Kenneth Boulding. Beyond Economics: Essays on Society, Religion, and Ethics. Ann Arbor, MI: University of Michigan Press, 1970 [1968].

A Pure Theory of Death: Dilemmas of Defense Policy in a World of Conditional Viability[*]

Death as a System Boundary

Death is a subject which is more often associated with the macabre half-light of Gothic fancy than with the sunshine of reason, science, and general systems research. It is, however, a phenomenon which is common to many systems and there is no reason why it cannot be examined in the light of systems dynamics. It may be defined as a system-break or a point of no return in the dynamic course of a system. It is a semi-permeable boundary around a system which has the property that it can be crossed from the inside to the outside but cannot be crossed from the outside to the inside. When the dynamic course of a system carries it beyond this boundary, therefore, it can never return. The system is excluded forever from the old paths.

Death may be followed by transfiguration or it may not. A system that crosses a death boundary may reform itself within another boundary. Sometimes, however, a system passes the irreversible boundary into sheer disintegration and nothingness. This raises, of course, the ancient conundrum about when is a system not a system, when does a set of variables in the course of their dynamic development stop being System A and start being System B. I doubt very much if any answer can be given to this question in logic; it can only be given in experience and in utility. We divide the great system of

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the universe into sub-systems such as people, animals, plants, things, and organizations—largely for our own convenience and because it pays us to do so. I shall argue that there is nothing wrong with this although it may seem untidy to the pure logician; there is nothing wrong, that is to say, with the payoffs of arbitrary classification, provided they do not turn out to be a cheat and disappointment. I will take, therefore, a fairly naive view of the universe as consisting of a large number of reasonably identifiable sub-systems, *the boundaries* of which I shall derive from experience rather than from logic.

The poetic images of death give us an important clue to its ubiquity as a systems phenomenon. A pitcher goes to the well once too often and is shattered; Humpty-Dumpty falls from his wall; and all the king's horses and men cannot put him together again. A clock stops; a flame is blown out; all these events are simple models of death at low systems levels. A static pattern like a china vase exists through time until some point where too great a strain is put upon it and it disintegrates never to be reassembled. A simple cyclical-mechanical system like a clock endlessly repeating a pre-ordained cycle may stop because one small link in the causative chain is broken, and to start it again requires the incursion of a much more complex system in the shape of the watchmaker. All clocks left to themselves eventually stop. This is a consequence of the great and universal law of increasing entropy. If they are to be restarted, entropy must be diminished from outside. The flame is a still closer analogue of life. It is one of the simplest of the open systems; it is a system, that is, with a role structure. At each point in the flame, there is a chemical state which can well be described as a role. The molecular occupants of this role are continually passing on to the state immediately above and are continually renewed from the state immediately below. An open system is a system in which a given structure is maintained in the midst of some kind of a throughput of role occupants. When the flame is out, the role-structure disappears. The candle and the oxygen may still be there, but the temperature is not high enough to maintain the role-structure of the flame. There is a physical boundary here within which the flame can exist and outside of which it cannot exist. The candle may be burnt out; that is, the food supply which provides the molecular occupants for the first roles in the system may disappear. The waste products may accumulate to the point where the last molecular occupants of the last role cannot leave it, and this stops the flow of material through the system. The surrounding temperature may be reduced to the point where the chemical reactions which sustain the system can no longer be carried on. This is what happens when we

blow out the flame. In any case, once a flame is blown out, it cannot reestablish itself. The system has passed a one-way boundary through which it can never return under its own dynamic. If the system is to be reestablished, it must be through the act of some outside system. Usually energy must be supplied to the system, although in some cases the reestablishment of a system may involve the withdrawal of energy. In all cases entropy must be withdrawn from it, and organization supplied.

Life as a Homeostatic System

The taxonomic boundary that separates non-living from living systems is perhaps hard to draw, as a fine line. We do not have to cross very far over it, however, before we are aware that we are in a new country and in a new type of system. It is the peculiar characteristic of life, as Schroedinger has said, that it feeds on entropy. The flame cannot defend itself against the wind. If it dies, it can only be reestablished from outside.

A living system, by contrast, is capable of at least minimum defense against its environment. It exhibits, that is to say, the phenomenon of homeostasis. Homeostasis is something a little different from mechanical equilibrium (of which it is the Greek translation). In a homeostatic system, information begins to play an essential role. Because of this, homeostatic systems are self-sustaining in a way that mechanical systems cannot be. If a clock runs down, it has to receive energy from outside; if it breaks, it has to receive organization from outside, that is, negative entropy. A living system is not passive in regard to its environment; it goes out and seeks sources of energy, and because it has information as an essential element it can create organization within itself. When a candle is burned out, the flame simply comes to an end: it does not wander around the room looking for a new candle. When even the simplest living thing is hungry, it seeks food. It does not simply maintain itself passively as an open system. When its open system is threatened, either by the absence of inputs or the inability to get rid of outputs, it indulges in at least scanning or seeking behavior in the endeavor to find a new environment in which it can survive.

