WAR GAMING

Herman Kahn
Irwin Mann

P-1167

July 30, 1957

The RAND Corporation
1700 MAIN ST. • SANTA MONICA • CALIFORNIA

Copyright 1957
The RAND Corporation

PREFACE

This is a draft of a report which is being circulated for information and comment. We hope to make it a chapter of a book titled Military Planning In An Uncertain World, and would appreciate any comments, criticism, ideas, and examples that readers may have. This draft began as a transcript of an informal talk and, despite some rewriting, it probably still suffers (like many such talks) from being "fashionable." We are aware that it has a number of other weaknesses and assume there are still others of which we are not aware. We hope to give it a thoughtful and leisurely review but are deferring this until we get some outside criticism.

A table of contents is given on the next page to show the relation of this chapter to the rest of the book. The chapter may not be quite self-contained as a paper, as it occasionally refers to other chapters; but we trust this will be understood or overlooked.

A more complete introduction and list of acknowledgements are given in RM-1829-1.

MILITARY PLANNING IN AN UNCERTAIN WORLD

CONTENTS OF BOOK

I. Techniques of Systems Analysis[1]

1. Designing the Offense
2. Probabilistic Considerations
3. Designing the Defense
4. The Two-Sided War
5. Evaluation and Criticism

II. Techniques of Operations Research

6. Flyaway Kits--An Application of and Introduction to Chapters 7 and 8
7. Elementary Economics and Programming
8. Probability and Statistics
9. Monte Carlo[2]
10. Game Theory[3]
11. War Gaming[4]

III. Philosophical and Methodological Comments

12. Ten Common Pitfalls[5]
13. Nine Helpful Hints
14. Miscellaneous Comments

---

[1] Has already appeared as RM-1829-1

[2] Has already appeared as P-1165

[3] Has already appeared as P-1166

[4] This document

[5] Has already appeared as RM-1937

It should be clear from our discussion of game theory that it is very difficult to solve analytically a game like poker. Nonetheless, some people are very skillful at this game. Their skill has been acquired in two ways. First and foremost, by experience, i.e., by actually playing the game a great number of times and learning from these plays what are good strategies. Secondly, by profiting from such mathematics, (particularly of the probabilistic type), as can be done, even though the complete game theoretical treatment cannot. One can calculate, for example, the probability of drawing successfully to an inside straight or the probability of getting a flush; as a result one can learn a good deal about what is wise and what is foolish.

But it is well-known that poker is not merely a simple question of combinatorics. The opponent's actions must be taken into account, particularly the probability of whether or not he is bluffing. The latter is a game theory question. Although, as we said, the game theoretic aspects of real poker have never been treated successfully, there are poker players who know a great deal about it. We too can learn much about more serious real-life games by designing simple games that simulate some aspects of the real world, but that are too complicated to be solved. We can play these games and learn from them. In a sense this is a Monte Carlo approach to the problem of solving a complicated game. Insofar as it is, some of the considerations about Monte Carlo that we have already mentioned are relevant.

There are four levels of War Gaming which we would like to distinguish.

1. <u>The Informal Game</u>

This is a conscious attempt to try to take account of the enemy's reactions. It is sometimes played inside one man's head. One simply asks

himself "what would the enemy do if I did this," or "what does he think I will do if he does such and such?" In an informal game, one tries to look at the situation from a symmetrical point of view, taking account, in a reasonable way, one's knowledge of the enemy's knowledge about oneself or what he is likely to know. In fact, one takes into account any properties or characteristics of oneself or the enemy that seem relevant. This kind of War Gaming can be done by more than one person. It can be done by two people, by a group, a staff, or a large number of other people. Simply to take into account, consciously, the fact that the enemy is not passive, but actually may be trying to thwart and circumvent you, is almost without question the most common and important kind of War Gaming that is done (or sometimes not done).

2. Rule Games

There is another class of games which is very popular. In this class, the analyst is trying to abstract from the real world a fairly definite set of rules which all players must observe. In some cases all the rules are written down explicitly. In other cases, this is too difficult. Some of the rules may then be left to referees to invent at the last moment. However, as many of the rules as possible are laid down in advance. The object is to make a game which could be played as well by two Martians (mathematicians?), who could read the rules, as by a player who had substantive knowledge and experience of the issues involved.

