AD-A235 660

(2)

STUDY PROJECT

The views expressed in this paper are those of the author and do not necessarily reflect the views of the Department of Defense or any of its agencies. This document may not be released for open publication until it has been cleared by the appropriate military service or government agency.

THE DECISION DILEMMA -- COGNITIVE BIAS

DTIC
MAY 2 0 1991

BY

LIEUTENANT COLONEL WILLIAM P. STORMER
United States Army

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

USAWC CLASS OF 1991

U.S. ARMY WAR COLLEGE, CARLISLE BARRACKS, PA 17013-5050

91-00104

91 5 20 050

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release; distribution is unlimited
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5 MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION U.S. Army War College Carlisle Barracks 6b. OFFICE SYMBOL (*If applicable*)	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (*City, State, and ZIP Code*) Carlisle, Pennsylvania 17013-5050	7b. ADDRESS (*City, State, and ZIP Code*)
8a. NAME OF FUNDING / SPONSORING ORGANIZATION 8b OFFICE SYMBOL (*If applicable*)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (*City, State, and ZIP Code*)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO / WORK UNIT ACCESSION NO.

11 TITLE (*Include Security Classification*)

The Decision Dilemma -- Cognitive Bias

12. PERSONAL AUTHOR(S)
LTC William P. Stormer

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (*Year, Month, Day*)	15. PAGE COUNT
Final MSP	FROM _____ TO _____	15 Apr 91	~~28~~ 30

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18 SUBJECT TERMS (*Continue on reverse if necessary and identify by block number*)
FIELD	GROUP	SUB-GROUP	

19. ABSTRACT (*Continue on reverse if necessary and identify by block number*)

Military decision-making at the national level is a formidable task. The environment is ambiguous and constantly changing. Intelligence systems, as good as they are, will never provide perfect information. The stakes involved range from the loss of thousands of lives to the sovereignty of the nation. Faced with this difficult task, the military decision-maker often has to rely on intuitive processes to arrive at a final decision. One of the magnificent qualities of human beings is the ability to integrate a vast array of factors weighing on a situation and come up with a viable solution. This process involves a great degree of intuitive judgment. While there are many examples of great military decisions made substantially on the basis of intuition, there is also a down side to this phenomenon. Research has shown that there are cognitive biases which can adversely affect the decision-making process.

20 DISTRIBUTION / AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21 ABSTRACT SECURITY CLASSIFICATION
22a. NAME OF RESPONSIBLE INDIVIDUAL Dr. Herbert F. Barber	22b TELEPHONE (*Include Area Code*) / 22c. OFFICE SYMBOL AWCAA

DD Form 1473, JUN 86 *Previous editions are obsolete.* SECURITY CLASSIFICATION OF THIS PAGE

19. (cont) This paper provides an analysis of these biases and offers practical suggestions on how to reduce their effects.

Accession For
NTIS GRA&I
DTIC TAB
Unannounced
Justification
By
Distribution/
Availability Codes
Dist | Avail and/or Special
A-1

USAWC MILITARY STUDIES PROGRAM PAPER

The views expressed in this paper are those of the author and do not necessarily reflect the views of the Department of Defense or any of its agencies. This document may not be released for open publication until it has been cleared by the appropriate military service or government agency.

THE DECISION DILEMMA -- COGNITIVE BIAS

AN INDIVIDUAL STUDY PROJECT

by

Lieutenant Colonel William P. Stormer
United States Army

Doctor H. F. Barber
Project Advisor

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

U.S. Army War College
Carlisle Barracks, Pennsylvania 17013

ABSTRACT

AUTHOR: William P. Stormer, Lt Col, USA

TITLE: The Decision Dilemma -- Cognitive Bias

FORMAT: Individual Study Project

DATE: 5 April 1991 PAGES: 28 CLASSIFICATION: Unclassified

Military decision-making at the national level is a formidable task. The environment is ambiguous and constantly changing. Intelligence systems, as good as they are, will never provide perfect information. The stakes involved range from the loss of thousands of lives to the sovereignty of the nation. Faced with this difficult task, the military decision-maker often has to rely on intuitive processes to arrive at a final decision. One of the magnificent qualities of human beings is the ability to integrate a vast array of factors weighing on a situation and come up with a viable solution. This process involves a great degree of intuitive judgment. While there are many examples of great military decisions made substantially on the basis of intuition, there is also a down side to this phenomenon. Research has shown that there are cognitive biases which can adversely affect the decision-making process. This paper provides an analysis of these biases and offers practical suggestions on how to reduce their effects.

