

schemata or mind-set that enables them to achieve whatever success they enjoy in making analytical judgments.

There is, however, a crucial difference between the chess master and the master intelligence analyst. Although the chess master faces a different opponent in each match, the environment in which each contest takes place remains stable and unchanging: the permissible moves of the diverse pieces are rigidly determined, and the rules cannot be changed without the master's knowledge. Once the chess master develops an accurate schema, there is no need to change it. The intelligence analyst, however, must cope with a rapidly changing world. Many countries that previously were US adversaries are now our formal or de facto allies. The American and Russian governments and societies are not the same today as they were 20 or even 10 or five years ago. Schemata that were valid yesterday may no longer be functional tomorrow.

Learning new schemata often requires the unlearning of existing ones, and this is exceedingly difficult. It is always easier to learn a new habit than to unlearn an old one. Schemata in long-term memory that are so essential to effective analysis are also the principal source of inertia in recognizing and adapting to a changing environment. Chapter 6, "Keeping an Open Mind," identifies tools for dealing with this problem.

PART II—TOOLS FOR THINKING

Chapter 4

Strategies for Analytical Judgment: Transcending the Limits of Incomplete Information

When intelligence analysts make thoughtful analytical judgments, how do they do it? In seeking answers to this question, this chapter discusses the strengths and limitations of situational logic, theory, comparison, and simple immersion in the data as strategies for the generation and evaluation of hypotheses. The final section discusses alternative strategies for choosing among hypotheses. One strategy too often used by intelligence analysts is described as "satisficing"—choosing the first hypothesis that appears good enough rather than carefully identifying all possible hypotheses and determining which is most consistent with the evidence.³⁷

* * * * *

Intelligence analysis should be self-conscious about their reasoning process. They should think about *how* they make judgments and reach conclusions, not just about the judgments and conclusions themselves. Webster's dictionary defines judgment as arriving at a "decision or conclusion on the basis of indications and probabilities when the facts are not clearly ascertained."³⁸ Judgment is what analysts use to fill gaps in their knowledge. It entails going beyond the available information and is the principal means of coping with uncertainty. It always involves an analytical leap, from the known into the uncertain.

37. An earlier version of this chapter was published as an unclassified article in *Studies in Intelligence* in 1981, under the title "Strategies for Analytical Judgment."
38. Webster's *New International Dictionary*, unabridged, 1954.

Judgment is an integral part of all intelligence analysis. While the optimal goal of intelligence collection is complete knowledge, this goal is seldom reached in practice. Almost by definition of the intelligence mission, intelligence issues involve considerable uncertainty. Thus, the analyst is commonly working with incomplete, ambiguous, and often contradictory data. The intelligence analyst's function might be described as transcending the limits of incomplete information through the exercise of analytical judgment.

The ultimate nature of judgment remains a mystery. It is possible, however, to identify diverse strategies that analysts employ to process information as they prepare to pass judgment. Analytical strategies are important because they influence the data one attends to. They determine where the analyst shines his or her searchlight, and this inevitably affects the outcome of the analytical process.

Strategies for Generating and Evaluating Hypotheses

This book uses the term hypothesis in its broadest sense as a potential explanation or conclusion that is to be tested by collecting and presenting evidence. Examination of how analysts generate and evaluate hypotheses identifies three principal strategies—the application of theory, situational logic, and comparison—each of which is discussed at some length below. A “non-strategy,” immersion in the data and letting the data speak for themselves, is also discussed. This list of analytical strategies is not exhaustive. Other strategies might include, for example, projecting one's own psychological needs onto the data at hand, but this discussion is not concerned with the pathology of erroneous judgment. Rather, the goal is to understand the several kinds of careful, consistent analysis one would hope and expect to find among a cadre of intelligence analysts dealing with highly complex issues.

Situational Logic

This is the most common operating mode for intelligence analysts. Generation and analysis of hypotheses start with consideration of concrete elements of the current situation, rather than with broad generalizations that encompass many similar cases. The situation is regarded as one-of-a-kind, so that it must be understood in terms of its own unique logic, rather than as one example of a broad class of comparable events.

moment of storage. By influencing the content of memory, all of these factors also influence the outcome of intelligence analysis.

Chapter 12 on “Biases in Estimating Probabilities” describes how availability in memory influences judgments of probability. The more instances a person can recall of a phenomenon, the more probable that phenomenon seems to be. This is true even though ability to recall past examples is influenced by vividness of the information, how recently something occurred, its impact upon one's personal welfare, and many other factors unrelated to the actual probability of the phenomenon.

Memory Rarely Changes Retroactively. Analysts often receive new information that should, logically, cause them to reevaluate the credibility or significance of previous information. Ideally, the earlier information should then become either more salient and readily available in memory, or less so. But it does not work that way. Unfortunately, memories are seldom reassessed or reorganized retroactively in response to new information. For example, information that is dismissed as unimportant or irrelevant because it did not fit an analyst's expectations does not become more memorable even if the analyst changes his or her thinking to the point where the same information, received today, would be recognized as very significant.

Memory Can Handicap as Well as Help

Understanding how memory works provides some insight into the nature of creativity, openness to new information, and breaking mind-sets. All involve spinning new links in the spider web of memory—links among facts, concepts, and schemata that previously were not connected or only weakly connected.

