12

Predictive Analysis

Your problem is that you are not able to see things before they happen.

Wotan to Fricka, in Wagner's opera *Die Walküre*

Describing a past event is not intelligence analysis; it is reciting history. The highest form of intelligence analysis requires structured thinking that results in an estimate of what is likely to happen. True intelligence analysis is always predictive. The previous chapters focused mostly on models of current or past situations. Now, we consider models of possible futures. This requires that we think about forces that shape the future.

The value of a model of possible futures is in the insights that it produces. Those insights prepare customers to deal with the future as it unfolds. The analyst's contribution lies in the assessment of the forces that will shape future events and the state of the target model. If an analyst accurately assesses the forces, she has served the intelligence customer well, even if the prediction derived from that assessment turns out to be wrong. Competent customers may make their own assessments anyway, but identifying the forces helps them to make a more reasoned assessment and to refine it as new events unfold. In the ideal case, the analyst's prediction will not come true because the customer will act on the intelligence to change the predicted outcome to a more favorable one.

However, policymaking customers tend to be skeptical of predictive analysis unless they do it themselves. They believe that their own opinions about the future are at least as good as those of intelligence analysts. So when an analyst offers an estimate without a compelling supporting argument, he or she should not be surprised if the policymaker ignores it.

By contrast, policymakers and executives will accept and make use of predictive analysis if it is well reasoned, and if they can follow the analyst's logical development. This implies that we apply a formal methodology, one that the customer can understand, so that he or she can see the basis for the conclusions drawn.

Former national security adviser Brent Scowcroft observed, "What intelligence estimates do for the policymaker is to remind him what forces are at work, what the trends are, and what are some of the possibilities that he has to consider."[1] Any intelligence assessment that does these things will be readily accepted. This chapter and the three following chapters discuss how to prepare such assessments. This chapter introduces the three basic predictive methodologies—extrapolation, projection, and forecasting. It then goes into detail on how the three are applied in predictive analysis.

Introduction to Predictive Analysis

Intelligence can usually deal with near-term developments. Extrapolation—the act of making predictions based solely on past observations—serves us reasonably well in the short term for situations that involve established trends and normal individual or organizational behaviors.

Long-term predictions are considerably more challenging because they encounter the effects of the second law of thermodynamics that was introduced in chapter 7: Entropy (chaos, randomness) always increases with time. And when you reach a turning point, a major shift of some kind, then the future becomes uncertain. We do not readily grasp fundamental changes and are skeptical of those who claim to have done so. To go beyond description to prediction, an analyst must be able to apply a proven methodology and bring multidisciplinary understanding to the problem. Understanding a narrow technical specialty may be useful for simple target modeling, but it is insufficient beyond that.

Adding to the difficulty, intelligence estimates can also affect the future that they predict. Often, the estimates are acted on by policymakers—sometimes on both sides. CIA reports released to the press by Congress and by President Jimmy Carter warned that Soviet oil production was likely to plateau by the early 1980s and then decline to the point where the Soviet Union would become a net importer of oil. Production did in fact fall, but the Soviets—likely warned by the published CIA estimate—shifted investment to their energy sector and changed their extraction and exploration policies to avert the worst.[2] As another example, the publication of the Yugoslavia national intelligence estimate in 1990 (see Appendix I) probably hastened the breakup of Yugoslavia that it predicted.

The first step in making any estimate is to consider the phenomena that are involved, in order to determine whether prediction is even possible.

Convergent and Divergent Phenomena

In chapter 7 we discussed convergent and divergent evidence. Items of evidence were convergent if they tended to reinforce the same conclusion and divergent if they pointed to different conclusions. In examining trends and possible future events, we use the same terminology: Convergent phenomena make prediction possible; divergent phenomena frustrate it.

So a basic question to ask at the outset of any predictive attempt is, Does the principle of causation apply? That is, are the phenomena we are to examine and prepare estimates about governed by the laws of cause and effect? One of the basic principles of classical physics is that of causation. The behavior of any system can be predicted from the average behavior of its component parts. Scientist and Nobel laureate Irving Langmuir defined such behavior as *convergent* phenomena.