INTRODUCTION

Military decision-making is a complex, multifaceted endeavor which is as much an art as a science. Certainly, there are many variables which lend themselves to quantification and the objective comparison of alternatives. However, as Clausewitz explained, matters which involve the human element do not neatly follow any tried and true mathematical formula which allows us to precisely predict the outcome with absolute certainty.[1] The process of assessing the economic, social, political and military environment in which policy is formulated is, in large part, necessarily subjective. The environments are characterized by a high degree of uncertainty and judgments must often be made with much less than perfect information about all of the factors which will bear on the outcome.

Each of us carry a certain amount of cognitive baggage which limits our vision. Few military decision-makers are aware of these limitations or their effects on the decision-making process. Some psychologists suggest that we may not be properly equipped to even attempt some of the decisions which the modern world forces upon us.[2] Others have done extensive research on the cognitive aspects of the decision process and have much to say about how we actually arrive at decisions. However, military

decision-makers receive very little training on the pitfalls of decision-making. This paper provides an analysis of one aspect of decision making theory, i.e., cognitive bias, and its implications for the military. The aim of this paper is to provide military decision-makers with a fundamental awareness of cognitive biases in the interest of improving their decision-making effectiveness.

DECISION-MAKING

Before beginning an analysis of cognitive biases which affect all of our thought processes, a few words on the environment in which we make our decisions are appropriate. Much of this paper deals with mental shortcuts all of us have adopted to allow us to cope with the complex environment which confronts us. Psychologists call these shortcuts "heuristics". Heuristics allow human beings to process huge amounts of information quickly, in complex contexts, and often arrive at reasonable decisions under difficult circumstances. These processes are not necessarily conscious acts and frequently involve the essence of intuition and creativity. Heuristics can produce brilliant decisions even under severe constraints. I do not postulate that heuristics are to be avoided altogether and that intuitive decision-making is no longer appropriate. Rather, the purpose is to show how some heuristics can adversely affect the decision process so that these pitfalls can be avoided.

Any discussion of decision-making must necessarily be preceded with a review of what is widely referred to as the

rational decision model. This model has numerous variations but basically follows the pattern of problem definition, assumptions bearing on the problem, facts bearing on the problem, development of alternatives, analysis of alternatives, and conclusion, i.e., decision. As the name implies, it is a rational sequence of events to arrive at a decision. Despite all of its obvious virtues, research suggests that the rational model only describes how we should make decisions as opposed to how we actually do make them. A pioneer in the psychology of decision-making, Herbert Simon, has shown that the rational model is an ideal which decision-makers seldom emulate.[3] The real world is simply not so tidy as to allow for perfect operation of the rational model. Real world decision-makers are constrained by time, available funds, imperfect information, memory, and a host of other ills which force them to operate within "bounded rationality." [4]

Although it is not possible to precisely determine the limits of human decision-making ability, there is considerable evidence to suggest that people only "approximate" completely rational behavior. The research indicates this bounded rationality leads decision-makers to "satisfice" in their decision-making process.[5] In other words, given a limited amount of time and less than perfect information, people will choose less than a fully rational approach. They will seek a satisfactory solution rather than an optimum solution. For many decisions, satisficing is adequate because there is sufficient room for error and a small probability of risk. Often the cost

of making a perfect decision is not cost-effective. The concept of bounded rationality is not likely to be too surprising to military decision-makers because they are aware that their craft necessarily involves dealing with the "fog of war"; giving rise to the "artistic" aspect of their work.[6] However, these same simple judgmental shortcuts which lead to brilliant decisions also have a down side. Military decision-makers are usually much less aware of the negative effects that heuristic biases can have on even relatively simple decisions.

Systematic biases can creep into the decision-making process. These biases can invade the rational model at any step along the way and, thereby, seriously prejudice the eventual decision. Developing an awareness of these biases, understanding their root causes, and learning ways to reduce their influence can significantly improve decision-making. A great deal of research has been done on cognitive biases and how they influence our decision-making capability.

COGNITIVE BIASES

An extensive body of scientific research clearly shows that all of us are susceptible to a large number of biases. These biases cause distortions in perception which can adversely affect the decision-making process. Complete coverage of all the biases researchers have identified is beyond the scope of this paper. There are a number of books available that cover the subject of cognitive or heuristic bias in great detail. This paper is

devoted to describing some of the more prevalent biases that military decision-makers are likely to encounter. A summary of the biases discussed in this paper is contained in Table 1.

Table 1 Summary of Biases

Bias	Description
Representativeness Bias	The attachment of certain characteristics to an event is based on its perceived similarity to another event, i.e., stereotyping.[7]
Availability Bias	The frequency of occurrence or probability of an event is based on the ease with which instances or associations can be brought to mind.[8]
Probability Biases	The false belief that people can perceive randomness or accurately judge probabilities of multistage problems.[9]
Confirmatory Bias	The inclination to seek and accept only information which supports a preconceived notion about what is the proper choice.[10]
Anchoring and Adjustment	The inclination to make insufficient adjustments from a first impression in judging the outcome of an uncertain event.[11]

REPRESENTATIVENESS BIAS

Consider the following personality sketch and determine which set of occupations and hobbies best fit the individual.