Training courses for intelligence analysts sometimes focus on trying to open up an analyst's established mind-set, to get him or her to see problems from different perspectives in order to give a fairer shake to alternative explanations. More often than not, the reaction of experienced analysts is that they have devoted 20 years to developing their present mind-set, that it has served them well, and that they see no need to change it. Such analysts view themselves, often accurately, as comparable to the chess masters. They believe the information embedded in their long-term memory permits them to perceive patterns and make inferences that are beyond the reach of other observers. In one sense, they are quite correct in not wanting to change; it is, indeed, their existing

demand. In other words, it serves as a mnemonic device that provides the hooks on which to hang information so that it can be found when needed.

The model is initially an artificial construct, like the previously noted acronym “HOMES.” With usage, however, it rapidly becomes an integral part of one’s conceptual structure—the set of schemata used in processing information. At this point, remembering new information occurs by assimilation rather than by mnemonics. This enhances the ability to recall and make inferences from a larger volume of information in a greater variety of ways than would otherwise be possible.

“Hardening of the Categories.” Memory processes tend to work with generalized categories. If people do not have an appropriate category for something, they are unlikely to perceive it, store it in memory, or be able to retrieve it from memory later. If categories are drawn incorrectly, people are likely to perceive and remember things inaccurately. When information about phenomena that are different in important respects nonetheless gets stored in memory under a single concept, errors of analysis may result. For example, many observers of international affairs had the impression that Communism was a monolithic movement, that it was the same everywhere and controlled from Moscow. All Communist countries were grouped together in a single, undifferentiated category called “international Communism” or “the Communist bloc.” In 1948, this led many in the United States to downplay the importance of the Stalin–Tito split. According to one authority, it “may help explain why many Western minds, including scholars, remained relatively blind to the existence and significance of Sino-Soviet differences long after they had been made manifest in the realm of ideological formulae.”³⁶

“Hardening of the categories” is a common analytical weakness. Fine distinctions among categories and tolerance for ambiguity contribute to more effective analysis.

Things That Influence What Is Remembered. Factors that influence how information is stored in memory and that affect future retrievability include: being the first-stored information on a given topic, the amount of attention focused on the information, the credibility of the information, and the importance attributed to the information at the

Starting with the known facts of the current situation and an understanding of the unique forces at work at that particular time and place, the analyst seeks to identify the logical antecedents or consequences of this situation. A scenario is developed that hangs together as a plausible narrative. The analyst may work backwards to explain the origins or causes of the current situation or forward to estimate the future outcome.

Situational logic commonly focuses on tracing cause-effect relationships or, when dealing with purposive behavior, means-ends relationships. The analyst identifies the goals being pursued and explains why the foreign actor(s) believe certain means will achieve those goals.

Particular strengths of situational logic are its wide applicability and ability to integrate a large volume of relevant detail. Any situation, however unique, may be analyzed in this manner.

Situational logic as an analytical strategy also has two principal weaknesses. One is that it is so difficult to understand the mental and bureaucratic processes of foreign leaders and governments. To see the options faced by foreign leaders as these leaders see them, one must understand their values and assumptions and even their misperceptions and misunderstandings. Without such insight, interpreting foreign leaders’ decisions or forecasting future decisions is often little more than partially informed speculation. Too frequently, foreign behavior appears “irrational” or “not in their own best interest.” Such conclusions often indicate analysts have projected American values and conceptual frameworks onto the foreign leaders and societies, rather than understanding the logic of the situation as it appears to them.

The second weakness is that situational logic fails to exploit the theoretical knowledge derived from study of similar phenomena in other countries and other time periods. The subject of national separatist movements illustrates the point. Nationalism is a centuries-old problem, but most Western industrial democracies have been considered well-integrated national communities. Even so, recent years have seen an increase in pressures from minority ethnic groups seeking independence or autonomy. Why has this phenomenon occurred recently in Scotland, southern France and Corsica, Quebec, parts of Belgium, and Spain—as well as in less stable Third World countries where it might be expected?

Dealing with this topic in a logic-of-the-situation mode, a country analyst would examine the diverse political, economic, and social groups whose interests are at stake in the country. Based on the relative power

³⁶ Robert Tucker, “Communist Revolutions, National Cultures, and the Divided Nations,” *Studies in Comparative Communism* (Autumn 1974), 235–245.

positions of these groups, the dynamic interactions among them, and anticipated trends or developments that might affect the future positions of the interested parties, the analyst would seek to identify the driving forces that will determine the eventual outcome.

It is quite possible to write in this manner a detailed and seemingly well-informed study of a separatist movement in a single country while ignoring the fact that ethnic conflict as a generic phenomenon has been the subject of considerable theoretical study. By studying similar phenomena in many countries, one can generate and evaluate hypotheses concerning root causes that may not even be considered by an analyst who is dealing only with the logic of a single situation. For example, to what extent does the resurgence of long-dormant ethnic sentiments stem from a reaction against the cultural homogenization that accompanies modern mass communications systems?