Four Degrees of Homeostasis

We may distinguish perhaps four kinds of homeostasis. We have first, the homeostasis of a state, cybernetics. This is a type of system, of course, which extends below the threshold of life and there are many examples of non-living cybernetic or control systems of which the

thermostat is the most often cited. Even non-living cybernetic systems, it should be observed, involve information as an essential variable. They must have the following components:

(1) An ideal state of the system (the temperature at which the thermostat is set); (2) a receptor, that is, an apparatus for perceiving the actual state of the system and recording the divergence between the actual and the ideal states (the thermometer); (3) a communication system which can communicate the information acquired by the receptor (2), and (4) an executive or decision-maker who can interpret this information and transform it into instructoin to (5) an effector (the furnace) which can effect the environment. All living organisms and all social organizations exhibit a great variety of these cybernetic or state-maintaining systems, and a great deal of behavior, although by no means all of it, can be explained by cybernetic models.

The second aspect of homeostasis is role-maintenance, that is, the maintenance of an occupant in each role of the system. The simplest level of an open system is one in which we have a structure of roles, holes, or slots in each of which is some kind of occupant, and which are connected by lines of transportation along which occupants can move. In a simple, one-way open system, each role is connected by a line of transportation to some role below and to some role above. As the current occupant of the role passes to the role above, a new occupant must be received from the role below. In the flame, the gases pass from one chemical zone to the one immediately above it and each zone receives the appropriate molecules from the one below and passes them on to the one above. In the river, another interesting example of a non-living open system, each segment of the river receives water, gravel, sand, vegetation and fish from a segment immediately above, and passes similar items on to the segment immediately below. In a university, sophomores become juniors and are continually recreated by freshmen. In any self-maintaining organization, a job which has become vacant either because of death, removal, or promotion of its occupant has to be filled either from another position in the organization or from the outside. At the simple biological level, as we have seen, such phenomena as hunger and thirst, and from the point of view of the species, sex, can be regarded as role-maintaining activity. In an industrial organization, the personnel office is the role-maintaining organization at lower levels; at the higher levels of the organization, the peer group tends to be the role-maintaining apparatus. The self-perpetuating board of trustees is, of course, the ideal type of the role-maintaining peer group.

A third and still higher organizational level of homeostasis might be described as "maintenance-maintenance." This is the apparatus for maintaining the role-maintenance apparatus itself. Thus, at the biological level, food-growing can be thought of as maintenance-maintenance, whereas mere food-seeking is role-maintenance. The food-grower sees to it that there is a supply of food for the food-seeker to find. Food-growing clearly represents a higher level of organization than mere food-seeking, and it is no accident that food-growing, that is, agriculture, signalized the passage from pre-civilized societies to civilization. The movement from civilization to post-civilization through which we are now passing reflects perhaps a fourth degree of homeostasis, in which, for instance, scientific research enables us to grow more food more easily and so support a still higher level of organization. Scientific research then is seen as the maintenance or even the improvement of the maintenance-maintaining activity.

Organizations as Defense against Death

It is not unreasonable to think of these increasing degrees of organization and homeostasis as successive levels of depth in defense against death. The flame has no defense against death. If its environment changes to the point where is goes out, it simply goes out. A simple cybernetic system has some defense against changes in the environment. When the weather gets cold, the furnace works harder, and the temperature of the house is maintained. Cybernetic systems, that is, build little islands of stability in a changing world. Even at this level, we can perhaps distinguish between two systems of defense which might be labeled "flight" and "fight." In flight, a worsening of the immediate environment which is perceived as dangerous is followed by a removal of the system to a new environment. If the system has receptors which inform it as to whether the environment is getting worse or getting better, and if there is a continuous field of more or less favorable environments, this procedure can be quite successful. The snake, who is too hot in the sun, for instance, will crawl into the shade. In cold weather he retreats into the warmer ground. By contrast, the so-called warm-blooded animals maintain an internal environment which is in a degree independent of the external environment. When the external environment worsens, they do not necessarily flee (although in practice fight and flight responses are frequently combined), but they put more energy into the system in order to maintain a favorable internal environment even when the external environment is unfavorable. When we get cold, we burn more fuel, we insulate

ourselves, our teeth chatter, we become more active, and so on. When we become hot, we perspire, we relax, we seek the shade, and so on. Similarly, the firm which finds itself in an increasingly unfavorable market environment—which finds, for instance, its inventory of product accumulating or finds that it cannot sell its output except at a loss—will develop new forms of activity. It may cut back its output; it may go in for price-cutting; it may go in for a sales campaign; it may even merge with another firm. All these are possible defenses against its death, that is, the dissolution of the organization.