> "Bill is 34 years old. He is intelligent, but unimaginative, compulsive, and generally lifeless. In school, he was strong in

mathematics but weak in social studies and humanities.

Bill is a physician who plays poker for a hobby.
Bill is an architect.
Bill is an accountant.
Bill plays jazz for a hobby.
Bill surfs for a hobby.
Bill is a reporter.
Bill is an accountant who plays jazz for a hobby.
Bill climbs mountains for a hobby."[12]

If you decided Bill was an accountant, you fell victim to the representativeness bias. The sketch and the possible responses are constructed so as to be representative of an accountant and nonrepresentative of a person who plays jazz. Your mental image of a typical accountant biased your answer in the direction of the accountant. The inappropriate application of stereotypes is a common bias produced by the representativeness heuristic.

Daniel Kahneman and Amos Tversky have researched this heuristic which frequently leads decision-makers in the wrong direction. The representativeness heuristic, as they call it, is brought into the judgment process when the likelihood of a less than certain event is estimated by comparing the degree of similarity it has with a model which is considered typical and, then, generalizing from that point.[13] In other words, the likelihood something will conform to a certain course is judged not on the merits of what may be a unique situation, but rather by the similarity of some facet of what is being observed to a previously recalled event. If the variables which determine the outcome are substantially identical, this could produce a highly

accurate prediction of the outcome of a course of action. However, seriously flawed decisions occur when the similarity of the event used as the model is not representative of the event about which a decision is being made. The erroneous assumption made is that key variables driving the outcome states of the model and the new event are perfectly correlated.

Common examples of this type of bias involve the application of stereotypes. A study conducted by Thomas Gilovich at Stanford University produced dramatic results that indicate foreign policy decisions can be seriously degraded by inconsequential similarities between current political situations and past ones when the representativeness heuristic is inappropriately applied.[14] In Gilovich's study, students enrolled in a political science class were asked to formulate U.S. strategic policy with regard to a hypothetical foreign policy crisis. The students were divided into three groups and each group was manipulated by analogies irrelevant to the outcome of the crisis. The analogies represented World War II and Vietnam scenarios as well as a control scenario which contained no biasing information. The results were dramatic. The World War II group clearly favored an interventionist strategy, whereas, the Vietnam group clearly favored an isolationist approach. Gilovich explains the control group's preference for an isolationist approach as indicative of the salience of the Vietnam War in the minds of the students as opposed to that of World War II which is more distant in the past. The control group's preference is the

result of the availability heuristic which will be described later in this paper.

The research by Gilovich shows that some people intuitively choose a completely irrelevant course of action solely on the basis of representativeness even when they have better information from which to make a decision. It is possible that some people may approach life with a set of stored circumstances which they sort through for the answer to virtually any complex problem with which they are confronted. These people may have a limited ability to think creatively. Faced with a situation where they must make a decision, they sort through their stored similar situations for an answer as opposed to creating new insights and solutions.

AVAILABILITY BIAS

Is it riskier to drive a car 400 miles or fly in a commercial airliner 400 miles? Statistics show that it is far safer, by the mile, to travel by commercial airliner.[15] However, some people may think otherwise because of the media attention afforded plane crashes. The image of a plane crash is more vivid and more readily available because it is more sensational than that of an automobile crash. This causes people to bias their answer to what stands out in their minds.

Tversky and Kahneman investigated this judgmental heuristic which is based upon the availability of information in terms of the ease with which seemingly relevant information is remembered.[16] They hypothesized that people employ a limited

number of heuristics to simplify complex questions involving probabilities or frequencies of occurrence. Their research shows that people estimate frequencies of occurrence or probabilities based on the ease with which instances or associations can be brought to mind. A person confronted with a complex problem cannot recall all necessary data from memory. Therefore, the person will judge overall frequency by what is remembered. The frequency of classes easily remembered will be perceived as occurring more frequently than those less available.[17]

This heuristic is usually very helpful to decision-makers because those things most easily remembered generally do follow a pattern of appearing most frequently in nature. However, this is not always the case because some of the things we most vividly recall are remembered for some other characteristic which makes them particularly salient in memory but has nothing to do with their frequency of occurrence. Conversely, the lack of ability to recall a class of activity can lead to a severe under-estimation of frequency of occurrence.[18] Signals can get mixed and one can confuse the unrelated salience with frequency of occurrence. The result is a judgmental bias.