Analyzing many examples of a similar phenomenon, as discussed below, enables one to probe more fundamental causes than those normally considered in logic-of-the-situation analysis. The proximate causes identified by situational logic appear, from the broader perspective of theoretical analysis, to be but symptoms indicating the presence of more fundamental causal factors. A better understanding of these fundamental causes is critical to effective forecasting, especially over the longer range. While situational logic may be the best approach to estimating short-term developments, a more theoretical approach is required as the analytical perspective moves further into the future.

Applying Theory

Theory is an academic term not much in vogue in the Intelligence Community, but it is unavoidable in any discussion of analytical judgment. In one popular meaning of the term, “theoretical” is associated with the terms “impractical” and “unrealistic”. Needless to say, it is used here in a quite different sense.

A theory is a generalization based on the study of many examples of some phenomenon. It specifies that when a given set of conditions arises, certain other conditions will follow either with certainty or with some degree of probability. In other words, conclusions are judged to follow from a set of conditions and a finding that these conditions apply in the specific case being analyzed. For example, Turkey is a developing country in a precarious strategic position. This defines a set of conditions that

Stretching the Limits of Working Memory

Limited information is available on what is commonly thought of as “working memory”—the collection of information that an analyst holds in the forefront of the mind as he or she does analysis. The general concept of working memory seems clear from personal introspection. In writing this chapter, I am very conscious of the constraints on my ability to keep many pieces of information in mind while experimenting with ways to organize this information and seeking words to express my thoughts. To help offset these limits on my working memory, I have accumulated a large number of written notes containing ideas and half-written paragraphs. Only by using such external memory aids am I able to cope with the volume and complexity of the information I want to use.

A well-known article written over 40 years ago, titled “The Magic Number Seven—Plus or Minus Two,” contends that seven—plus or minus two—is the number of things people can keep in their head all at once.³⁵ That limitation on working memory is the source of many problems. People have difficulty grasping a problem in all its complexity. This is why we sometimes have trouble making up our minds. For example, we think first about the arguments in favor, and then about the arguments against, and we can’t keep all those pros and cons in our head at the same time to get an overview of how they balance off against each other.

The recommended technique for coping with this limitation of working memory is called externalizing the problem—getting it out of one’s head and down on paper in some simplified form that shows the main elements of the problem and how they relate to each other. Chapter 7, “Structuring Analytical Problems,” discusses ways of doing this. They all involve breaking down a problem into its component parts and then preparing a simple “model” that shows how the parts relate to the whole. When working on a small part of the problem, the model keeps one from losing sight of the whole.

A simple model of an analytical problem facilitates the assimilation of new information into long-term memory; it provides a structure to which bits and pieces of information can be related. The model defines the categories for filing information in memory and retrieving it on

35. George A. Miller, “The Magical Number Seven—Plus or Minus Two: Some Limits on our Capacity for Processing Information,” *The Psychological Review*, Vol. 63, No. 2 (March 1956).

names or words have been devised by various memory experts, but these require some study and practice in their use.

Mnemonic devices are useful for remembering information that does not fit any appropriate conceptual structure or schema already in memory. They work by providing a simple, artificial structure to which the information to be learned is then linked. The mnemonic device supplies the mental “file categories” that ensure retrievability of information. To remember, first recall the mnemonic device, then access the desired information.

Memory and Intelligence Analysis

An analyst’s memory provides continuous input into the analytical process. This input is of two types—additional factual information on historical background and context, and schemata the analyst uses to determine the meaning of newly acquired information. Information from memory may force itself on the analyst’s awareness without any deliberate effort by the analyst to remember; or, recall of the information may require considerable time and strain. In either case, anything that influences what information is remembered or retrieved from memory also influences intelligence analysis.

Judgment is the joint product of the available information and what the analyst brings to the analysis of this information. An experiment documenting differences between chess masters and ordinary chess players was noted earlier. Similar research with medical doctors diagnosing illness indicates that differences between stronger and weaker performers are to be found in the organization of information and experience in long-term memory.³⁴ The same presumably holds true for intelligence analysts. Substantive knowledge and analytical experience determine the store of memories and schemata the analyst draws upon to generate and evaluate hypotheses. The key is not a simple ability to recall facts, but the ability to recall patterns that relate facts to each other and to broader concepts—and to employ procedures that facilitate this process.

imply conclusions concerning the role of the military and the nature of political processes in that country, because analysts have an implicit if not explicit understanding of how these factors normally relate.

What academics refer to as theory is really only a more explicit version of what intelligence analysts think of as their basic understanding of how individuals, institutions, and political systems normally behave.

There are both advantages and drawbacks to applying theory in intelligence analysis. One advantage is that “theory economizes thought.” By identifying the key elements of a problem, theory enables an analyst to sort through a mass of less significant detail. Theory enables the analyst to see beyond today’s transient developments, to recognize which trends are superficial and which are significant, and to foresee future developments for which there is today little concrete evidence.

Consider, for example, the theoretical proposition that economic development and massive infusion of foreign ideas in a feudal society lead to political instability. This proposition seems well established. When applied to Saudi Arabia, it suggests that the days of the Saudi monarchy are numbered, although analysts of the Saudi scene using situational logic find little or no current evidence of a meaningful threat to the power and position of the royal family. Thus, the application of a generally accepted theoretical proposition enables the analyst to forecast an outcome for which the “hard evidence” has not yet begun to develop. This is an important strength of theoretical analysis when applied to real-world problems.