The Theory of Conflict and Viability

Up to this point, we have assumed that the state of the organization is simply part of a generalized state of nature, and that the defenses against death are defenses against the "worsening" of an abstract external environment. We must now move one step towards reality and suppose that the environment includes other organizations or organisms. The system then becomes much more complex, since we now have a system of interaction among organisms. The defenses against death then involve not merely defenses against a worsening external environment, but defenses against other organisms. We now move into the theory of conflict, in which death may be the result of a loss of a conflict or of the dominance of one party over another. This is the system, of course, which is of peculiar interest from the point of view of national viability or national defense. It is derived largely from the economic theory of duopoly or oligopoly.

I have developed it in some detail in my book entitled *Conflict and Defense*[1] and I shall only summarize it here. The essential concept is an undefined variable which I call simply "strength." The only significance of this concept for the pure theory is that it serves to define the dominance relationship. One of the systems is said to be dominant in any part of the field in which its strength is greater at that point than the other party. To fix our ideas and to bring us closer to the problems of the day, let us suppose that the systems are two nations and that they exist in a geographical field. For purposes of simplicity, let us suppose this is a straight line. The two nations are located at A and B in Figure 1. For each nation, we postulate a strength function over the field, represented by FHC for A and LKM for B. As we have drawn these functions in the figure, we have supposed that the maximum strength for each nation is at its home base.

[1] K. E. Boulding, *Conflict and Defense* (New York: Harper and Row, 1962).

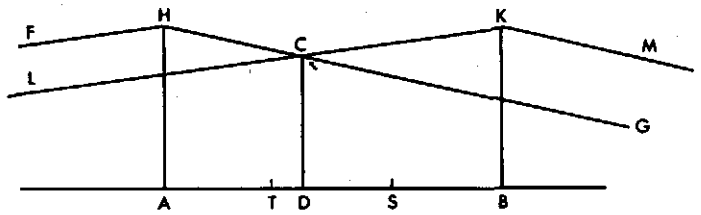

FIGURE 1. Areas of Dominance and the Boundary of Equal Strength: Unconditional Viability

This is a reasonable but not a necessary assumption—that the strength of each nation is the greatest at its home base but declines as it goes away from home in any direction. The point of intersection of the two strength functions at C, is the boundary of equal strength D. Anywhere to the left of D, A is dominant, anywhere to the right, B is dominant. The situation of Figure 1 is what I would describe as mutual unconditional viability. Each party is dominant in its own territory and neither can destroy the other.

Consider, however, the situation of Figure 2. Here nation A is dominant over B at all points in the field including B's home base. Assuming that dominance implies the ability to destroy, then I would

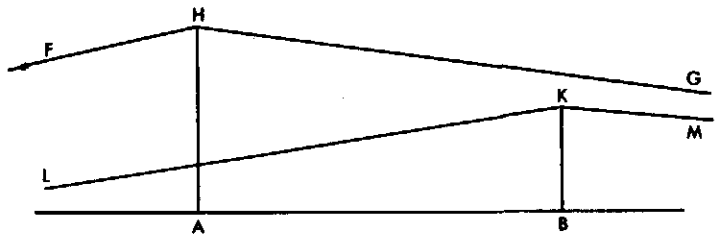

FIGURE 2. Conditional Viability

say that in this case, B was only conditionally viable. The condition here is that A is unwilling to use his power to destroy. Here we may distinguish two further sub-cases. If A has the power to destroy B, but it is not to A's interest to do so, we may call this secure conditional viability. If A has the power to destroy B and it would be in its interest to do so, but for some reason or other, either through ignorance or sheer lack of imagination, it refrains from doing so, this might be described as insecure conditional viability.

Consider now the extraordinary case of Figure 3, in which the strength of each country increases as it goes away from home. Here B is clearly dominant over A to the left of D whereas A is dominant

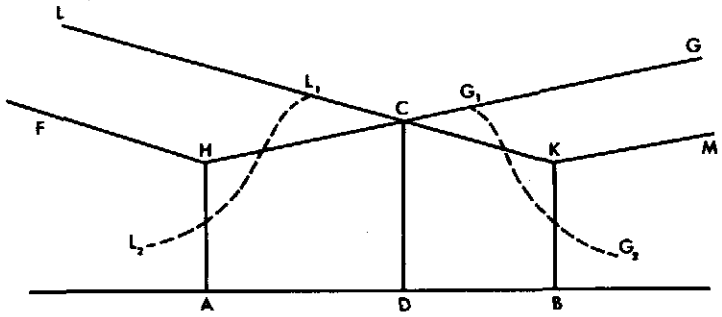

FIGURE 3. Mutual Conditional Viability

over B to the right of D. That is to say, each country can dominate the other one at the other's home base. This is what I would call mutual conditional viability, for each country can destroy the other. This is the sort of situation that we are moving to very rapidly on a world scale, if indeed we have not already arrived there.