A way in which people employ the availability heuristic to arrive at conclusions involves paired associations. This is a powerful mental reasoning tool that helps us create significant knowledge. However, when the presumed association is incorrect, this heuristic can be very misleading. Some pairings of dichotomous events seem inextricably linked because of the ease with which they are associated.[19] This may be because of the

recency or vividness of the pairing being recalled. For example, it is intuitively easy to arrive at the conclusion that church attendance and religious conviction are related. The pairing of church attendance and religious conviction is so strong that some people would jump to the erroneous conclusion that they are perfectly, or near perfectly, correlated. More careful consideration uncovers the fact that there are four possible outcomes in the occurrence of two dichotomous events. It is certainly possible that there are (1) religious people who go to church, (2) non-religious people who go to church, (3) religious people who do not go to church, and (4) non-religious people who do not attend church. Still, only one possibility is seriously considered by many, i.e., religious people go to church. The research suggests that people simply do not consider all of the possible outcomes in the decision making process.

Another example of the availability heuristic can be shown by asking if more words in the English language start with the letter "k" or have "k" as their third letter? Most people confronted with this choice, who are given no time to research their answer, will apply the availability heuristic and decide that more words start with "k". This is because it is much easier to remember words which start with "k". In fact more words have "k" as their third letter. The evidence is clear that what is most easily remembered is not necessarily accurate.[20]

A more practical example of this bias involves the preparation of performance appraisals. Most appraisal periods cover a year and the individual's performance over the entire

year should be taken into account when preparing the appraisal. However, in many cases what happens in the last few months of the rating period determines the final rating because it is fresher in the rater's mind and, therefore, is given more weight.[21]

Stephen Read, at Northwestern University, discovered disconcerting evidence that people frequently make predictions and explain events on the basis of a single past experience which is "available". This dominates their thought process in a predictable way.[22] His work shows that, as decisions become more complex, people tend to rely more heavily on a single past experience which is perceived to be analogous. History contains many examples of an entire line of decisions flowing from a single, presumed salient perception.

An actual example of this is the line of reasoning President Roosevelt pursued in his dealings with the Soviet Union during World War II. In his 1943 Christmas Eve radio address to the nation, President Roosevelt predicted "The United States and the Soviet Union are going to get along very well...there will be no possibility of an aggressor nation arising to start another World War."[23] History now shows this statement to be blatantly false. President Roosevelt held to this belief until the time of his death in spite of overwhelming evidence to the contrary. The behavior of the Soviet Union during and just after World War II should have made it clear that a new threat was emerging. Still, President Roosevelt clung tenaciously to his view that Germany would continue to pose a real threat to world peace in the post-war era because this was precisely what had

happened at the end of World War I. Many of President Roosevelt's significant decisions were based on his conclusion that World War II was a replay of World War I in the important aspects. He apparently harbored a genuine belief that the post-war era would parallel that of World War I in spite of vast differences in the critical variables of the two events which produced the two entirely different outcomes.[24]

It should have been apparent that the principle of "unconditional surrender" and the intended destruction of the German industrial base would render Germany impotent as a military power for many years to come. It should also have been apparent that the control over Eastern Europe which the Soviet Union was gaining was not going to be given up to democratic ideals at the end of the war. The frequent U.S. capitulation to the Soviets during this period, because of undue concern for a possible resurgence of German power after the war, gave the Soviets a strong position from which to threaten the freedom of Central Europe after World War II.

PROBABILITY BIASES

Which coin toss sequence is more likely: H-T-H-T-T-H or H-H-H-T-T-T? If you did not conclude both sequences are equally likely, you fell victim to a probability bias that causes people to believe that they can perceive randomness.[25] Tversky and Kahneman call this bias "belief in the law of small numbers". Their research shows this judgmental bias appears to result from an intuition that sampling error will somehow cancel itself

out.[26] Also known as the "gambler's fallacy", this bias compels people to make assumptions about random events on the basis of what they believe randomness should look like. If one has four sons and a daughter, one may perceive the probability of the next child being a son as higher although there is an equal chance of it being a daughter. Another example is expecting good performance from a newly arrived officer because the last two officers assigned were somehow less than effective. The "law of averages" causes some people to believe the next officer assigned will be effective. This logic is patently incorrect but people are somehow drawn to it by a belief that things will even out. Tversky and Kahneman speculate that the belief that variations will eventually cancel themselves out may stem from our observations of the physical world.[27]

Laws of nature involving the equilibrium of matter fall into this category of being self-regulating. Laws of chance, on the other hand, are fundamentally different. Assuming a normal distribution, events do cancel out in the long run. However, failure to appreciate that events are independent of each other seems to be a common bias. There is a natural tendency to be convinced that a string of events in what is viewed to be a random process conjures up some mystical force which will influence the next event. What is true, of course, is that there is an equal probability that the string will continue. In the case of the coin toss, there is a .5 probability of a head or tail no matter what has preceded that toss. After looking at five heads in a row this is somehow counter-intuitive.

