placing a dollar value on human life. Human factors studies can attempt to prevent loss of life in vehicular accidents, incorporate the number of lives saved as a criterion of the benefits of improvements in defense systems, examine the nature of behavior governed by deterrence, and investigate some of the complexities of population control. Systematic investigation might also be conducted into the parameters of death. An ecological projection suggests that a nuclear war may occur to counteract the disequilibrium of nature resulting from technology, including the population explosion.

INTRODUCTION

Four years ago I came across an appeal in *Science* for a “systems analysis of man and his environment.” Entitled “Save the World,” this appeal (Wofle, 1965) by the executive officer of the American Association for the Advancement of Science contained the following key sentence: “If it be assumed – as it must be – that we will succeed in stemming population growth and preventing nuclear catastrophe, our expected success on these problems makes it time for an analysis on a global scale of the whole set of environmental problems, a systems study of mankind in relation to his planet.”

It occurred to me at the time that according to this viewpoint the world’s future was literally a matter of life and death. However, I questioned the assumption of mankind’s success, at least the way Wofle phrased it. I also said to myself, “Here’s a human factors problem.”

The tradition has been growing in the Human Factors Society that Presidential Addresses adopt a philosophical vein, if only by indicating new horizons toward which human factors research and practice should march. In pondering this tradition, I recalled the *Science* editorial. I speculated that life and death are indeed human factors and could properly provide the theme for my presentation.

Certainly no one can deny that death and the threat of death play a major if not central role in modern life. In Viet Nam, on TV, Biafra, on the streets, and even on Martha’s Vineyard, death intrudes on us daily. The threat of death and the excitement and avoidance behavior this threat generates are even more intrusive than death itself. Death is threatened by terrorists in Brazil, by the Cosa Nostra in the United States, by Soviet troops in Prague, by starvation in Calcutta, by plane hijackers everywhere. Robbery replaces burglary in crime popularity polls. The astronauts make it to the moon and back, while innumerable millions watch them with the same fascination that once gripped thousands in the Coliseum. The Safeguard antiballistic missile system is debated in terms of the total number of deaths threatened by ICBMs on the one side or the other. The commander of the *Pueblo* says he surrendered his ship to save the lives of his crewmen. Subordinates buy guns to defend themselves from those in the central city. Hearts are transplanted to forestall death. A mighty ecclesiastical institution is rent over the issues of life and death in the womb. The draft, with its threat of death in Viet Nam, has helped transform a generation into rebels of many kinds – and some of the fallout is visible in the hirsute embellishments on the faces of my friends here.

George Bernard Shaw (1959) had a point when he wrote: “Nothing is ever done in this world until men are ready to kill each other if it is not done.”

Yet death and its reciprocal have encountered little systematic analysis as general phenomena. Except for religious preaching about immortality, there seems to be an aversion to

discussing the termination of life – another example, perhaps, of the avoidance behavior that death generates. Only poets, philosophers, and playwrights face this universal phenomenon in human terms and they have produced more popular quotations about death and life than about any other topic, even love (Stevenson, 1935).

Or at least that was the case until more recent years. In today's culture, where sex and making money occupy so much of our attention, death does encounter some real competition as a topic. In any event, the humanist has strongly resisted any inclination to examine life and death systematically. In the value system, death is a subject to be shrouded in amorphousness. And though he lives in a plutocracy, he particularly resents the evaluation of life in dollars.

ECONOMIC EVALUATION OF LIFE

Yet to undertake Wofle's systems analysis of humankind, surely one would have to incorporate a study of life's cost-effectiveness or cost-benefit ratio. The dollar cost of human life has been variously assessed – from 30 pieces of silver almost 2,000 years ago to insurance policies and court judgments widely ranging in value today. One method of determining the economic value of an individual life has been to total a person's lifetime earnings, or the earnings the deceased would have acquired had he survived (Rice & Cooper, 1967). Another more operational method involves keeping alive a terminal patient in a hospital, though in vegetable-like state; the amount he or she or relatives can afford presumably represents the value of that life at that point.