In the case of military defense a further complicating factor arises. War may be defined as men throwing things at each other with malicious intent. In this kind of system, the range of the deadly missile is a variable of great importance. Thus, to return to Figure 1, if the range of the deadly missile is equal to AT or BS, the countries would still be unconditionally viable because each can dominate an area beyond its home base equal to the range of the deadly missile. If, however, we suppose the range of the deadly missile increasing, shall we say to AS (= BT), the situation reverses itself. Under these circumstances, neither country can dominate an area beyond its home base equal to the range of the deadly missile and neither of them, assuming that the missiles exist, is any longer unconditionally viable. If, under these circumstances, both had the deadly missiles, we have a situation which is known as deterrence, which is also roughly where we are today.

If the strength functions are linear, they can be described by two very important parameters. One is the home strength, AH or BK, that is, the strength at the home base. The other is the loss of strength gradient, that is, the slopes of the lines HF, HG, LK, and KM. With

this simplification, we can now relate the viability conditions to the home strengths of the two nations concerned. Thus, in Figure 4, we measure the home strength of A along OA and of B along OB. Refer-

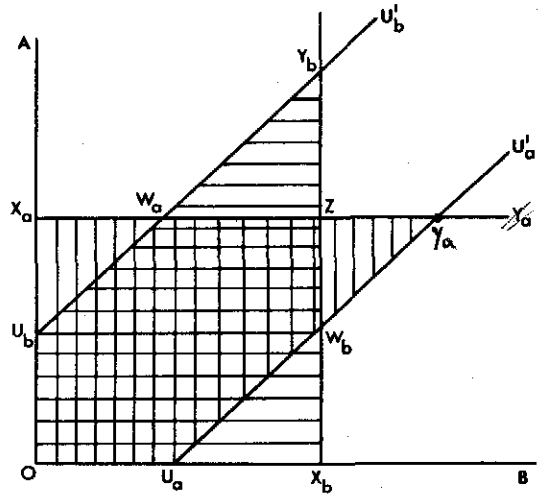

FIGURE 4. The Unconditional Viability Boundaries

ring now to Figure 5, we see that if A's strength function HG passes through K, B is only just unconditionally viable. This condition

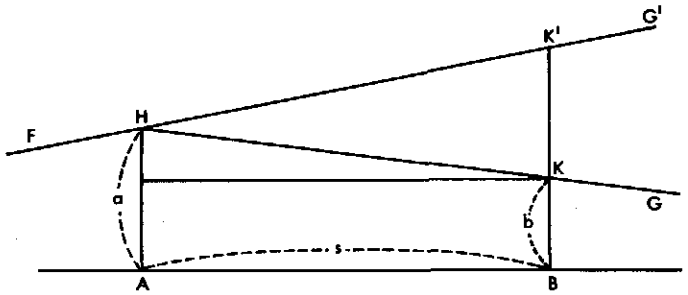

FIGURE 5. Situation on B's Unconditional Viability Boundary

is expressed by the equation $a - b = cs$, where a and b are the respective home strengths, s is the difference between the nations (equal to AB) and c is the loss of strength gradient or the slope of the line

HK. In Figure 4, this is the equation of the line $U_b\ U^1_b$. This is an unconditional viability boundary for B. At any combination of home strengths above and to the left of this 45° line, B is no longer unconditionally viable because A can dominate him at its home base. That is, we have a condition like Figure 5. Similarly the line $U_a\ U^1_a$ is the unconditional viability boundary for A corresponding to the equation $b - a = cs$. This would be the situation in Figure 5, where BK^1 was the home strength of B and AH the home strength of A.

In Figure 4, let us further suppose that there is some level of home strength of A, OX_a and B, OX_b which these countries cannot exceed. This represents the economical, political, or psychological limit of their strength capability. We then have two further boundaries, $X_a\ Y_a$ and $X_b\ Y_b$. The horizontally shaded area $OU_bY_bX_b$ is that part of the field within which B is unconditionally viable with respect to A. This area is shaded horizontally to show that B can move unilaterally in this direction, but not vertically. Similarly, the vertically shaded area $OX_aY_aU_a$ is A's area of unconditional viability. We have now divided the field into four regions. We have an area of mutual unconditional viability which is the cross-hatched area $OU_bW_aZW_bU_a$. We have two triangles, $U_aW_bX_b$ and W_aY_bZ in which B is unconditionally viable but A is not. There are two similar triangles vertically shaded in which A is unconditionally viable and B is not. Then there is the unshaded area of the field in which neither country is unconditionally viable, and we have mutual conditional viability.