Sometimes rule games are used for pedagogical purposes. In order to teach some principle a game is devised which forces the point home for the players in a way that is difficult to do by normal exposition. In such games pseudo-experience replaces exposition. War Gaming is amazingly

effective for teaching obvious ideas that people have resisted because they run counter to doctrine, or are unpleasant e.g., if one's airforce is exposed to destruction, the enemy may destroy it.

If the players are willing to accept the assumptions that are embodied in the rules, they are often forced to accept conclusions with an intensity which would not be there if these same conclusions arose in the course of a briefing or a lecture. There is, of course, no guarantee that the points that are taught are correct. In fact, the opposite may be true. Because the players have a sense of participation, their critical sense is often dulled. Intensity of communication, rather than correctness of conclusion, is the hallmark of the pedagogical game.

It is also possible that one can learn skills from games which carry over to the real world. Some people even argue that games can be devised which will be good tests of the military competency of the players. It is our opinion that both of these ends are very difficult to accomplish with pure rule games. We can only admire people for putting research into this effort and wish them well. However, experience has shown that it can be a very stimulating experience to play these games and we expect that one of the most useful applications of rule games may be in schools or study groups as a portion of a larger program.

One thing which the formal rule game is not very well adapted for is empirical research. Only very rarely, if ever, does the play of a Rule War Game turn up valid conclusions about the real world which could not have been deduced in an immediate way directly from the rules. In every game of this type, that the authors have seen, the interesting results of the play have always been completely and obviously prejudged by the rules.

Once these rules have been made up the research is just about finished; actual play of the game produces very little information. This is why the game has the previously described quality of being a pedagogical tool rather than a substantive research tool.

This is not at all surprising. Generally speaking, most real world systems are either very good or very bad. One property of a good system is that it looks good under a wide variety of assumptions and conditions. Under these circumstances it is generally obvious that the system is good and it does not take very skillful play to see it. A similar situation seems to be true when a system is bad. In the occasional situation when the system described by the rules of the game is so controversial that it takes play to decide what the implications of the rules are, one still cannot usually claim that play actually turned up substantive facts about the real world. If the situation is controversial, the results are invariably sensitively dependent on the rules assumed, and a minor change will completely alter the results. In these cases, one would have to do a contingency and sensitivity analysis while playing the game to really understand the situation. This seems to be too difficult to do.

These last paragraphs on the valuelessness of Rule Games for empirical research deserve at least two qualifications. We mentioned in the previous chapter on game theory that one of its main values lies in the fact that it takes a very idealized aspect of the situation and treats it completely. While this idealization may turn out to be a very approximate and incomplete picture of the real problem, it is nevertheless quite important to understand these idealized aspects thoroughly. One's intuition and grasp of complex problems is usually better if one understands the simpler ones. It is clear

that there might be idealized games which are simple enough to be powerful aids to the intuition and general understanding, and yet too complex to be treated by game theory. One might then want to treat this kind of game by either numerical or war gaming (Monte Carlo?) techniques.

The second qualification is even more to the point. One reasonable way to initiate research is to ask people to make up a reasonable set of rules for a game of this character. The attempt to draw up the rules will force them to look very hard at whole classes of problems. They have to think about them in a thorough way because they have to make definite and usually quantitative statements about every aspect of the situation. Indeed, making up rules for a game always involves research, sometimes in a very productive way. In addition the design of a large detailed rule game may be a useful way to summarize, integrate, and evaluate research that has been done in bits and pieces. It acts as a sort of jigsaw puzzle. It not only fits together the research that has been done, but it also makes the lacunae stand out. (However, our friends in economics tell us there are other methods besides the construction of rule games to motivate such activities, e.g., an extra $5,000 a year.)

3. The Formal Minimum Rule Game

Let us look now at the game which has only a few explicit predetermined rules. This is not because there are a priori or in-principle objections to explicit rules, but because it is one of the objects of the game to investigate what are sensible rules. This sort of game is less a formal game than a social situation. Roughly, it can be described as follows.

A number of skilled experts are gathered together, with their assistants. These people are to study a certain problem area; hopefully they will interact

with each other in an intimate and fruitful way over a fairly lengthy period of time. In addition, they must work in a concrete and detailed way. Most important of all, one wants a critical examination of all the work while it is being done.