In a different approach, the life-assessor makes comparisons as well as, or in place of, absolute evaluations. For example, it must have occurred to many that the billions spent in trying to kill off the Viet Cong and North Vietnamese at a rate of so much per enemy death could have been better allocated to rewards for desertion or to bounties on the lives of leaders. Possibly the CIA has been doing something like this. The most intriguing comparison analysis I have seen comes from Morgan Jul, secretary of the FOA/WHO/UNICEF Protein Advisory Group at United Nations Headquarters and formerly director of the Danish Meat Research Institute (1969):

The author has made some rough estimates of the world effort to prevent loss of human lives in various fields – or, to put it bluntly, what is the value of a human life? An estimate of the research and development effort may be calculated in terms of dollars spent for death prevented from each cause:

| | |
|----------------------|-----------------|
| Space Exploration | \$1,000,000,000 |
| Civil Aviation | 1,000,000 |
| Automobile Accidents | 1,000 |
| Malnutrition | 1 |

The comparative approach has most often zeroed in on the cost of sending men to the moon. In a luncheon talk before the Highway Research board in 1969, Alvin M. Weinberg, Director of Oak Ridge National Laboratory, estimated that the \$40 billion spent on Apollo would save 110,000,000 American lives in a nuclear war if the money were spent on shelters. Let us hypothesize that the total Apollo project expenditures, if there had been no need to bring astronauts back alive, would have been lower by about 20%, or \$8 billion to preserve the lives of 16 human beings (disregarding the value of the scientific data their return assured), or one-half billion dollars per person. Even if some of the above assumptions are altered, the lives of Apollo astronauts are the most valuable ever protected by American taxpayers. Further, on the basis of

Weinberg's figures, \$8 billion in shelters would save 22 million lives, at \$363.63 per individual. The value ratio of an ordinary citizen's life to an astronaut's life is about 1:1,375,000.

To discuss the Apollo project in these terms will certainly seem repugnant to many, especially humanists, and in no sense am I advising that the Apollo shots should have been designed as kamikaze-like missions. The idea that they might have been, however, has occurred to others, for example, Boule (1965) and an anonymous author in *The Flying Physician*. The basic question still bedevils NASA in another form: Should there be a space rescue system?

Probably the most impressive source of an Apollo-inspired comparative approach to the economic value of life was Walter Orr Roberts when he was president of the AAAS (1968):

We plan to walk on the moon, and with exquisite concern for the lives of the two or four astronauts who will walk there, we spend hundred of millions of dollars to assure their safe return. But we find it impossible to marshal the human ingenuity to give food or shelter to the uncounted millions of souls who will die of sheer starvation or exposure.

Another comparative approach is the trade-off analysis. What should be foregone in desirable features of our culture to prevent deaths? In a paper at a National Academy of Engineering Symposium in 1969, Martin Wohl of the Ford Motor Company stated the problem succinctly:

. . . It is hardly sensible to adopt a policy that attests that "lives and limbs" are priceless. No matter how final one's death or loss of vital parts may be, neither can be regarded as priceless. To argue the contrary, for example, would be to argue that people would be willing to sacrifice their homes, recreation, food, clothing, traveling – in a word, everything – in order to reduce traffic safety hazards and guarantee their chance of survival and non-injury.

A different trade-off approach is to weigh the loss of income incurred by some segment of the population, such as those in the cigarette industry who would suffer if cigarette sales were reduced or forbidden, against lives to be lost, such as those succumbing to smoking.

HUMAN FACTORS

Analysis of the economic value of the human lives and of the economic losses incurred by deaths does have tangential significance for the field of human factors, since we too engage sometimes in cost-effectiveness studies. But they are primarily the province of economists. How might life and death figure more directly in human factors research and practice? I find a number of ways, most of them concerned with technology and its products, the legitimate home of human factors enterprise.

One will have been apparent to you already: the prevention of fatal (and otherwise injurious) accidents, especially in transportation, and more especially in motor-vehicle transportation. Human factors people have already moved into this field, in human engineering, simulation, and training. I should like to see them compare human engineering, training, and selection for their relative advantages. I should like to see them protect the pedestrian. We need more Naders. One of the ironies of the human factors world is that not human factors but law produced Ralph Nader. Lawyers are our social engineers, and it seems they can also become human factors engineers. Above all, I should like to see human factors people try to get a handle on the motivational variables in driver behavior that lead to life or death decisions on the highway – such as those, for example, responsible for what I call "caution" behavior.

In recent years human factors people have also been entering hospital and health systems. Human factors techniques may raise the chances of survival of hospital patients and applicants for

admission. Medical instrumentation cries for human engineering attention. I do not see much likelihood of human factors involvement in the most dramatic human-machine situation in medicine, namely, the determination as to who shall live and who shall die, to which patients life-saving devices should be assigned when there are too few of these for all. Yet this is a selection of personnel.