Remembering now that $OU_b = OU_a = cs$ in Figure 4, we can see immediately the effect either of a decline in the loss of power gradient c or diminution of the distance between countries s or, more exactly, a diminution of what might be called the effective distance, which is the distance between them minus twice the range of the deadly missile, or the distance TS in Figure 1. Any of these things moves the lines $U_bU^1_b$ and $U_aU^1_a$ closer together in Figure 4, diminishing the cross-hatched area or the area of mutual unconditional viability. By the time either c or s reaches zero, the area of unconditional viability has been eliminated. This, again, I would argue, is close to the condition that we face today.[2] It is easy to develop variations on Figure 4 with different assumptions about the viability boundaries. The maximum home strength of each country, for instance,

[2] If r is the range of the deadly missile, the unconditional viability boundaries are $a - b = cs - 2cr$, and $b - a = cs - 2cr$. An increase in the range of the deadly missile therefore diminishes OU_b or OU_a in Figure 4 by twice the increase in range.

may be a function of the home strength of the other, in which case the lines $X_aX^1_a$, etc. may bend toward or away from one of the other axes. None of these various cases, however, destroys the fundamental conclusion regarding the systems-effect of a decline in the loss of strength gradient or an increase in the range of the deadly missile.

Viability in the Interpretation of History

These models may seem abstract, but they imply a whole interpretation of history, and, in particular, they imply a conclusion about the nature of the present crisis which is both startling and is certainly not generally accepted. The interpretation of history is that with each diminution in the loss of strength gradient as a result of improvements in methods of transport and as a result of a continual increase in the range of the deadly missile, the size of the unconditionally viable unit has been continually shrinking. We have now got to the point where the range of the deadly missile is close to 12,500 miles. This is the end of a long historical process. Unconditional viability has now disappeared from the earth. If we think of unconditional viability as the essence of what might be called the classical system of national defense, we can put the matter even more strongly by saying that the system of national defense has now come to an end. It has been succeeded by a quite different system which is the system of deterrence. This is, unfortunately, a system which is only metastable. It is stable for small disturbances, but not for large, like Humpty-Dumpty on the Wall. Unfortunately, also, there is no guarantee that disturbances will not be large enough to upset Humpty-Dumpty and then all the king's horses and men will never put him together again.

I think it can be demonstrated historically that where unconditional viability has disappeared in any human or organizational relationship, the system of deterrence which has succeeded it has turned out to be so disagreeable and unstable that the system has always either fallen back into defense, that is, into unconditional viability, because of some regression in technology, or else it has gone forward into a system that might be called community. This has been true, for instance, in the field of personal combat. We have achieved personal disarmament not by any agreement—the American constitution, indeed, explicitly guarantees the individual the right to bear arms —but by a disarmament race, initiated unilaterally by individuals because of the sheer personal danger of living under a system of deterrence. Unconditional personal viability disappeared with the crossbow and was completely finished off by the revolver. If anybody seriously wants to kill me, there is practically no way in which I can

stop him. There is, perhaps, a certain second-strike capability in the hands of the law, but certainly not in my hands, as I know of no way of killing a man after I am dead. But even the operation of the law is highly uncertain, and it is doubtful whether it acts as much of a deterrent. It certainly does not succeed in preventing homicide, although it does perhaps succeed in limiting it. We have now arrived at the same condition of conditional viability in regard to the relation of nations to which we have long been accustomed in the relation of persons. Unconditional viability has disappeared, and with it the whole classical concept of national defense. Unless we can go forward into world community, we are almost bound to slip back. The only way to go back to national defense, however, is through a widespread technological collapse as a result perhaps of a nuclear war.