The events leading up to World War I, which Barbara Tuchman superbly outlines in *The Guns of August*, had an inevitable quality about them, as befits convergent phenomena.[3] World War I was predictable; many astute observers at the time saw it as almost inevitable. No one person or event actually "started" World War I; the assassination of Archduke Franz Ferdinand and his wife, Sophie, in Sarajevo merely triggered a process for which groundwork had been laid over many years.

Likewise, a war between the United States and Japan was predictable (and both sides foresaw it) throughout most of 1941. The Japanese aggression in China and Indochina, the consequent U.S. imposition of a petroleum embargo on Japan, the freezing of funds by both sides, the steady deterioration in American-Japanese relations during the fall of 1941—all events converged toward war.[4]

Similarly, a pattern of continued Al Qaeda terrorist attacks on U.S. interests worldwide were predictable and had been predicted before September 11, 2001, when terrorists flew airplanes into the Pentagon and the World Trade Center.

In the late 1940s U.S. ambassador George Kennan identified perhaps the most significant convergent phenomenon of the last century in defining his "containment" policy for the United States to pursue against the Soviet Union. He argued that, if contained, the Soviet Union would eventually collapse due to its overdeveloped military and underdeveloped economic system. It took over forty years for the collapse to happen, but successive U.S. administrations basically followed the containment policy.

In contrast to the above examples, many phenomena are not governed by the laws of cause and effect. Quantum physics deals with the individual atom or basic particles and tells us that the behavior of such particles is as unpredictable as the toss of a coin; they can be dealt with only by the laws of probability.[5] Such behavior can, from a small beginning, produce increasingly large effects—a nuclear chain reaction, for example. Langmuir defined such phenomena as *divergent*. In the terms of chaos theory, such phenomena are the result of *strange attractors*—those creators of unpredictable patterns that emerge out of the behavior of purposeful actors.[6] When dealing with divergent phenomena, we have an almost insurmountable difficulty making estimates.

To contrast the effect of the two phenomena, consider three major events that have occurred in Russia since 1997. CIA analysts warned policymakers of Russia's looming economic crisis two months before the August 1998 ruble crash; they subsequently identified the economic rebound in the Russian

economy long before business and academic experts did.[7] Both events involved convergent phenomena and were predictable. In contrast, the CIA was unable to predict the rise of Vladimir Putin to the Russian presidency until his handling of the Chechen war dramatically increased his popularity. But in early 1999, Putin himself probably did not foresee this happening.[8] It was a divergent phenomenon.

A good example of a divergent phenomenon in intelligence is the coup d'état. Policymakers often complain that their intelligence organizations have failed to warn of coups. But a coup event is conspiratorial in nature, limited to a handful of people, and dependent on the preservation of secrecy for its success. If a foreign intelligence service knows of the event, then secrecy has been compromised and the coup is almost certain to fail—the country's internal security services will probably forestall it. The conditions that encourage a coup attempt can be assessed and the coup likelihood estimated by using probability theory, but the timing and likelihood of success are not "predictable."

The failed attempt to assassinate Adolf Hitler in 1944, for example, had more of the "what if?" hypothetical quality that characterizes a divergent phenomenon. Assassinations, like that of Israeli prime minister Yitzhak Rabin in 1995, are simply not predictable. Specific terrorist acts, such as those on September 11, 2001, similarly are not predictable in detail, though some kind of terrorist attempt was both predictable and predicted. In all such divergent cases, from the Sarajevo assassination to the 9/11 attack, some tactical warning might have been possible. An agent within the Serbian terrorist organization Black Hand could have warned of the Sarajevo assassination plan. An agent within Al Qaeda might have warned of the attack planned for September 11, 2001. But tactical warning is not the same as estimation. All such specific events can be described by probabilities, but not predicted in the same fashion as the larger events they were immersed in—World War I, the collapse of Nazi Germany, and the increasing conflict between the United States and Al Qaeda.