Yet this same example also illustrates a common weakness in applying theory to analysis of political phenomena. Theoretical propositions frequently fail to specify the time frame within which developments might be anticipated to occur. The analytical problem with respect to Saudi Arabia is not so much whether the monarchy will *eventually* be replaced, as when or under what conditions this might happen. Further elaboration of the theory relating economic development and foreign ideas to political instability in feudal societies would identify early warning indicators that analysts might look for. Such indicators would guide both intelligence collection and analysis of sociopolitical and socioeconomic data and lead to hypotheses concerning when or under what circumstances such an event might occur.

But if theory enables the analyst to transcend the limits of available data, it may also provide the basis for ignoring evidence that is truly

³⁴ Arthur S. Elstein, Lee S. Shulman & Sarah A. Sprafka, *Medical Problem Solving: An Analysis of Clinical Reasoning* (Cambridge, MA: Harvard University Press, 1978), p. 276.

indicative of future events. Consider the following theoretical propositions in the light of popular agitation against the Shah of Iran in the late 1970s: (1) When the position of an authoritarian ruler is threatened, he will defend his position with force if necessary. (2) An authoritarian ruler enjoying complete support of effective military and security forces cannot be overthrown by popular opinion and agitation. Few would challenge these propositions, yet when applied to Iran in the late 1970s, they led Iran specialists to misjudge the Shah's chances for retaining the peacock throne. Many if not most such specialists seemed convinced that the Shah remained strong and that he would crack down on dissent when it threatened to get out of control. Many persisted in this assessment for several months after the accumulation of what in retrospect appears to have been strong evidence to the contrary.

Persistence of these assumptions is easily understood in psychological terms. When evidence is lacking or ambiguous, the analyst evaluates hypotheses by applying his or her general background knowledge concerning the nature of political systems and behavior. The evidence on the strength of the Shah and his intention to crack down on dissidents was ambiguous, but the Iranian monarch was an authoritarian ruler, and authoritarian regimes were assumed to have certain characteristics, as noted in the previously cited propositions. Thus beliefs about the nature of authoritarian regimes *per se*. For an analyst who believed in the two aforementioned propositions, it would have taken far more evidence, including more unambiguous evidence, to infer that the Shah would be overthrown than to justify continued confidence in his future.³⁹

Figure 4 below illustrates graphically the difference between theory and situational logic. Situational logic looks at the evidence within a single country on multiple interrelated issues, as shown by the column

39. Even in retrospect these two propositions still seem valid, which is why some aspects of the Shah's fall remain incredible. There are, in principle, three possible reasons why these seemingly valid theoretical assumptions failed to generate an accurate estimate on Iran: (1) One or more of the initial conditions posited by the theory did not in fact apply—for example, the Shah was not really an authoritarian ruler. (2) The theory is only partially valid, in that there are certain circumstances under which it does and does not apply. These limiting conditions need to be specified. (3) The theory is basically valid, but one cannot expect 100-percent accuracy from social science theories. Social science, as distinct from natural science, deals with a probabilistic environment. One cannot foresee all the circumstances that might cause an exception to the general rules, so the best that can be expected is that the given conditions will lead to the specified outcome most of the time.

ably because it only leads them to rehearse the information in short-term memory, which is ineffective as compared with other forms of processing.

There are three ways in which information may be learned or committed to memory: by rote, assimilation, or use of a mnemonic device. Each of these procedures is discussed below.³³

By Rote. Material to be learned is repeated verbally with sufficient frequency that it can later be repeated from memory without use of any memory aids. When information is learned by rote, it forms a separate schema not closely interwoven with previously held knowledge. That is, the mental processing adds little by way of elaboration to the new information, and the new information adds little to the elaboration of existing schemata. Learning by rote is a brute force technique. It seems to be the least efficient way of remembering.

By Assimilation. Information is learned by assimilation when the structure or substance of the information fits into some memory schema already possessed by the learner. The new information is assimilated to or linked to the existing schema and can be retrieved readily by first accessing the existing schema and then reconstructing the new information. Assimilation involves learning by comprehension and is, therefore, a desirable method, but it can only be used to learn information that is somehow related to our previous experience.

By Using A Mnemonic Device. A mnemonic device is any means of organizing or encoding information for the purpose of making it easier to remember. A high school student cramming for a geography test might use the acronym "HOMES" as a device for remembering the first letter of each of the Great Lakes—Huron, Ontario, etc.

To learn the first grocery list of disconnected words, you would create some structure for linking the words to each other and/or to information already in LTM. You might imagine yourself shopping or putting the items away and mentally picture where they are located on the shelves at the market or in the kitchen. Or you might imagine a story concerning one or more meals that include all these items. Any form of processing information in this manner is a more effective aid to retention than rote repetition. Even more effective systems for quickly memorizing lists of

33. This discussion draws on Francis S. Belletta, "Mnemonic Devices: Classification, Characteristics, and Criteria" (Athens, Ohio: Ohio University, pre-publication manuscript, January 1980).

factor in transferring information from short-term to long-term memory is the development of associations between the new information and schemata already available in memory. This, in turn, depends upon two variables: the extent to which the information to be learned relates to an already existing schema, and the level of processing given to the new information.