Adaptive Systems Survive Periods of Transition

The moral of all this rather abstract argument is that we live in a time of history of quite unprecedented system-change. The only period in history which remotely approaches what we are now going through is the transition from pre-civilization to civilization which began about 3000 B.C. In periods of very rapid change, it is the adaptive systems that survive rather than the simple equilibrium systems. The difference between these is illustrated in Figure 6. Here we suppose that each

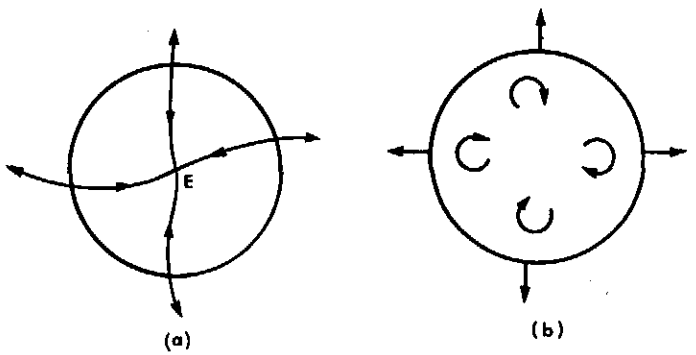

FIGURE 6. Adaptive Systems

point in the plane of the paper represents a different state of some system or organization. In each case, the heavy circular line represents the "death boundary." Within it, all the points represent the states in

which the system is viable. Outside it, the system is not viable and will disintegrate or be transformed. The lines with arrows represent the possible dynamic paths of the system. In Figure 6(a), which is an equilibrium system, all the dynamic paths lead to an equilibrium system at E, within the death boundary. As long as E is within the death boundary, that is, in the viable area, the organism will survive indefinitely. If, however, the death boundary shifts so that E is no longer within the viable area, the organism has no defenses against this shift and will not survive.

In Figure 6(b), we see by contrast an adaptive system. Here, as the dynamic course of the system turns it toward the death boundary, this fact is "perceived" and forces are brought into play to turn the system away from it. There may or may not be a single position of equilibrium within the death boundary. This does not matter, however, as the system is defended against passing the death boundary by its adaptive nature. If there is a shift in the position of the death boundary, the system perceives this and adapts accordingly. A good example of an adaptive system would be a man in a car driving towards a railway crossing with a red light flashing. His behavior and the resulting motion of the vehicle is a function of the distance between the vehicle itself and the perceived death boundary. An equilibrium system by contrast would be a vehicle proceeding at a constant rate of speed no matter whether the danger signals were flashing or not. Clearly, the more rapid the rate of system change, the more important it is for a system to be adaptive to survive. In the relatively stable world and in a relatively stable environment, equilibrium systems may have high survival value. They may indeed be better adapted to a particular stable environment than an adaptive system would be, for we almost always have to pay a certain price, in complexity if nothing else, for adaptivity. In the rapidly changing environment, however, equilibrium systems are continually finding themselves outside the viability zone and they have no recourse against this disaster.

The Crisis of National Defense

With these considerations in mind, let us take a look at the present crisis of the system of national defense. I have argued that we are here facing a true system-breakdown in national defense, in that no nation is now unconditionally viable, and national defense implies a world system in which unconditional viability is possible. There are several possible adaptations to this situation. We may attempt to restore unconditional viability and the system of national defense. Two approaches are generally suggested to this problem. One is arms control, world organization, and the elimination of war as a social system. The other is the development of defensive weapons or other defensive apparatus to reduce the strength of the potential enemy in the neighborhood of the home base of the defender. Let us suppose that in Figure 3, by defensive measures, we could lower the strength-line KL to KL_1L_2 and the line HG to HG_1G_2. Unconditional viability has now been restored, for each party is stronger than the other at home, provided that the defensive measures are not so expensive as to destroy the internal viability of the nations concerned. This, in essence, is the theoretical base of those who would argue that we should go underground in the face of a nuclear weapon. The feasibility of this proposal is partly technical, partly psychological and ethical. I am no expert in the technical feasibility of these proposals. I am, however, highly skeptical about them, even if they are technically feasible, for the price of defense under these circumstances seems to be absurdly high. Furthermore, if there are any lessons from history, it is that defensiveness of this kind is always obtained at an extremely high cost, especially in mobility and other forms of adaptiveness. Neither the turtle nor the knight in armor ever got very far, and though the tank had a brief success, its day seems to be over. The truth seems to be that the concentration of effort on defensiveness in this sense, that is, on city walls, Maginot lines, armor plate and civil defense, either is inimical to survival or, if it succeeds, succeeds only at a fantastically high cost in terms of the nature of the organism which is defended. If the continuance of the system of the sovereign national states implies that we shall all live on algae in caverns, then I say, "To hell with it." There must be better solutions to the problem than this.