One way not to do this would be to lock them up in a conference room and say, "Get to work." There might be an initial period where there was an exchange of views and people learned about the issues. After this initial period, conferences tend to stagnate into interminable arguments and dissensions or into feasts of agreement. Therefore, after the first interaction period is over, there tends to be very little constructive work. Almost the best thing the conferees can then do is write a report and go home.

If, on the contrary, these same people are asked to play a game, the situation is quite different. The individual players then take sides. They will study the problems associated with their sides with passionate interest and devotion. In fact, experience has shown, with too much passion. There will be a real impetus to doing constructive work and to criticize assumptions which favor the opposition.

If the referees are skillful, they will let the players do a great deal of arguing about the interpretation of what is reasonable or unreasonable. After all, the referees' decisions should often themselves be the product of research, and one wants the players to contribute their knowledge and experience to these decisions. However, when the discussion tends to drag out or become intolerable, the referee has the privilege of making a flat decision which cuts off controversy and allows the game to continue. He is in a much better social situation than a chairman of a

conference for everybody has to accept his decisions with good grace. Not only does he have the legal authority, but our whole tradition of being "good sports" enforces his authoritative power.[1] The only retaliation a player possesses is to write a paper. Since it is one of the referee's jobs to stimulate such papers, he can be unperturbed even if the paper is vitriolic.

In fact, the game gives a very good environment for the output of all kinds of detailed papers on policy, hardware, or context questions which ordinarily wouldn't get written. Furthermore, the fact that the players themselves are pretending to take active roles in affairs forces them to think in a concrete and relatively responsible way about problems which they normally tend to discuss in lofty and abstract terms, often overlooking important qualifications. One is much more likely to get feasible suggestions from a War Game context than from a person working in isolation. (Of course, really scholarly work or good technical analysis probably cannot be done in this feverish atmosphere, although it may be inspired there.)

On the whole, this kind of activity is very promising. However, one should recognize clearly that the value of the results is almost completely dependent on the skill of the players and, even more, on the skill of the referees. There seems to be a tendency to overlook this point. Many people, in reporting the results of gaming place a heavy reliance on the fact that the results came out of a game. The implication is that any kind of War Gaming automatically gives conclusions a little extra degree of reliability. Aside from the fact that they should have had at least a moderate amount of hostile scrutiny (which may have been ignored), there

---

[1] We are here ignoring the Brooklyn Dodgers "kill the umpire school." it is to be assumed that very few of this group will ever qualify to participate in a war game.

is no reason for this belief.

Any substantive results that come out of a War Game should be justified on their own merits. The fact that they came out of a game is almost completely irrelevant to their reliability. One has to justify them in the same way one justifies any idea.

It may be, from the pedagogical point of view, a very good idea to present the results in the setting given by the history of the game. This is sometimes a clear and vivid way to talk about the issues. One should, however, never fall into the error of trying to justify the results by the history produced by the game, but rather the opposite. One first justifies the results. This may or may not make the history seem plausible. (As we will mention later, one often wants to study implausible histories.)

There are some other comments that should be made about this kind of War Game. First, there should be no overwhelming compulsion to try to simulate every possible aspect of reality in the details of the game. For example, the pattern of information flow and decision making, which correspond to the real world, doesn't have to be followed by the players. While certain players may be appointed to think about the enemy as their chief responsibility, one can still ask them in for consultation on other questions. In fact, one can reveal to them ostensibly secret information about the other side in order to consult with them about some question which has arisen. Similarly the player who takes the part of our own country might well be asked to advise the enemy on what would be sensible actions for him.

If, as a result of this close consulting, information which one does not think would actually leak in the real world, does leak, one simply asks the player to act as if he did not know about the information. We admit

this may be difficult to do in practice, but if a player is reasonable and asked to act as if he does not know a piece of information, he is probably as good an analogue of the real honest-to-goodness opponent as the player who does not actually know the information. There are so many important and relevant ways in which the analogue fails as a straight analogue that the mere question of pretending lack of information itself while not irrelevant, is not dominant.