Take one minute to try to memorize the following items from a shopping list: bread, eggs, butter, salami, corn, lettuce, soap, jelly, chicken, and coffee. Chances are, you will try to burn the words into your mind by repeating them over and over. Such repetition, or maintenance rehearsal, is effective for maintaining the information in STM, but is an inefficient and often ineffective means of transferring it to LTM. The list is difficult to memorize because it does not correspond with any schema already in memory.

The words are familiar, but you do not have available in memory a schema that connects the words in this particular group to each other. If the list were changed to juice, cereal, milk, sugar, bacon, eggs, toast, butter, jelly, and coffee, the task would be much easier because the data would then correspond with an existing schema—items commonly eaten for breakfast. Such a list can be assimilated to your existing store of knowledge with little difficulty, just as the chess master rapidly assimilates the positions of many chessmen.

Depth of processing is the second important variable in determining how well information is retained. Depth of processing refers to the amount of effort and cognitive capacity employed to process information, and the number and strength of associations that are thereby forged between the data to be learned and knowledge already in memory. In experiments to test how well people remember a list of words, test subjects might be asked to perform different tasks that reflect different levels of processing. The following illustrative tasks are listed in order of the depth of mental processing required: say how many letters there are in each word on the list, give a word that rhymes with each word, make a mental image of each word, make up a story that incorporates each word.

It turns out that the greater the depth of processing, the greater the ability to recall words on a list. This result holds true regardless of whether the test subjects are informed in advance that the purpose of the experiment is to test them on their memory. Advising test subjects to expect a test makes almost no difference in their performance, presum-

Figure 4

	Country	Country	Country	Country
Issue	Evidence	Evidence	Evidence	Evidence
Issue	Evidence	Evidence	Evidence	Evidence
Issue	Evidence	Evidence	Evidence	Evidence
Issue	Evidence	Evidence	Evidence	Evidence

Situational Logic Vs. Theory

highlighted in gray. This is a typical area studies approach. Theoretical analysis looks at the evidence related to a single issue in multiple countries, as shown by the row highlighted in gray. This is a typical social science approach.

The distinction between theory and situational logic is not as clear as it may seem from this graphic, however. Logic-of-the-situation analysis also draws heavily on theoretical assumptions. How does the analyst select the most significant elements to describe the current situation, or identify the causes or consequences of these elements, without some implicit theory that relates the likelihood of certain outcomes to certain antecedent conditions?

For example, if the analyst estimating the outcome of an impending election does not have current polling data, it is necessary to look back at past elections, study the campaigns, and then judge how voters are likely to react to the current campaigns and to events that influence voter attitudes. In doing so, the analyst operates from a set of assumptions about human nature and what drives people and groups. These assumptions form part of a theory of political behavior, but it is a different sort of theory than was discussed under theoretical analysis. It does not illuminate the entire situation, but only a small increment of the situation, and it may not apply beyond the specific country of concern. Further, it is

much more likely to remain implicit, rather than be a focal point of the analysis.

Comparison with Historical Situations

A third approach for going beyond the available information is comparison. An analyst seeks understanding of current events by comparing them with historical precedents in the same country, or with similar events in other countries. Analogy is one form of comparison. When an historical situation is deemed comparable to current circumstances, analysts use their understanding of the historical precedent to fill gaps in their understanding of the current situation. Unknown elements of the present are assumed to be the same as known elements of the historical precedent. Thus, analysts reason that the same forces are at work, that the outcome of the present situation is likely to be similar to the outcome of the historical situation, or that a certain policy is required in order to avoid the same outcome as in the past.

Comparison differs from situational logic in that the present situation is interpreted in the light of a more or less explicit conceptual model that is created by looking at similar situations in other times or places. It differs from theoretical analysis in that this conceptual model is based on a single case or only a few cases, rather than on many similar cases. Comparison may also be used to generate theory, but this is a more narrow kind of theorizing that cannot be validated nearly as well as generalizations inferred from many comparable cases.

Reasoning by comparison is a convenient shortcut, one chosen when neither data nor theory are available for the other analytical strategies, or simply because it is easier and less time-consuming than a more detailed analysis. A careful comparative analysis starts by specifying key elements of the present situation. The analyst then seeks out one or more historical precedents that may shed light on the present. Frequently, however, a historical precedent may be so vivid and powerful that it imposes itself upon a person's thinking from the outset, conditioning them to perceive the present primarily in terms of its similarity to the past. This is reasoning by analogy. As Robert Jervis noted, "historical analogies often precede, rather than follow, a careful analysis of a situation."⁴⁰

red spade to be matched against the sensory impression. If information does not fit into what people know, or think they know, they have great difficulty processing it.