Tversky and Kahneman determined in a 1983 study that people generally demonstrate a tendency to assign higher than warranted probabilities to outcomes of a sequence of events which each depend upon the success of each other for overall success. A tragic example of such an overestimation is demonstrated in the unwarranted confidence in the reliability of the Challenger spacecraft. Analysis of the probability of "O-ring" failure shows that failure was actually much larger than would have been intuitively obvious. If the probability of success for each "O-ring" was judged as .97 this could have been considered adequate. However, overall safety was found to depend on the combined probability of both "O-rings" in both rocket motors functioning properly. This probability is much lower, i.e., .885 (.97 x .97 x .97 x .97) and proved to be disasterous. The study by Tversky and Kahneman confirms that people tend to ignore less likely uncertainties and base judgments only on most likely uncertainties when confronted with multistage problems.[28] The result is a consistent bias which overstates the probability of the outcome as compared with the statistically computed probabilities.

The overconfidence appears to emanate from a combination of the availability and representativeness biases. The addition of another variable which makes the overall probability of success less likely seems counter-intuitive. When the combined effect of the variables is taken into consideration, intuitively the likelihood of success seems improved. The biases team up to cause the conjunction to seem more important than either of the parts

from which it was constructed. This happens because the conjunction is more available than either of its parts and because the conjunction incorrectly represents a situation which seems more likely. In some cases this bias is so strong that it produces conjunctions that people will insist are more likely even when the bias is clearly explained to them using a mathematical formula. There is no question that probability theory clearly shows that a combination of two independent variables cannot be more probable than any of its individual variables.[29]

The strategist's vision of the likelihood of political events is subject to the "conjunction fallacy" Tversky and Kahneman demonstrated in their research. A group of political scientists found "a Russian invasion of Poland, and a complete suspension of diplomatic relations between the USA and the Soviet Union, some time in 1983" more probable than just "a complete suspension of diplomatic relations between the USA and the Soviet Union, sometime in 1983".[30] Once again, mathematically the conjunction of the two events (invasion and suspension) cannot be more probable than the suspension alone, but the "conjunction fallacy" makes it seem intuitively more plausible.

The conjunction fallacy leads to consistent over-estimation of the probability of an event. The world of the military strategist is wide open to this bias because many of the plans developed necessarily entail assessing the probability of success in a multistage event.

The ill-fated "Desert One" mission to Iran is a good example. Success of the mission depended upon the combined probabilities of numerous events. Careful analysis of the probability of having sufficient transportation to complete the mission from the staging base and the probability of mechanical failures and the probability of bad weather conditions should have led to a conclusion that there was little likelihood of success. Whereas, independent component reliability may have been high, the multistage probability of failure was much higher than what might have otherwise been intuitively obvious.

Often the old adage that " a chain is only as strong as its weakest link" is very true. It is all too easy to become overconfident about such an endeavor. Although there may be little likelihood of the failure of an individual subsystem, the combined probability of failure, when considered in the context of multiple subsystems, may be much larger than that which seems immediately apparent.[31] Each subsystem has a small probability of failure which is inconsequential by itself. However, when the subsystems are combined, overall system failure is much more likely.

CONFIRMATORY BIAS

No discussion of biases which affect decision-making would be complete without a discussion of confirmatory bias. This bias is the inclination to seek and accept only that information which supports a preconceived notion or a hunch about what is the proper choice.[32] It often involves a "gut feeling" as to what

is the proper decision which evolves far too early in the decision-making process. Buying a new car is an example which most of us have experienced. When it is time to buy a new car it is often because we like a particular model car. In the search for comparative information about other cars many people will find numerous reasons why the first model chosen is the best car to buy. Although they may consider many other cars and receive all kinds of information, they may discount positive information on other models non-rationally.

Some people feel that their education level or special training exempts them from the pitfalls of confirmatory bias. Detailed knowledge of a particular field is not a guarantee against being susceptible to confirmatory bias. There is substantial evidence to support this. Mahoney and DeMonbreun conducted a study in 1977 to determine the impact of confirmatory bias on the problem-solving abilities of scientists. Their hypothesis was that scientists should be superior problem solvers because of their training in the "scientific method".[33] A control group of Protestant ministers and a group of scientists possessing doctoral level degrees were given identical problem solving tasks. The results showed that both groups demonstrated a significant confirmatory bias, and that there were no significant differences between the two groups.[34]

This study shows that people use selective perception to ignore or even discredit any information which does not positively reinforce their original notion. Our individual experiences color our perceptions. Each of us sees the world

through the filters of our past experiences. This gives us a predisposition for some judgments we make. Robert Jervis calls this a "perceptual readiness". Jervis argues that the decisions made by John Foster Dulles while he was Secretary of State were consistently influenced by a single, dominant perception. Dulles is said to have been predisposed to the idea that the Russian people were actually less than supportive of the Soviet regime.[35] It can be inferred that this caused Dulles to not consider the Soviet threat as carefully as he should have. He may have created foreign policies which allowed the Soviets to make unwarranted gains in the early stages of the Cold War simply because he believed the Soviet leadership did not have the support of their people. When these predispositions are particularly salient they are likely to lead to conclusions which have no rational underpinning. For example, an American strategist may easily conclude that a Communist dictator is a more likely threat than the head of a democratic government solely on the basis of perceptual readiness.

