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The Commander's Estimate  
Considerations Thereon

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PRÉFACE

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The point of view expressed in this paper is that of the author - not necessarily that of The Infantry School or the Department of the Army.

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## INTRODUCTION

The estimate of the situation is a tool provided commanders of United States military forces to assist them in decision making. It is by definition "... a logical and orderly examination of all the factors affecting the accomplishment of the mission to determine the most suitable course of action in arriving at a decision."(2:73) The estimate is based on enemy capabilities and as such is conservative. While implicit to the system, no formalized method is provided for examining the possible consequences of deviations from this conservative approach nor is any formalized approach provided to insure the completeness of the estimate.

The estimate is based on logic. Mathematics is logic in its purest form. Here, an attempt will be made to apply a mathematical system to the estimate of the situation in order to first provide a system to aid the commander to insure the completeness of his estimate, and second to provide some information on the risks involved and the gains that may be realized from decisions not as conservative as those resulting from the estimate of the situation.

It is believed that the methods shown have some application at all levels of command but particularly at the small unit level. The methods are not complete, i.e., they are not always applicable nor do they provide for every situation. It can be said that if the methods do not apply, insufficient information is available upon which to base a

decision. However, such may often be the case.

The mathematical terminology used is that of game theory(5) and the ideas as to its application those of Haywood (4:365).

## DISCUSSION

### I - THE METHOD

To introduce some of the terminology to be utilized and the general nature of the mathematics involved, consider the following highly idealized situation. A rifle company as a security force for a larger unit now beginning organization of an important terrain feature has been given the mission of providing early warning of enemy approach and has been instructed to organize a delaying position forward of the main battle position. The battalion commander has emphasized the importance of timely warning but has authorized the use of only one squad forward of the blocking position. The remainder of the company is to be utilized in the preparation of the position. Upon consulting a map (see fig.1), the company commander finds that only two widely separated avenues of approach lead into the battalion sector and that these converge on his blocking position. He further sees that the nature of the terrain dictates that his squad be used as a unit. The left approach is suitable for armor and infantry and is fairly open. The right approach is rugged, wooded, and suitable only for infantry. The visibility at present is limited. The S-2 informs him that the approaching enemy is of estimated battalion strength and may be supported by armor. He further states that friendly aerial reconnaissance is ineffective. The visibility is not expected to change in the immediate future. The problem - where to send the

reconnaissance squad to insure the earliest possible warning of enemy approach.

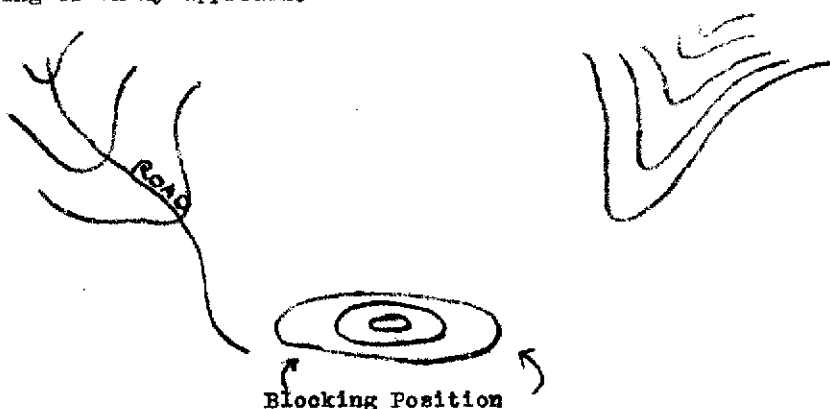


Fig. 1

The estimate of the situation with regard to the employment of the reconnaissance squad might look something like this.

1. MISSION. Provide early warning of enemy approach.
2. THE SITUATION AND COURSES OF ACTION

General situation as given above. Friendly courses of action are limited to two - left route or right route for the reconnaissance squad. The enemy on the other hand has three possible courses of action, i.e., infantry only on the left, infantry and armor on the left or infantry only to the right.

3. ANALYSIS OF OPPOSING COURSES OF ACTION

With two courses of action for the friendly squad and three for the enemy main body, six outcomes are possible. Figure 2 shows these and the consequences of each in terms of time of warning. The

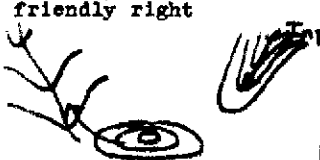
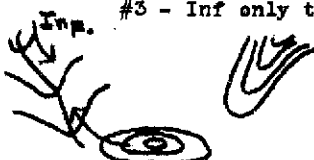
**Courses of Action**

**Friendly**

**Enemy**

- #1 - sqd. to the left
- #2 - sqd. to the right

- #1 - Inf and armor to friendly left
- #2 - Inf only to friendly left
- #3 - Inf only to friendly right



Fr. course of action #1  
En. course of action #1

Fr. course of action #1  
En. course of action #2

Fr. course of action #1  
En. course of action #3

Ease of travel for fr. sqd. and ease of location of enemy.