The anti-missile missile represents a variant of the above case. This might be called the defensive-aggressive weapon, or the interceptor which is designed to destroy the enemy's deadly missile before it reaches its target. Here again, I cannot judge the present technical feasibility of such systems. I may be permitted, however, to express extreme skepticism about them. There is a profound tendency for defensive measures to become obsolete, and for offensive weapons to outrun them. The deadliness of the nuclear weapon is so great that I shall be extremely surprised if any defense for it is ever found. Just as firearms destroyed armor, and the revolver led to personal disarmament, now I suspect the nuclear weapon will likewise lead to the destruction of national sovereignty and to world disarmament. The final answer to those who advocate the practicability of nuclear war

seems to me to lie in the purpose of such a war, which is to restore the system which produced it! If the price of national sovereignty is a nuclear war every generation or so, again I say, "to hell with it," for the loyalties on which national sovereignty depends will not stand up under these circumstances. The best form of loyalty to a hopelessly insolvent organization is to bankrupt it as soon as possible so that it may be reorganized into a viable form.

The Necessity for Adaptive Conflict Control

The world system in which we now live has a positive probability of nuclear disaster built into it, and though we do not know how great this probability is, it is certainly of an order of magnitude to be seriously disturbing, even if it is only one per cent per annum. Under these circumstances, it is desperately necessary to develop adaptive systems, especially adaptive social systems, which can diminish and rapidly eliminate the probability of this disaster. The attempts to build equilibrium systems of defense on stable deterrence seem to me to be doomed to failure. The world changes too rapidly and, as we have seen, it is the adaptive system, not the equilibrium system, that will survive under these circumstances. The adaptive system which is required here is a world system of conflict control. By this I mean social institutions which will be able to detect the dynamics of conflict situations and will be able to throw in counterweights, or countervailing forces, which will prevent these systems from reaching the crisis point of system-breakdown into overt violence involving the use of national armed forces. Such institutions already exist on the national level. In the less-developed countries this may take the form of conflict-suppression rather than control, which is dangerous in the long run. In the developed countries we have an extremely elaborate set of social institutions—the law, the courts, the regulative agencies, collective bargaining, arbitration, and so on—all of which are designed to divert conflicts into peaceful channels and to diminish the reactivity of conflict processes. At the world level, we have the beginnings of such institutions but they are not yet adequate, and we do not even have the information institutions which will warn us when we are approaching a system boundary. We desperately need something which will be the equivalent of national-income statistics in the field of international tensions. As it is now, we often do not know what is happening until it is too late. We should ask ourselves, for instance, by what world institutions could we have dealt with Hitler, and this, incidentally, is a most unusual and unlikely case which may not occur again for a thousand years. We must then seek to build these institutions and put our major efforts in this direction.

The Armed Forces as Destroyers of Defense

There are, of course, even more urgent tasks than the development of the long-run institutions of conflict control. My personal view is that the armed forces of the world have become a social system almost completely divorced from the states which they ostensibly defend and which pay for them. They have become a highly reactive dynamic and isolated social system and it is, paradoxically, the armed forces themselves that have destroyed the system of national defense which they are supposed to embody. Under these circumstances it is an urgent task to build organizational ligaments between the armed forces of the world. I have argued elsewhere that, just as we resolved the religious question by the ingenious device of separating the church from the state, to the great mutual benefit of both parties, so we must solve the question of war by the separation of the armed forces from the state. In this case, however, the armed forces will wither away unless they can find other functions, for an armed force is one organization which has no justification apart from the existence of another organization of like kind. It is this which makes the interaction of the world armed forces a unique social system.

The bargaining problems involved in this movement are difficult, but they are not insoluble; this, however, would have to be the subject of another paper. In the meantime, we must exploit and strengthen all the tacit agreements which we have. Bargaining is not necessarily a matter of explicit agreement. Most of the important bargains of social life are never made explicit, and many of them are even unconscious. The tacit "agreement" that we have with the Russians to do nothing really serious about civil defense, for instance, is an extremely important element of the stability of the present situation, as Schelling (1960) and others have observed.[3] If either side breaks this, the results might be disastrous for all. Tacit agreements, however, are somewhat insecure, and there is much to be said for trying to reinforce them

[3] The incredibly dangerous situation which resulted from Kennedy's civil defense program of late 1961, the quiet sabotage of this program by the good sense of the American public, and the inability of Leon Gouré to persuade us that mysterious doors in Moscow subways constitute a civil defense program appropriate to the nuclear age are all tributes to the stability of this "agreement," even though it may rest on little more than mutual inertia.

with explicit agreements, as long as the attempt to write explicit agreements does not destroy the tacit.

The Price System as an Adaptive Mechanism

In the present state of the world, one must look not only toward the postponement—one hopes the indefinite postponement—of disaster; one must also look beyond disaster. We should certainly give thought to the nature of the adaptiveness of the social and economic system to recovery from a nuclear disaster. We may face a certain dilemma in that activity which is directed towards more rapid recovery from a disaster may make that disaster itself more probable, just as insurance probably increases the number of fires. For the most part, however, I am optimistic enough to think that some measures which would make for recovery from disaster would also postpone it, or at least would not make it more probable.