The content of schemata in memory is a principal factor distinguishing stronger from weaker analytical ability. This is aptly illustrated by an experiment with chess players. When chess grandmasters and masters and ordinary chess players were given five to 10 seconds to note the position of 20 to 25 chess pieces placed randomly on a chess board, the masters and ordinary players were alike in being able to remember the places of only about six pieces. If the positions of the pieces were taken from an actual game (unknown to the test subjects), however, the grandmasters and masters were usually able to reproduce almost all the positions without error, while the ordinary players were still able to place correctly only a half-dozen pieces.³²

That the unique ability of the chess masters did not result from a pure feat of memory is indicated by the masters' inability to perform better than ordinary players in remembering randomly placed positions. Their exceptional performance in remembering positions from actual games stems from their ability to immediately perceive patterns that enable them to process many bits of information together as a single chunk or schema. The chess master has available in long-term memory many schemata that connect individual positions together in coherent patterns. When the position of chess pieces on the board corresponds to a recognized schema, it is very easy for the master to remember not only the positions of the pieces, but the outcomes of previous games in which the pieces were in these positions. Similarly, the unique abilities of the master analyst are attributable to the schemata in long-term memory that enable the analyst to perceive patterns in data that pass undetected by the average observer.

Getting Information Into and Out of Long-Term Memory. It used to be that how well a person learned something was thought to depend upon how long it was kept in short-term memory or the number of times they repeated it to themselves. Research evidence now suggests that neither of these factors plays the critical role. Continuous repetition does not necessarily guarantee that something will be remembered. The key

40. Robert Jervis, "Hypotheses on Misperception," *World Politics* 20 (April 1968), p. 471.

32. A. D. deGroot, *Thought and Choice in Chess* (The Hague: Mouton, 1965) cited by Herbert A. Simon, "How Big Is a Chunk?" *Science*, Vol. 183 (1974), p. 487.

woman, or vice versa. A subsequent chapter will consider ways of breaking out of mental ruts.

One useful concept of memory organization is what some cognitive psychologists call a "schema." A schema is *any pattern of relationships* among data stored in memory. It is any set of nodes and links between them in the spider web of memory that hang together so strongly that they can be retrieved and used more or less as a single unit.

For example, a person may have a schema for a bar that when activated immediately makes available in memory knowledge of the properties of a bar and what distinguishes a bar, say, from a tavern. It brings back memories of specific bars that may in turn stimulate memories of thirst, guilt, or other feelings or circumstances. People also have schemata (plural for schema) for abstract concepts such as a socialist economic system and what distinguishes it from a capitalist or communist system. Schemata for phenomena such as success or failure in making an accurate intelligence estimate will include links to those elements of memory that explain typical causes and implications of success or failure. There must also be schemata for processes that link memories of the various steps involved in long division, regression analysis, or simply making inferences from evidence and writing an intelligence report.

Any given point in memory may be connected to many different overlapping schemata. This system is highly complex and not well understood.

This conception of a schema is so general that it begs many important questions of interest to memory researchers, but it is the best that can be done given the current state of knowledge. It serves the purpose of emphasizing that memory does have structure. It also shows that how knowledge is connected in memory is critically important in determining what information is retrieved in response to any stimulus and how that information is used in reasoning.

Concepts and schemata stored in memory exercise a powerful influence on the formation of perceptions from sensory data. Recall the experiment discussed in the previous chapter in which test subjects were exposed very briefly to playing cards that had been doctored so that some hearts were black and spades red. When retained in SIS for a fraction of a second, the spades were indeed red. In the course of interpreting the sensory impression and transferring it to STM, however, the spades became black because the memory system has no readily available schema for a

The tendency to relate contemporary events to earlier events as a guide to understanding is a powerful one. Comparison helps achieve understanding by reducing the unfamiliar to the familiar. In the absence of data required for a full understanding of the current situation, reasoning by comparison may be the only alternative. Anyone taking this approach, however, should be aware of the significant potential for error. This course is an implicit admission of the lack of sufficient information to understand the present situation in its own right, and lack of relevant theory to relate the present situation to many other comparable situations.

The difficulty, of course, is in being certain that two situations are truly comparable. Because they are equivalent in some respects, there is a tendency to reason as though they were equivalent in all respects, and to assume that the current situation will have the same or similar outcome as the historical situation. This is a valid assumption only when based on in-depth analysis of both the current situation *and* the historical precedent to ensure that they are actually comparable in all relevant respects.

In a short book that ought to be familiar to all intelligence analysts, Ernest May traced the impact of historical analogy on US foreign policy.⁴¹ He found that because of reasoning by analogy, US policymakers tend to be one generation behind, determined to avoid the mistakes of the previous generation. They pursue the policies that would have been most appropriate in the historical situation but are not necessarily well adapted to the current one.

Policymakers in the 1930s, for instance, viewed the international situation as analogous to that before World War I. Consequently, they followed a policy of isolation that would have been appropriate for preventing American involvement in the first World War but failed to prevent the second. Communist aggression after World War II was seen as analogous to Nazi aggression, leading to a policy of containment that could have prevented World War II.

More recently, the Vietnam analogy has been used repeatedly over many years to argue against an activist US foreign policy. For example, some used the Vietnam analogy to argue against US participation in the Gulf War—a flawed analogy because the operating terrain over which

41. Ernest May, *Lessons of the Past: The Use and Misuse of History in American Foreign Policy* (New York: Oxford University Press, 1973).

battles were fought was completely different in Kuwait/Iraq and much more in our favor there as compared with Vietnam.