Ease of travel for fr. sqd. En. not detected as easily as with armor.

Fr. sqd. on wrong route. En. almost on blocking position before being observed.  
10 min. warning

1 hour warning

50 min. warning



Fr. course of action #2  
En. course of action #1

Fr. course of action #2  
En. course of action #2

Fr. course of action #2  
En. course of action #3

Fr. sqd. on the wrong route. Because of open terrain and noise of tanks, some warning given by men in blocking position.

Fr. sqd. on the wrong route. Because of open terrain, some warning given of en. inf by men in blocking position

Sqd. on right route but because terrain difficult, not so much warning as similar meeting on left flank.

20 min. warning

15 min. warning

45 min. warning

Fig. 2



times are relative. They are introduced to illustrate a point. It is not intended to imply that the rifle company commander would know these times down to the minute.

#### COMPARISON OF OWN COURSES OF ACTION

In sending out the reconnaissance patrol, say to the left, the company commander could only assure himself that one of the outcomes shown in the first row of fig. 2 would take place. If he sent the patrol to the right, he could only assure one of the outcomes in the second row. Neither of the opposing commanders could select the exact outcome. Each could only choose the set of outcomes that would be most desirable to his force. Our company commander would choose the right patrol route for there he assures himself at least fifteen minutes warning. This is in accordance with the terrain, weather and enemy capabilities. If he choose the left route, he might get one hour warning but on the other hand, might get only ten minutes.

A better way to organize the information of fig. 2 would be as shown in fig. 3. The courses of action are numbered as shown in fig. 2.

Friendly Courses of Action:	Enemy Courses of Action		
	#1	#2	#3
#1	1 hour	50 min.	10 min.
#2	20 min.	15 min.	45 min.

Fig. 3

From the friendly commander's point of view, he is interested in the least or minimum amount of warning time that each course of action offers him. Then he chooses the course of action that will give him the most or maximum of these minimums. He seeks the maximin - the maximum of the minimums. From the enemy commander's point of view, he is interested in the maximum warning that can be given of his approach for each of his courses of action and chooses that course of action that will minimize those maximums. He seeks the minimax - the minimum of the maximums. These concepts are shown in fig. 4 by the addition of a row and a column to fig. 3.

Friendly Courses of Action:	Enemy Courses of Action				maximum:
	#1	#2	#3	minimum	
#1	1 hour	50 min.	10 min.	10 min.	15 min.
#2	20 min.	15 min.	45 min.	15 min.	
maximum	1 hour	50 min.	45 min.		

minimax: 45 min.

The maximin is 15 min. Therefore, the better course of action for the friendly commander is #2. The minimax is 45 min. Therefore the best course of action for the enemy commander is #3.

Fig. 4

It is to be emphasized that the numbers used in the problem were used for purposes of illustration, although in such a situation it would not be unreasonable to tack a number to each possible outcome.

The problem could have been as well handled by using the statements of the possible outcomes as shown in fig. 2, ordering them as to their desirability, and then continuing as was done above. For fig. 4, the minimum for friendly course of action #1 would then have been; Friendly Squad on the wrong route. Enemy almost on the blocking position before being observed; and for friendly course of action #2: Friendly squad on the wrong route. Because of open terrain, some warning given of enemy infantry by men in blocking position. The maximum would be the second of these and indicate a proper choice of course of action #2.

In analyzing the enemy courses of action, it is assumed here that what is good from the friendly point of view is equally bad from the enemy point of view. While this may not always be true, in general it holds, e.g., our capture of a defended hill is considered good, while to the enemy the loss of the hill is considered bad and each to about the same degree. It is of interest to note that in the last example the enemy's best course of action is the same as that of the friendly commander's, i.e., to proceed along the friendly unit's right flank. However, if either commander knew what the other was going to do, he could improve upon his situation. Such would not be true if the "number" attached to friendly course of action #2 and enemy course of action #3 (see fig. 4) were changed to "15 minutes." The maximum would then equal the minimax and we would have what might be called matched courses of action. When we do have matched courses of action, knowledge of enemy intentions by either commander

would have no effect on his decision. Usually, however, knowledge of enemy intentions will certainly be of value. Some considerations along these lines follow.