Perceptual readiness has led to significant mistakes in the intelligence arena. Two notable cases were the failure of American intelligence analysts to identify ships carrying offensive missiles into Cuba and the failure of British analysts to see V-2 rockets that were clearly visible in World War II reconnaissance photographs.[36] In the first case, the American analysts were predisposed to the idea that the Soviets would not dare to send missiles to Cuba because they were clearly not in a position to confront the West. In the latter case, the analysts

were looking for what was believed to be a much larger, rail-mounted, rocket. In both cases, the evidence was right before the eyes of those trained to find it, but they could not see it because of their "perceptual readiness" not to see it.

ANCHORING AND ADJUSTMENT

If a military installation has four branch post exchanges averaging $10,000 in monthly sales and a fifth store is added, what might its sales be? If you answered that it depends on many factors, you are headed in the right direction. However, research shows that even knowing the other pertinent factors, you are likely to be unduly influenced by the $10,000 average. In 1973, Tversky and Kahneman proposed a judgmental heuristic they called "anchoring and adjustment".[37] This heuristic involves making adjustments from a starting point which serves to "anchor" further adjustments. The underlying bias is that the adjustments tend to be insufficient to allow for accurate estimations. The research shows that adjustments are biased towards the initial estimate even if the initial estimate is chosen at random, and the individual knows it is chosen at random.[38] Another example is the Congressional bias towards approving a three to five percent cost of living raise for federal workers regardless of the past injustices caused by inflation. If such raises are intended to maintain a parity in purchasing power any bias which ignores the past inequities will not achieve the goal of maintaining constant purchasing power.

The budget process offers many opportunities for the ill effects of anchoring and adjustment. In budgeting, very often

the question is asked, "How much is enough?". The size of the problem and the number of variables involved frequently make this a very subjective question. How many B-17 aircraft should be built may be a very complex decision but the outcome is like y to be more affected by the initial estimate of needs than any other factor. People often cling tenaciously to these initial estimates but have difficulty providing a rationale for their position. As Tversky and Kahneman point out, adjustments from the original estimate are likely to be minor. Often people go with a first impression of what is a reasonable estimate. Having made that first estimate they are willing to adjust, but if their first impression is far off base it is unlikely any adjustments will be of significant magnitude so as to make the final estimate relatively accurate.

IMPLICATIONS FOR MILITARY DECISION MAKERS

Unfortunately, there is no simple panacea for overcoming the cognitive biases which creep insidiously into our decision-making processes. Most of the research that has been done on heuristics is descriptive in nature. There is no all encompassing prescriptive theory which provides a framework for systematically protecting the military decision-maker from these biases. However, there are some practical ways to keep these biases from causing decisions to go awry.

Higher level decision-makers will necessarily use more heuristic processes because of the vague and uncertain nature of work at their level. Therefore, they must be aware of the biases

heuristics can produce. Just being aware of cognitive biases can help one avoid them. It is also important to understand that rationality is bounded and that cognitive overload is one of the major contributing causes of cognitive bias. Decision-makers should be aware of the character of the heuristics discussed in this paper and the impact they can have on the decision process.

The quality of decision-making can be significantly improved by increasing the amount of time spent studying and understanding the decision-making process in Service schools. Aside from studying the format for a standard staff study, very little time is currently devoted to studying the process. The number of decisions made by military leaders and the stakes involved in making strategic decisions clearly call for more emphasis in this area. By studying the decision process and the biases which influence it, decision-makers can avoid the negative effects of heuristic biases.[39]

In formulating strategic policy, it is clear that policy makers must go far beyond the rhetoric of comparing Saddam Hussein to Adolf Hitler. Bringing in historical examples is relevant only to the extent that there is a good correlation between the concepts, people, and events being compared. Superficial comparisons will generally lead to the wrong conclusions. Knowing the detailed history of the event considered analogous is of the utmost importance. One means of making such a comparison is to consider those variables which can be quantified and to apply statistical analysis to determine a coefficient of correlation for each of the dependent variables.

In those areas not amenable to quantification, expert opinions or other reliable information should be used to validate each of the dependent variables.