The major victim of a nuclear disaster is likely to be large-scale organization of all kinds, private or public, as the central offices and records of large-scale organizations are almost all concentrated in large cities. Some relatively simple measures, however, in the way of the establishment of a monetary system, of some form of quick allocation of the equity in the remaining property among survivors, and of a minimum of law and order, would be sufficient to set in motion a rapid process of recovery. The system of private enterprise is peculiarly well adapted to such a situation. Even Communist Russia, for instance, had to adopt the New Economic Policy which involved a partial restoration of private enterprise in the 1920's after an extensive economic collapse.

The extraordinary recovery of West Germany from the holocaust of the second World War is a good example of the adaptability of systems of this kind, and their remarkable powers of recuperation. Such a system, of course, requires a certain minimum of government. It requires a reasonably stable monetary unit, and it requires reasonable security of property. Once these are assured, however, the price-profit system has extraordinary powers of regeneration and recuperation. Even though a nuclear war, for instance, would see the United States with an extreme maldistribution of resources, with far too much in agriculture and not enough in manufacturing, provided that the holocaust led to a considerable collapse of restrictive and regulative government institutions, recovery should be swift. If a price system can be established, agricultural prices and incomes would fall very low and there would be a very rapid migration out of agriculture into construction and industry. Very large payoffs would appear at the

places in the society where they were needed, and resources would move accordingly. Recovery might even be assisted by the destruction of much of the apparatus of the Federal Government, or at least of its past laws, which on the whole would prevent adjustment and strangle developments under these circumstances.

Learning to Live with Conditional Viability

Even though I have a good deal of confidence in the adaptiveness of the social and economic system, I have very little confidence in the adaptive nature of the national state, and it is this institution which I think is really threatened by the existing technology. No national state, not even the United States or the Soviet Union, can guarantee to its citizens that minimum area of peace and security which alone can justify its sovereign existence. The political organization of the world is bankrupt. It is as obsolete as the sword. Unfortunately, we have no social institutions for bankrupting it decently and quietly, and for reorganizing it in a more stable and more satisfactory form. The present system is, I think, almost certain to end in catastrophe. The question remains, then, do we change the system before catastrophe or after it? If we prepare to change it before, we may be successful, in which case the catastrophe will be avoided. But even if the catastrophe is not avoided, preparation to change the system will bear fruit after the catastrophe, if this is not wholly fatal to mankind. It is the great genius of man that he is able to anticipate catastrophe in his imagination. He develops early-warning systems that warn him when he is approaching the cliffs. It is hoped that we can still do this in the crisis which now confronts us.

The problem is essentially one of learning under conditions of very rapid system-change. There is no doubt that this learning is going on. The Khrushchev doctrine of peaceful coexistence, incompletely thought out as it is, represents a very fundamental learning process within Marxism. Our own ideology is not so explicit, but still one can detect in our actions a certain learning process. The crucial question is, "Will it be rapid enough?" At the present time, the mass of the American people, and to a large extent what might be called the "establishment," still have an image of the world which is fundamentally obsolete. It is an image of the world in which national defense and unconditional viability still exist as they did for the United States before 1949. Among the more sophisticated, the realization is spreading that we have suffered a system-change, and that we must adapt our behavior accordingly. In particular, we must learn to live with conditional viability if we expect to survive as a society. This means

a national posture very different from what we have been accustomed to in the past. It is a posture, however, which is not wholly alien to what is best in our tradition. It may be that in this day the ability to survive and to avoid the impending death of our society may depend upon our ability to learn certain skills which have long been preached but very little practiced—the skill, for instance, of loving our enemies, of saving our life through being willing to lose it, and of being meek, adaptable, and teachable. These, I think it can be shown, are the skills that lead to survival in an age of conditional viability. They are skills that we have not taken seriously. We have regarded them as platitudes and preachments. In the past, on the whole, we have relied on unconditional viability and national defense, and we have gotten away with it. Now, I suspect, we can get away with it no longer. We must unlearn the lessons of experience; the payoff function has changed and we had better find this out before it is too late.

My final plea, therefore, is that we correct a massive misallocation of our intellectual resources. We put most of our resources into the study of physical and biological systems, but very little of the study into social systems. It is here, however, that the problems lie. We have now got to the point, I believe, where major efforts in this direction would not only have a very high rate of return in terms of sheer dollars and cents, but might make the difference between life and death for our system. We can no longer rely on the machinery of state-maintenance, role-maintenance, or even maintenance-maintenance to defend us against death. We must go to the fourth level, the level of the metatask. We have spent too much time and energy in trying to find the best way of doing things that should not be done at all. We must now put a major effort in finding those things which should be done and which must be done if we are to survive.