

THE MATHEMATICAL FORMULATION OF STRATEGIC PROBLEMS

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THIS PAPER does not record the results of exhaustive research, leading to the development of promising new techniques, which a group of scholars such as this has a right to expect. Nor is it a mathematical paper. It does, however, touch upon a need which is all too evident in various human activities today, namely, the application of analytical methods to the broad major problems which confront our world, and illustrates this need by discussion of a particular problem which was uppermost in the minds of many for some time—how to win a war. The paper, furthermore, is addressed to mathematicians, since they seem best equipped to take the necessary next step of specifying, for any given problem, what data are relevant, and of showing how to manipulate those data in such a way that the probable consequences of our actions may be predicted. It is to be hoped that your interest, both in a discussion of war and in the broader implications of that discussion, may outweigh the shortcomings and inadequacies of the following remarks.

Total war, in which all the people of a nation, and to a lesser degree all nations, are involved, is not alone a conflict between armed forces; it is a struggle between complex organizations of men. Rates of expenditure of all kinds are likely to reach such proportions that reliance cannot be placed in stocks of finished goods. Within the limits of man's ingenuity, production must be so organized that maximum expenditures can be maintained, the only restrictive factor being the availability of manpower and raw materials. A nation thus resembles a living, growing organism that survives by healing its wounds. Under these circumstances war no longer is a question of fixed destruction, of defeating an army, but becomes a race between destruction and production. In this sense it has some of the elements of the problem of emptying a bathtub into which a tap is pouring water. How much effort should be expended on turning off the tap and how much on opening the drain? In order to bring out this aspect of the problem, particular attention must be given to long-range bombardment, attacking the national productive system and thus shutting off the source of supply so that the problem of attrition in combat may be undertaken with some assurance of finality.

In this discussion the central theme is strategy, or how to use available resources to maximum advantage in any given situation. Important as the details of the situation are, their study is relevant to the selected central theme only in supplying the basic data for arriving at strategic decisions. What kinds of data do we need, and what kinds of answers are we likely to get in response to questions about the component parts of the problem?

For a complex synthesis such as we are interested in, it would seem advisable to reduce the component parts to their barest essentials, adding complicating