May argues that policymakers often perceive problems in terms of analogies with the past, but that they ordinarily use history badly:

When resorting to an analogy, they tend to seize upon the first that comes to mind. They do not research more widely. Nor do they pause to analyze the case, test its fitness, or even ask in what ways it might be misleading.⁴²

As compared with policymakers, intelligence analysts have more time available to “analyze rather than analogize.” Intelligence analysts tend to be good historians, with a large number of historical precedents available for recall. The greater the number of potential analogues an analyst has at his or her disposal, the greater the likelihood of selecting an appropriate one. The greater the depth of an analyst’s knowledge, the greater the chances the analyst will perceive the differences as well as the similarities between two situations. Even under the best of circumstances, however, inferences based on comparison with a single analogous situation probably are more prone to error than most other forms of inference.

The most productive uses of comparative analysis are to suggest hypotheses and to highlight differences, not to draw conclusions. Comparison can suggest the presence or the influence of variables that are not readily apparent in the current situation, or stimulate the imagination to conceive explanations or possible outcomes that might not otherwise occur to the analyst. In short, comparison can generate hypotheses that then guide the search for additional information to confirm or refute these hypotheses. It should not, however, form the basis for conclusions unless thorough analysis of both situations has confirmed they are indeed comparable.

Data Immersion

Analysts sometimes describe their work procedure as immersing themselves in the data without fitting the data into any preconceived pattern. At some point an apparent pattern (or answer or explanation) emerges spontaneously, and the analyst then goes back to the data to check how well the data support this judgment. According to this view,

⁴² Ibid., p. xi.

There has been considerable research on how information is organized and represented in memory, but the findings remain speculative. Current research focuses on which sections of the brain process various types of information. This is determined by testing patients who have suffered brain damage from strokes and trauma or by using functional magnetic resonance imaging (fMRI) that “lights up” the active portion of the brain as a person speaks, reads, writes, or listens.

None of the current theories seems to encompass the full range or complexity of memory processes, which include memory for sights and sounds, for feelings, and for belief systems that integrate information on a large number of concepts. However useful the research has been for other purposes, analysts’ needs are best served by a very simple image of the structure of memory.

Imagine memory as a massive, multidimensional spider web. This image captures what is, for the purposes of this book, perhaps the most important property of information stored in memory—its interconnectedness. One thought leads to another. It is possible to start at any one point in memory and follow a perhaps labyrinthine path to reach any other point. Information is retrieved by tracing through the network of interconnections to the place where it is stored.

Retrievability is influenced by the number of locations in which information is stored and the number and strength of pathways from this information to other concepts that might be activated by incoming information. The more frequently a path is followed, the stronger that path becomes and the more readily available the information located along that path. If one has not thought of a subject for some time, it may be difficult to recall details. After thinking our way back into the appropriate context and finding the general location in our memory, the interconnections become more readily available. We begin to remember names, places, and events that had seemed to be forgotten.

Once people have started thinking about a problem one way, the same mental circuits or pathways get activated and strengthened each time they think about it. This facilitates the retrieval of information. These same pathways, however, also become the mental ruts that make it difficult to reorganize the information mentally so as to see it from a different perspective. That explains why, in the previous chapter, once you saw the picture of the old woman it was difficult to see the young

There are no practical limits to the amount of information that may be stored in LTM. The limitations of LTM are the difficulty of processing information into it and retrieving information from it. These subjects are discussed below.

The three memory processes comprise the storehouse of information or database that we call memory, but the total memory system must include other features as well. Some mental process must determine what information is passed from SIS into STM and from STM into LTM; decide how to search the LTM data base and judge whether further memory search is likely to be productive; assess the relevance of retrieved information; and evaluate potentially contradictory data.

To explain the operation of the total memory system, psychologists posit the existence of an interpretive mechanism that operates on the data base and a monitor or central control mechanism that guides and oversees the operation of the whole system. Little is known of these mechanisms and how they relate to other mental processes.

Despite much research on memory, little agreement exists on many critical points. What is presented here is probably the lowest common denominator on which most researchers would agree.

Organization of Information in Long-Term Memory. Physically, the brain consists of roughly 10 billion neurons, each analogous to a computer chip capable of storing information. Each neuron has octopus-like arms called axons and dendrites. Electrical impulses flow through these arms and are ferried by neurotransmitting chemicals across what is called the synaptic gap between neurons. Memories are stored as patterns of connections between neurons. When two neurons are activated, the connections or "synapses" between them are strengthened.

As you read this chapter, the experience actually causes physical changes in your brain. "In a matter of seconds, new circuits are formed that can change forever the way you think about the world."³¹

Memory records a lifetime of experience and thoughts. Such a massive data retrieval mechanism, like a library or computer system, must have an organizational structure; otherwise information that enters the system could never be retrieved. Imagine the Library of Congress if there were no indexing system.

31. George Johnson, *In the Palace of Memory: How We Build the Worlds Inside Our Heads*. Vintage Books, 1992, p. xi.

objectivity requires the analyst to suppress any personal opinions or preconceptions, so as to be guided only by the "facts" of the case.