## II A Variation

The estimate of the situation as a doctrine, as was stated before, is based upon enemy capabilities, not enemy intentions. In effect, it is assumed that the enemy will discover the friendly decision and make the wisest use of his forces in countering it. Without doubt, if correctly arrived at, this doctrine will provide for the greatest security for the friendly command in the carrying out of its mission. It may be, however, that the situation is such that if some risks are taken, great gain may be realized. In other words, acting upon enemy intentions rather than enemy capabilities will, if correctly done, reap benefits in most situations. Also, it may be that action upon enemy intentions rather than enemy capabilities is required because of the lack of combat strength to meet all of the enemy's capabilities. An example of this type of situation was met in Korea where friendly forces were often greatly outnumbered by the enemy. General Michaelis often of necessity had to leave his front manned only by skeleton forces while he employed his strength to meet expected attacks to his flanks or rear. Time after time he was correct in his analysis of enemy intentions as he had to be for his regiment to perform its mission. Along this line, consider an example from World War II. (3)

A Ranger Group consisting of the 2d and 5th Ranger Battalions was to land at Pointe Du Hoc, France some four miles west of Omaha Beach on D-Day, 6 June 1944. The group had a dual mission, the first of which was to neutralize a battery of 155mm howitzers which it was expected could cause considerable trouble if allowed to fire on Omaha Beach. The second mission was to establish a block on a highway which ran roughly parallel to the shore line and lay approximately five miles in from the sea to deny the use of this vital road to the enemy. The initial landings were accomplished by the 2d Ranger Battalion and after scaling one hundred foot cliffs, the rangers set out to accomplish their missions. As their training dictated, the rangers did not wait for organizational units to be formed, but as soon as three or four men had gathered, moved out. As a result of this, within a short time after the landing a heterogeneous group of rangers and unbelievably, three troopers from the 101st Division who had missed their drop zones by about fifteen miles, had gathered to set up the roadblock. This group of about sixty men was later reinforced by a platoon of the 5th Ranger Battalion. We will concern ourselves with their actions on the night of 6-7 June 1944. The senior officer present was a Lt. Arman. While there is some doubt as to the actual leadership of the group, it is assumed that the senior officer commanded and that the decisions made were his. In particular, the situation was as follows.

Lt. Arman with a total force of eighty five men had

a mission of establishing a road block on the Grandcamp road. The men were elements of two ranger battalions and the 101st Div. The terrain was fairly flat with individual fields bordered by hedge rows (see fig. 5). The exact enemy strength was not known but probably consisted of major portions of the German 762d Infantry Regiment. Lt. Armon's force was not supported by outside fire support. His automatic weapons were made up of eight BAR's and three captured enemy machine guns. Enemy activity had been noted to the south and southwest and also to the north. Lt. Armon evidently reasoned that his road block had little hope of survival if he attempted to counter all enemy capabilities, i.e., attacks from the south, southwest and from the north. His analysis of opposing courses of action in arriving at his decision was probably something like that shown in fig. 6.

The maximin is: some resistance offered but road-block overrun. The minimax on the other hand is: road-block may survive. The maximin is not equal to the minimax. This difference indicates that the friendly commander can improve his situation by either defending only to the north or to the south and southwest. Lt. Armon choose to defend to the south and southwest (fig. 5). As a matter of interest, the enemy did attack from the southwest. The ranger force held for a time but finally was forced to withdraw to the north to join friendly elements at Pointe Du Hoc. The point here is this: if the maximin is less desirable from the friendly point of view than the minimax,