The detrimental effects of the availability heuristic and the linkage it has to representativeness should be borne in mind. The decision-maker should reflect on the course of action being considered and determine if there is a central, repetitive theme that seems to dominate the decision-making process. If there is a stereotypic theme there may be a single, particularly salient event which is dominating the entire decision process. This may or may not be appropriate. More often than not, domination by a single event means the process is flawed. In searching for information to test a course of action, it is vitally important to consider information which tends to disprove one's logic or suggests a different course of action. Often such information is more important to good decision-making than information which proves it. Alternative actions should be tried. If the alternatives are not comprehensive, or if they do not offer any realistic alternate actions, be aware of the confirmatory bias. These alternatives may have been created for the sole purpose of having an alternative to cast aside.

Military leaders are called upon to make numerous decisions, sometimes very significant ones, in the normal course of daily military life. It is important to remember that people generally do not make good intuitive predictions and that this is particularly true when there is more than one variable being considered. Risk assessment is particularly susceptible to

errors in judgment. When numerical estimates are used which are based on nothing more rigorous than a best guess, adjustments are generally biased in the direction of original estimates. This can lead to errors such as overestimation of enemy or friendly capabilities which can have devastating consequences. The military budgeting and program management processes are fertile grounds for these kind of errors. Certainly everything cannot be quantified, but in those cases when data can be quantified the application of statistical methods and computer assisted decision support models can prove invaluable.

The environment created by the military decision-maker can have significant consequences for the quality of the decision process. The military decision-maker must enforce the decision process and resist the temptation of speeding up the process by taking unnecessary shortcuts. This is because heuristics are cognitive shortcuts and are more likely to be employed when the formal decision process is violated. Whether using the Deliberate Planning Process[40] or Crisis Action Procedures[41], it is important to slow the process enough to allow full consideration of all possible courses of action. It is important that every course of action and every fact or analogy have a "devil's advocate". The environment must allow for genuine dissent and the decay of ownership of specific courses of action. Openness and full participation will serve to deteriorate cognitive bias. Open-mindedness may be the best armor available to protect the military decision-maker from cognitive biases.

Notes

1. Carl Von Clausewitz, On War ed. by Michael Howard and Peter Paret, p. 86.

2. Robin Hogarth, Judgement and Choice, p. 3.

3. H.A. Simon, "Rational Choice and the Structure of the Environment." Psychological Review, 1956, p. 129-138.

4. Max H. Bazerman, Judgment in Managerial Decision Making, p. 5.

5. Simon, p. 129.

6. Clausewitz, p. 649.

7. Amos Tversky and Daniel Kahneman, "Subjective Probability: A Judgment of Representativeness." Cognitive Psychology, 1972, Vol. 3, p. 430.

8. Amos Tversky and Daniel Kahneman, "Availability: A heuristic for Judging Frequency and Probability." Cognitive Psychology, 1973, Vol. 5, p. 207.

9. Amos Tversky and Daniel Kahneman, "Judgment Under Uncertainty: Heuristics and Biases." Science, 1974, p. 1127.

10. Ibid., p. 1129.

11. Ibid., p. 1128.

12. Amos Tversky and Daniel Kahneman, "Extensional Versus Intuitive Reasoning: The Conjunction Fallacy in Probability Judgment." Psychology Review, p. 297.

13. Amos Tversky and Daniel Kahneman, "Subjective Probability: A Judgment of Representativeness." Cognitive Psychology, 1972, Vol. 3, p. 430.

14. Thomas Gilovich, "Seeing the Past in the Present: The Effect of Associations to Familiar Events on Judgments and Decisions." Journal of Personality and Social Psychology, 1981, Vol. 40, No. 5, p. 803.

15. Ibid., p.15.

16. Amos Tversky and Daniel Kahneman, "Availability: A heuristic for Judging Frequency and Probability.", p. 207.

17. Amos Tversky and Daniel Kahneman, "Judgment Under Uncertainty: Heuristics and Biases.", p. 1127.

18. John Fox, "Making Decisions Under the Influence of Memory." Psychological Review, 1980, p. 193.

19. Bazerman, p. 18.

20. Amos Tversky and Daniel Kahneman, "Availability: A Heuristic for Judging Frequency and Probability.", p. 211.

21. Bazerman, p. 16.

22. Stephen Read, "Once is Enough: Causal Reasoning From a Single Instance." Journal of Personality and Social Psychology, 1983, Vol. 45, No. 2, p. 332.

23. Earnest R. May, Lessons of the Past, (New York: Oxford University Press, 1973), p. 4.

24. Ibid., p. 7.

25. Amos Tversky and Daniel Kahneman, "Judgment Under Uncertainty: Heuristics and Biases.", p. 1125.

26. Amos Tversky and Daniel Kahneman, "Belief in the Law of Small Numbers." Psychological Bulletin, 1971, Vol. 76, No. 2, p. 106.