To think of analysis in this way overlooks the fact that information cannot speak for itself. The significance of information is always a joint function of the nature of the information and the context in which it is interpreted. The context is provided by the analyst in the form of a set of assumptions and expectations concerning human and organizational behavior. These preconceptions are critical determinants of which information is considered relevant and how it is interpreted.

Of course there are many circumstances in which the analyst has no option but to immerse himself or herself in the data. Obviously, an analyst must have a base of knowledge to work with before starting analysis. When dealing with a new and unfamiliar subject, the uncritical and relatively non-selective accumulation and review of information is an appropriate first step. But this is a process of absorbing information, not analyzing it.

Analysis begins when the analyst consciously inserts himself or herself into the process to select, sort, and organize information. This selection and organization can only be accomplished according to conscious or subconscious assumptions and preconceptions.

The question is not whether one's prior assumptions and expectations influence analysis, but only whether this influence is made explicit or remains implicit. The distinction appears to be important. In research to determine how physicians make medical diagnoses, the doctors who comprised the test subjects were asked to describe their analytical strategies. Those who stressed thorough collection of data as their principal analytical method were significantly less accurate in their diagnoses than those who described themselves as following other analytical strategies such as identifying and testing hypotheses.⁴³ Moreover, the collection of additional data through greater thoroughness in the medical history and physical examination did not lead to increased diagnostic accuracy.⁴⁴

One might speculate that the analyst who seeks greater objectivity by suppressing recognition of his or her own subjective input actually has less valid input to make. Objectivity is gained by making assumptions

43. Arthur S. Elstein, Lee S. Shulman, and Sarah A. Sprafka, *Medical Problem Solving: An Analysis of Clinical Reasoning* (Cambridge, MA: Harvard University Press, 1978), p. 270.

44. *Ibid.*, p. 281. For more extensive discussion of the value of additional information, see Chapter 5, "Do You Really Need More Information?"

explicit so that they may be examined and challenged, not by vain efforts to eliminate them from analysis.

Relationships Among Strategies

No one strategy is necessarily better than the others. In order to generate all relevant hypotheses and make maximum use of all potentially relevant information, it would be desirable to employ all three strategies at the early hypothesis generation phase of a research project. Unfortunately, analysts commonly lack the inclination or time to do so.

Different analysts have different analytical habits and preferences for analytical strategy. As a broad generalization that admits numerous exceptions, analysts trained in area studies or history tend to prefer situational logic, while those with a strong social science background are more likely to bring theoretical and comparative insights to bear on their work. The Intelligence Community as a whole is far stronger in situational logic than in theory. In my judgment, intelligence analysts do not generalize enough, as opposed to many academic scholars who generalize too much. This is especially true in political analysis, and it is not entirely due to unavailability of applicable political theory. Theoretical insights that are available are often unknown to or at least not used by political intelligence analysts.

Differences in analytical strategy may cause fundamental differences in perspective between intelligence analysts and some of the policymakers for whom they write. Higher level officials who are not experts on the subject at issue use far more theory and comparison and less situational logic than intelligence analysts. Any policymaker or other senior manager who lacks the knowledge base of the specialist and does not have time for detail must, of necessity, deal with broad generalizations. Many decisions must be made, with much less time to consider each of them than is available to the intelligence analyst. This requires the policymaker to take a more conceptual approach, to think in terms of theories, models, or analogies that summarize large amounts of detail. Whether this represents sophistication or oversimplification depends upon the individual case and, perhaps, whether one agrees or disagrees with the judgments made. In any event, intelligence analysts would do well to take this phenomenon into account when writing for their consumers.

memory. When a person forgets immediately the name of someone to whom he or she has just been introduced, it is because the name was not transferred from short-term to long-term memory.

A central characteristic of STM is the severe limitation on its capacity. A person who is asked to listen to and repeat a series of 10 or 20 names or numbers normally retains only five or six items. Commonly it is the last five or six. If one focuses instead on the first items, STM becomes saturated by this effort, and the person cannot concentrate on and recall the last items. People make a choice where to focus their attention. They can concentrate on remembering or interpreting or taking notes on information received moments ago, or pay attention to information currently being received. Limitations on the capacity of short-term memory often preclude doing both.

Retrieval of information from STM is direct and immediate because the information has never left the conscious mind. Information can be maintained in STM indefinitely by a process of "rehearsal"—repeating it over and over again. But while rehearsing some items to retain them in STM, people cannot simultaneously add new items. The severe limitation on the amount of information retainable in STM at any one time is physiological, and there is no way to overcome it. This is an important point that will be discussed below in connection with working memory and the utility of external memory aids.

Long-Term Memory

Some information retained in STM is processed into long-term memory. This information on past experiences is filed away in the recesses of the mind and must be retrieved before it can be used. In contrast to the immediate recall of current experience from STM, retrieval of information from LTM is indirect and sometimes laborious.

Loss of detail as sensory stimuli are interpreted and passed from SIS into STM and then into LTM is the basis for the phenomenon of selective perception discussed in the previous chapter. It imposes limits on subsequent stages of analysis, inasmuch as the lost data can never be retrieved. People can never take their mind back to what was *actually there* in sensory information storage or short-term memory. They can only retrieve their interpretation of what they *thought* was there as stored in LTM.