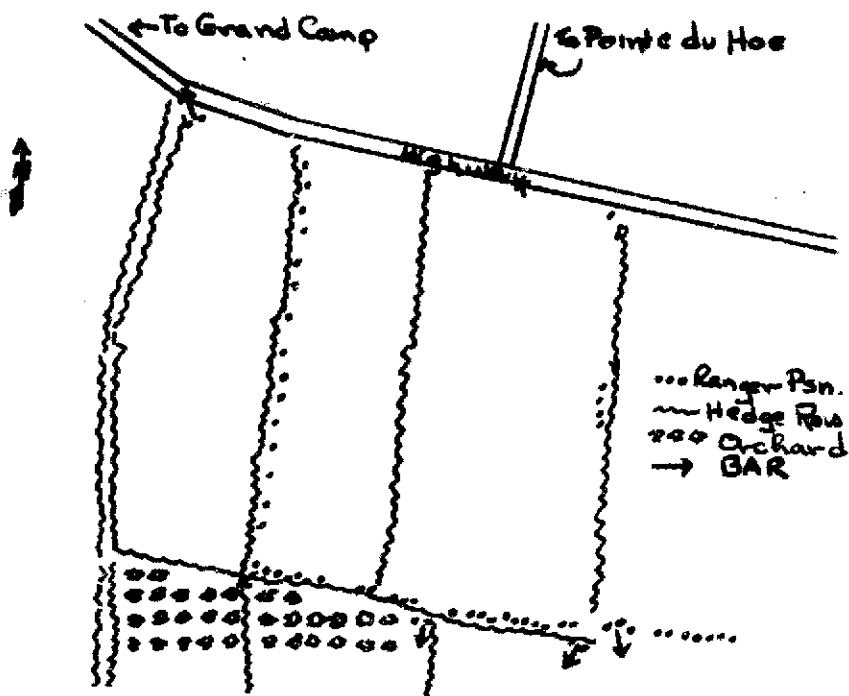


Fig. 5

Enemy Courses of Action

	#1(North)	#2(S or SW)	minimum	
#1	Some resistance offered but roadblock overrun	Some resistance offered but roadblock overrun	Roadblock overrun	<i>Standard Surrender Effort</i>
#2	Roadblock overrun	Roadblock may survive	Roadblock overrun	
#3	Roadblock may survive	Roadblock overrun	Roadblock overrun	
maximum	Roadblock may survive	Roadblock may survive		

Minimax: roadblock may survive

Friendly Courses of Action:

1. Prepare to meet attacks from N, S, and SW
2. Prepare to meet attacks from S or SW
3. Prepare to meet attack from N

Fig. 6

then a course of action based on enemy intentions rather than enemy capabilities may offer greater rewards than the course indicated by the maximin. Of course, a risk is taken that the result may be less desirable than the safe course would offer. In the example just analyzed, this conclusion is obvious. This is not always the case and without actually determining the maximin and the minimax, the best solution may be overlooked.

### III Further Variations

In the last section it was shown how the minimax-maximin concept may have value in a situation where friendly combat strength is insufficient to counter all enemy capabilities. Here, through another example, it will be shown that for a given situation, the risks involved in deviations from the conservative solution can be analyzed. The example deals with a battalion but the situation depicted is basically that that faced Bradley in 1944 and is described by him in A Soldier's Story (3:372). Haywood (4) has analyzed Bradley's situation and the methods used below are based on his with some modification.

Situation: Friendly forces have achieved a penetration of the enemy MLR and the regimental reserve (2d Bn. plus the Tank Co.) has been committed to exploit the success. For the general situation - see sketch, fig. 7. The 1st Battalion commander has been given the mission of protecting the gap should it be attacked or of inflicting maximum damage on the enemy battalion should



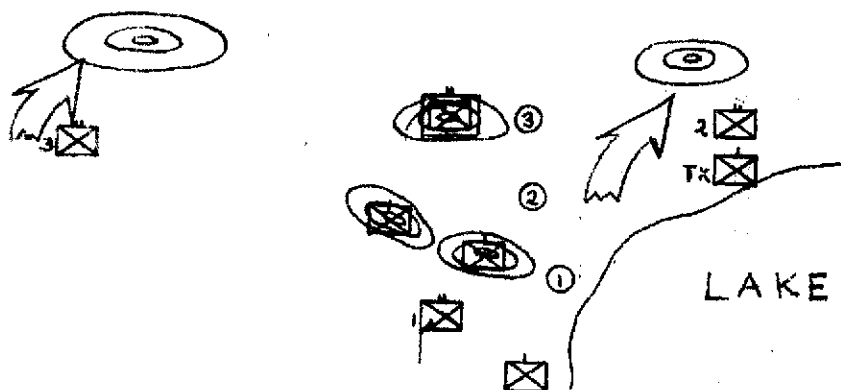


Fig. 7

that battalion withdraw. It is considered that the enemy battalion's present <sup>position</sup> is untenable. The 1st Battalion commander is faced with the problem of positioning his company now in reserves. His courses of action are the following: (see fig. 7)

1. Move his reserve to position 1
2. Move his reserve to position 2
3. Move his reserve to position 3

The enemy battalion commander's courses of action are limited to two:

1. Attack the gap to cut the supply line of the exploiting force
2. Withdraw

The six possible outcomes are shown in fig. 8. It is seen that course of action #2 is best for the friendly commander and that enemy course of action #2 is the better for