This does not mean that one does not want to have any analoguing in the game (including security aspects), but simply that there is nothing sacred about the analogue. It may or may not be followed, as convenience suggests. The important thing is to have enough of an analogue so that players feel they are playing roles instead of merely partaking in an elaborate conference. Nothing else is essential.

A second thing to emphasize is that the game should not necessarily concern itself only with probable situations but should also emphasize "interesting" situations. It is true that one way a situation can be interesting is because it is probable, but it is also true that often relatively improbable situations are very interesting because if they occur they are so extraordinarily important. That is, the game should be guided into a study if situations about which one wishes to be educated and not simply because one thinks they are most likely to happen. It is not the purpose of the game to be an oracle.

The whole question of how much of an oracle the war game can be expected to be is quite interesting. Experience has shown that people often tend to adopt the same solutions to similar problems. Insofar as this is true, a realistic war game may predict the future, or at least some aspects

of it, quite accurately. In fact, it has been claimed that War Gaming is a very valuable adjunct to intelligence activities because merely looking at something from the opponent's point of view in a detailed and concrete way, may indicate what the opponent will do -- also in a detailed and concrete way. Even things like troop dispositions might be predicted by this technique.

However, admitting all of the foregoing, it is probably wrong to think of the war game as portraying the future. The reason for this is, first of all the obvious one: the future is uncertain. More than that, it is clear that some very improbable events are sure to occur and that some of these improbable events will have important effects. By their very nature, it is impossible to take into account these improbable events. However, insofar as some parts of the future are more or less determined or even over-determined by existing constraints, a war game might be successful in exploring these constraints and, therefore, useful in predictions.

Some other aspects of the minimum rule detailed war game should be mentioned:

a. This kind of game usually does provide a possibility of valuable training because one can simulate a man's actual job and test at least paper responses.

b. Real war games may occasionally have very dull aspects, i.e., war is dull and a game which analogizes it may also have periods of dullness. While a lot should be done to avoid this, there is a real tendency to introduce things arbitrarily and deliberately which eliminate dullness (for example things which make the game less onesided). This tendency should be guarded against.

c. It is probably true that the role of the consultant should be fairly severely circumscribed. While a War Game fulfills some of the functions of a conference, it is a different kind of animal and care should be taken that it does not degenerate into a conference. In particular, this means that most of the players should probably be full-time and obliged to come to discussions prepared in a detailed way.

d. War Gaming might find a very important application in the testing of hypotheses generally and War Plans in particular. The formal structure of the game almost automatically subjects the plan to a semi-hostile critical review and, what may be more to the point, the planners themselves may be forced to take realistic looks at their plans. However, it is not suitable for the testing of "brilliant" or "psychological" strategies that depend on assumed weaknesses of the enemy (although it may suggest such strategies). War Games which make a big thing of assumed weakness of the enemy have had a rather dolorous history.

e. One of the major weaknesses of large minimum rule war games is that they tend to be so expensive in time and manpower that it is impossible to consider many variations of a scenario. However, experience has shown that once a group has gone through any particular scenario they have often learned so much about the situation that they can talk themselves through variations in a quite fruitful way. In particular, it is possible to hold a formal conference after a war game to discuss, "What would have happened if instead of assuming _____, we had assumed _____?". Whether or not the conferees should be assigned roles or be on an equal footing depends on special

circumstances but almost all variations have proved fruitful in practice.

4. Realistic War Games

War Games and training maneuvers are historically an old activity, but that doesn't make them any less important. In fact, modern conditions have made them even more important because so much of the equipment that is used by the armed forces has never been tested in a realistic environment or in realistic contexts. They are all tested under simulated conditions where the simulations have to be very simple because one cannot supply even an unrealistic war time environment at a proving ground. In particular, logistic, service and alert organizations have no other adequate method in peace time of testing their performance. Because the training aspects of a real war game are so large, one cannot afford to let realism, in the sense of overall realistic situations, interfere with letting most of the participants get their training. It is, therefore, doubly important to be conscious of the unrealistic elements if the game is to be used for evaluation purposes as well as training. Maneuvers and training exercises do have a very important role in evaluation, but it takes a great deal of judgment to use their results. They generate a great deal of substantive information, much of which may have a sobering influence on people too addicted to official planning factors, but they are almost always completely unreliable analogues of even the current situation, let alone the future.