Another human factors area is military systems – notably those designed for defense. The number of lives saved through human factors improvements in an air defense system, for example, has always seemed to me a valid criterion, among others, of the effectiveness of the improvements, just as the total of lives saved seems like a good criterion of the effectiveness of the system (provided, of course, you are in favor of human life). I first verbalized to myself this criterion almost two decades ago when I worked at Columbia University's Electronics Research Laboratories on the human engineering of some air defense semi-automatic equipment. The work seemed terribly important. Just think, one might be helping to save a million lives by reducing the number of effective enemy bombers by one or two! When I went to the System Development Corporation to continue developing system training for the SAGE system, the same kind of thought sustained me, although I don't recall any widespread use of "lives saved" as a criterion of system effectiveness. Perhaps if more attention had ever been paid to it, efforts to increase system effectiveness, if only by a few percentage points, would have attracted wider interests – since each percentage point might mean a million fewer deaths in a nuclear war.

In addition to trying to limit the death total in war, human factors people might well engage in attempting to prevent war itself. I think particularly of the concept of deterrence, which is so central to the strategy of the Soviet Union and ^{3.4} Deterrence means influencing the adversary's behavior – the development and use of his technology – through one's own behavior in relation to one's own technology. Surely these are human-machine relationships, with enormous import. Assumptions with life-and-death significance are being made about human behavior, particularly behavior to be influenced by the threat of death, multiple deaths, in competition with other influences in a complex organizational context. What is known about such behavior? How valid are assumptions of rationality? What values will variables in motivational mechanisms acquire and maintain, under a range of circumstances, and what contingencies will result in what action? To answer such questions requires an extension of human factors knowledge onto motivational mechanisms in human behavior, probably drawing on research from operant conditioning. But why shouldn't human factors research and applications be thus extended?

As an example, it might be concluded that one way to avert the use of destructive technology on a massive scale would be for rival powers to demonstrate this use jointly on a limited, controlled scale, giving it maximum publicity. In other words, the United States and the Soviet Union might together destroy some simulated metropolis with a nuclear explosion while the world watches on TV. Would such an undertaking augment a mutual deterrence, that is, mutual avoidance of initiating hostilities? Might not the balance of terror be maintained by mutually renewing the terror?

Human factors people might well get involved in population control. Population growth is outstripping the development of new food resources and apparently will continue to do so. More and more human beings are moving further and further along the nourishment continuum toward starvation. It has been estimated that 417 persons die in the world every hour from malnutrition and its effects. In spite of this attrition, demographic estimates of the world's population in the year 2000 are as high as even 7 billion. Even if the final figure is a billion or two lower, the planet will be crowded, and more so in the year 2100. Nor is the problem simply one of food supply. Man does not live by bread alone. Humans call on many other resources which will also be in short supply. Furthermore, as numbers increase, so will human waste products and those of the industries satisfying collective wants.

The population problem is a complex one. The IUD and the pill were developed without benefit of human engineering know-how, but there remains a formidable problem in training, that is, in persuading women to use them and men to support their use. Beyond these devices, moreover, there remain difficult questions of preferred family size and of alternatives to woman's role as a mother. Widespread distribution and use of contraceptives are not the only way to reduce birth rates, and it has even been argued that "family planning" programs will not bring birth rates down to levels that will halt population growth (Davis, 1967), even when the programs are successful.

It should be realized that high birth rates are not the only cause of the population explosion. Decreasing mortality has made its contribution. "There are two biological checks upon a rapid increase in number," Dorn (1962) has pointed out, "a high mortality has resulted in the past from war, disease, and famine.[close quote here?] Man has achieved some success in controlling two of these regulators, disease and famine. Mortality has dropped and the population grown. I shall come back to this theme in a few moments, after looking at one more potential human factors venture.

To enable people to adopt a more systematic view of the subject, human factors research and analysis might be directed toward defining the parameters of death. By parameters are meant those aspects of death which influence the behaviors of those who survive. Certainly the parameters of death and their interactions will have to be better understood if a systems analysis of humankind is to achieve results. What are some of these parameters?

One is the amount of pain accompanying death. Related to it is the manner of dying – by disease, famine, "old age," accident, war, murder, suicide. Even though the ultimate outcome is the same, people seem to have preferences. (Further, the manner of dying may be prosaic or rather special.) Another parameter is the duration between certainty of death and death itself, death's suddenness. A fourth is an individual's subjective probability that death will result from certain conditions – the uncertainty of the event, so well expressed in "when there's life, there's hope." The point in time during a person's lifespan when death occurs constitutes another parameter. It may be shortly after birth, for example, or at the start of adulthood, or in mid-life, or in senescence. The significance of death varies according to when it happens during life.