**Enemy Courses of Action**

		#1(atk. gap)	#2(withdraw)	minimum	
Friendly Courses of Action	#1	Gap holds. Poor pen. for pursuit when atk. fails.	Fr. forces de- ployed for atk. on gap - weak pressure on en. withdrawal.	Gap holds poor pen.	Maximin: gap holds - fr. elms. in good pen. for pursuit.
	#2	Gap holds. Good pen. for pursuit when atk. fails.	Moderate pres- sure on en. withdrawal.	Gap holds good pen.	
	#3	Gap cut. Re- opened after stiff fight.	Heavy pressure on en. with- drawal.	Gap cut.	
	maximum	Gap holds. Fr. units in good pen. to pursue.	Heavy pressure on en. with- drawal.		

minimax: heavy pressure on enemy withdrawal.

Fig. 8

the enemy commander. Here again, as in the last example, the minimax is not as desirable to the friendly commander as the maximin; so the friendly commander can do better if he is willing to take a risk. One way to examine the risk would be as follows:

If the enemy knows our capabilities, he will withdraw. The enemy is intelligent; therefore he will withdraw, and the friendly course of action should be based upon that premise.

Unfortunately the enemy may not cooperate. There is a better way to investigate risks. First it is necessary to order the possible outcomes as to their desirability. This ordering for the above example results in the

following:

1. Heavy pressure on enemy withdrawal
2. Moderate pressure on enemy withdrawal
3. Gap holds. Good position for pursuit when attack fails
4. Weak pressure on enemy withdrawal
5. Gap holds. Poor position for pursuit when attack fails
6. Gap cut. Reopened after stiff fight

With this in mind, consider fig. 9.

Heavy pressure on enemy withdrawal

Moderate pressure on enemy withdrawal

Gap holds. Good posn. for pursuit

Weak pressure on enemy withdrawal

Gap holds. Poor posn. for pursuit

Gap cut. Reopened after fight

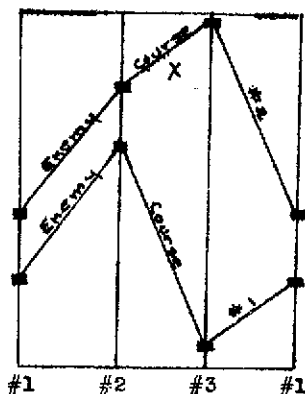


Fig. 9

Fig. 9 contains the same information as fig. 8. The vertical lines represent the friendly courses of action and the "blocks" (■) the outcomes for each of the two enemy courses of action. The bottom block on any of the vertical lines represents the minimum that can be expected from that course of action and the top block, the

the maximum, e.g., for course of action #1, the minimum is "Gap holds. Poor pen. for pursuit" and the maximum "Weak pressure on enemy withdrawal." It is obvious from the figure that course of action #1 offers no interest if a risk is to be taken for there is nothing to offer here that is better than the safe course of action, #2. Course of action #3 does offer possibilities for gain over that of #2. It would seem desirable if some course between that of #2 and #3 could be found, say at position "X" as shown in fig. 9. This in effect could be done if a flip of a coin were allowed to decide between courses of action #2 and #3. If this were done in a great number of combat situations, 50% of the time an outcome would result no worse than the minimum outcome for the safe decision. Part of the other 50% of the time, an outcome would result that would be better than the maximum of the safe decision. This means that in the long run more successes would be realized than if the safe approach were always taken. However, losses would also occur that would not if the safe approach were always adopted. Probability-wise, more extra successes would be realized than extra losses. For the example above, allowing fate to decide between courses of action #2 and #3 would result in a probability of .5 that a result no worse than "Gap holds. Good pen. for pursuit" would occur and a probability greater than .5 that a more desirable result would occur.

## CONCLUSION

The estimate of the situation is a valuable tool provided a commander to assist him in decision making. However, without further formalization there is no assurance of completeness of the estimate nor is any method provided to investigate the nature of risks it may be desired to take. The methods of game theory provide the needed formalization and also provide a scheme to insure that if a risk is to be taken, that the greatest chance for success is not overlooked nor the true nature of the risk ignored.

In particular, the minimax-maximin concept provides the formalization. This concept points out the best course of action based on the terrain, the weather and enemy capabilities. Further, the concept combined with an ordering of probable outcomes as to their desirability provides a method to select a course of action other than the most conservative and yet that offers the highest probability for success.

The author wishes to go on record as not favoring the making of decisions based on the flip of a coin. Yet he realizes that necessity or other reason will often dictate the taking of a risk and sees a need for a formal method of analyzing these risks. The method used in this paper to introduce certain ideas was that of example. However, mathematical proofs of these are available.

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