27. Amos Tversky and Daniel Kahneman, "Belief in the Law of Small Numbers." Psychological Bulletin, 1971, p. 106.

28. Amos Tversky and Daniel Kahneman, "Extensional versus intuitive reasoning: The conjunction fallacy in probability judgment." Psychological Review, p. 293-315.

29. John Netter, William Wasserman, and G.A. Witmore, Applied Statistics, p. 95.

30. Amos Tversky and Daniel Kahneman, "Extensional Versus Intuitive Reasoning: The Conjunction Fallacy in Probability Judgment.", pp. 307-308.

31. Amos Tversky and Daniel Kahneman, "Judgment Under Uncertainty: Heuristics and Biases.", p. 1129.

32. Ibid.

33. Michael Mahoney and Bobby DeMonbreun, "Psychology of the Scientist: An Analysis of Problem-Solving Bias." Cognitive Therapy and Research, 1977, Vol. 1, No. 3, p. 229.

34. Ibid., p. 229.

35. Robert Jervis, Perception and Misperception in International Politics, Princeton University press, Princeton, New Jersey, 1976, p. 146.

36. Ibid, p. 143.

37. Amos Tversky and Daniel Kahneman, "Judgment Under Uncertainty: Heuristics and Biases." p. 1128.

38. Ibid.

39. Bazerman, p. 168.

40. U.S. Joint Chiefs of Staff, Joint Chiefs of Staff Publication 5-02.1, pp. III-1 to III-20.

41. U.S. Joint Chiefs of Staff, Joint Chiefs of Staff Publication 5-02.4, pp. I-1 to I-6.

BIBLIOGRAPHY

Bazerman, Max H., Judgment in Managerial Decision Making. New York: John Wiley and Sons, 1986.

Fox, J. "Making Decisions Under the Influence of Memory." Psychological Review, Vol. 87, No. 2, 1980, pp. 190-211.

Gentner, D. and Collins, A. "Studies of Inference from Lack of Knowledge." Memory and Cognition, Vol. 9, No. 4, 1981, pp. 434-443.

Gilovich, T. "Seeing the Past in the Present: The Effect of Associations to Familiar Events on Judgments and Decisions." Journal of Personality and Social Psychology, Vol. 40, No. 5, 1981, pp. 797-808.

Hogarth, Robin. Judgement and Choice. New York: John Wiley and Sons, 1980.

Howard, Michael and Paret, Peter., ed. On War. Princeton: Princeton University Press, 1976 by Carl Von Clausewitz.

Jervis, R. Perception and Misperception in International Politics. Princeton: Princeton University Press, 1976.

Mahoney, M. and DeMonbreun, B. "Psychology of the Scientist: An analysis of Problem-Solving Bias." Cognitive Therapy and Research, Vol. 1, No. 3, pp. 229-238.

May, Earnest R. Lessons of the Past. New York: Oxford University Press, 1973.

Netter, John; Wasserman, William; and Witmore, G.A. Applied Statistics, Boston: Allyn and Bacon, Inc., 1982.

Read, S. "Once is Enough: Causal Reasoning from a Single Instance." Journal of Personality and Social Psychology, Vol. 45, No. 2, 1983, pp. 323-334.

Simon, H.A. "Rational Choice and the Structure of the Environment." Psychological Review, 1956, pp. 129-138.

Tversky, A. and Kahneman D. "Availability: A Heuristic for Judging Frequency and Probability." Cognitive Psychology, Vol. 5, pp. 207-231.

Tversky, A. and Kahneman D. "Belief in the Law of Small Numbers." Psychological Bulletin, Vol. 76. No. 2, pp. 105-110.

Tversky, A. and Kahneman, D. "Extensional Versus Intuitive Reasoning: The Conjunction Fallacy in Probability Judgment." Psychological Review, Vol. 90, No. 4, October 1983, pp. 293-315.

Tversky, A. and Kahneman, D. "Judgment Under Uncertainty: Heuristics and Biases." Science, Vol. 185, pp. 1124-1131.

Tversky, A. and Kahneman, D. "Subjective Probability: A Judgment of Representativeness." Cognitive Psychology, Vol. 3, 1972, pp. 430-454.

U.S. Joint Chiefs of Staff. Joint Chiefs of Staff Publication 5-02.1: Joint Operational Planning System Volume I Deliberate Planning Procedures. Washington: 6 July 1988.

U.S. Joint Chiefs of Staff. Joint Chiefs of Staff Publication 5-02.4: Joint Operational Planning System Volume IV (Crisis Action Procedures). Washington: 8 Jul 1988.