Reaction to death varies according to who dies, and where. There are gradients of individual importance and geographical or cultural location. I first fully realized this when I became a newspaper reporter in New York City and was occasionally assigned to a police beat. There had to be a dozen deaths in a fire in Harlem to get the same space as one on Park Avenue. A dozen deaths in a Park Avenue fire are something else again.

The number who die under the same circumstances is an important parameter. In impact, it interacts with identity, location, and cultural affinity, as well as cause and suddenness. If a thousand human beings starve to death during 24 hours in Calcutta, who in New York knows or cares? Yet if the same number should starve to death in New York or be killed in Calcutta in an earthquake, it is another story. More U.S. citizens die each week in automobile accidents than are killed in Viet Nam. Which get the headlines?

Our century has seen genocide in Russia, in Germany, in Indonesia, in Africa. One's reaction in each instance depends on who one is

The last parameter I shall mention is not a trivial one. People react to the possibility of death according to what they confront as alternatives. "Better dead than Red" is an example. So is the convers.

These parameters are not novel, but to my knowledge they have not been measured, nor have their interactions been fully explored. The parameters of the threat of death are equally interesting and uninvestigated. As I have already noted, we tend to avoid systematic analysis of the subject, so we are left in ignorance about matters of life and death.

A PROJECTION

I will conclude with some observations about something else we find aversive and avoid, partly because in our culture "life" as such is valued so positively. Those who find the topic of death too lugubrious should read no further.

Let me refer back to Wolfe's statement that we "must" assume "we will succeed in stemming population growth and preventing nuclear catastrophe." As I said at the outset, this assumption may be questioned. The very systems analysis Wolfe proposed might reject it! The analysis might lead instead to the following hypothesis:

1. Population levels cannot be held in check by limiting fertility, that is, by reducing birth rates to the required levels. The alternative, as we have seen earlier, is to increase mortality.
2. Nuclear catastrophe cannot be prevented.
3. However, nuclear war would reduce population levels in such a way that population control would no longer be a problem. Fallout, fire, flood, and famine would decimate both agricultural and urban populations in all lands.
4. If the Earth is a closed ecological system, it is likely that this is the way things will go to arrive at the balance of nature. The only uncertainty lies in the character of the cataclysm. Some other population-destroying event may occur that would fulfill the same function and at the same time eliminate the possibility of nuclear war.
5. However, nuclear war is the most probable event, because a process which assures it is already operating. The strategy of deterrence depends in part on the adversary's conviction that we would employ the deterrent. Yet continued growth of uncertainty in this country about the employment of this strategy, and even hostility to such a strategy, may weaken the adversary's conviction to the point that the deterrent is no longer effective. If at the same time a similar "softening" does not develop in the adversary, a process of progressive imbalance occurs, leading to war.
6. Like the population explosion, other unsolved and possibly unsolvable problems, such as water and air pollution, will be resolved by the cataclysm through the destruction of the technology that created them.

The ecological projection I have outlined derives its strength in large part from the first hypothesis, to which I am inclined to subscribe, that population cannot be held in check. The prospect is grim, yet neither unique nor hopeless. Man is just now learning, in our time, that sometimes life must perish for life to survive. For example, the belief has grown that some forest fires should be permitted to burn or even be prescribed rather than suppressed, to prevent more devastating fires or unwanted changes in the composition of the forest. Man has also discovered he has, in the past, destroyed much of his environment. For example, it is thought that through his agricultural practices in past millennia, man has changed much of Egypt, Libya, the Sahara, Arabia, and Tibet from forest and cultivated fields to desert (Bouillenne, 1962).

Please note that my ecological projection does not include the destruction of civilization. Culture is exceedingly tenacious and seems to survive when only a few people and their artifacts survive. Despite enormous destruction, habitats are rebuilt, as attested by Normandy's St Lo and Leningrad after World War II. Nor is my projection founded on religious or moral beliefs that Armageddon is at hand.

According to the projection, death on a very large scale over a relatively short period of time is inevitable on this planet. Only one circumstance might stand in its way. If it is widely enough

appreciated that on our present course the holocaust is inevitable, the reaction of mankind may be strong enough to prevent it.