One of the watershed moments in personal computing was clearly a divergent phenomenon. In 1980, IBM was searching for software to run on its planned Personal Computer (PC) and had zeroed in on a small startup company named Microsoft Corporation, located in Bellevue, Washington. Microsoft could provide the languages that programmers would use to write software for the PC, but IBM wanted more; it needed an operating system. Microsoft did not have an operating system and was not positioned to write one, so Bill Gates, Microsoft's president, steered IBM to Intergalactic Digital Research (later known as DRI).

An intelligence analyst assessing the likely future of personal computing in 1980 would have placed his bets on DRI. DRI built the CP/M operating system, at that time the most popular operating system for computers, using the Intel processor. It had the basic features IBM needed. Gates arranged an appointment between the IBM team and Gary Kildall, DRI's president, in Pacific Grove, California.

Instead of meeting with the IBM team, however, Kildall chose to take a flight in his new airplane. Miffed, the IBM team told Gates to find or write an operating system himself. Gates found one from a small software company in the Seattle area, and called it the Disk Operating System (DOS), which later became the most widely used personal computer operating system and a major contributor to Microsoft's dominance of the personal computer business. A single event, a decision made not to keep an appointment, shaped the future of personal computing worldwide.[9]

In summary, the principles of causation apply well to convergent phenomena, and estimates are made possible. Divergent phenomena, such as the actions of an individual person, are not truly predictable and must be handled by different techniques, such as those of probability theory or high-impact/low-probability analysis, discussed later in this chapter. Where estimation is possible, analysts typically consider the forces involved, which we discuss in this chapter.

The Estimative Approach

The target-centric approach to prediction follows an analytic pattern long established in the sciences, in organizational planning, and in systems synthesis and analysis. In intelligence analysis, we are concerned with describing the past and the current states of the target in order to make an assessment about its future state.

Estimates are as old as engineering. No large projects—temples, aqueducts, pyramids—were undertaken without some type of estimative process. Many estimative techniques have evolved over the past five centuries as mathematics and science have evolved.[10] They frequently reappear with new names, even though their underlying principles are centuries old.

The synthesis and analysis process discussed in this chapter and the next is derived from an estimative approach that has been formalized in several professional disciplines. In management theory, the approach has several names, one of which is the Kepner-Tregoe Rational Management Process.[11] In engineering, the formalization is called the Kalman Filter. In the social sciences, it is called the Box-Jenkins method. Although there are differences among them, all are techniques for combining complex data to create estimates. They all require combining data to estimate an entity's present state and evaluating the forces acting on the entity to predict its future state.

This concept—to identify the forces acting on an entity, to identify likely future forces, and to predict the likely changes in old and new forces over time, along with some indicator of confidence in these judgments—is the key to successful estimation. It takes into account redundant and conflicting data as well as the analyst's confidence in these data. It can be made quantitative if time permits and if confidence in the data can be quantified. But the concept can be applied qualitatively by subjectively assessing the forces acting on the entity. Figure 12-1 shows an overview of the methodology. The key is to start from the present target model (and preferably, also with a past target model) and move to one of the future models, using an analysis of the forces involved as a basis. Other texts on estimative analysis describe these forces as issues, trends, factors, or drivers.[12] All those terms have the same meaning: They are the entities that shape the future.[13] Something to note is that, in most cases, the future target models will be in the form of scenarios, as Figure 12-1 indicates.

The methodology relies on three predictive mechanisms: extrapolation, projection, and forecasting. Those components and the general approach are defined here; later in the chapter, we delve deeper into "how-to" details of each mechanism. All three mechanisms involve assessing forces that act on the entity. An extrapolation assumes that these forces do not change between the present and future states, a projection assumes they do change, and a forecast assumes they change and that new forces are added. The analysis follows these steps:

1. Determine at least one past state and the present state of the entity. In intelligence, this entity is the target model, and it can be a model of almost anything—a terrorist organization, a government, a clandestine trade network, an industry, a technology, or a ballistic missile.

2. Determine the forces that acted on the entity to bring it to its present state. In Figure 12-1, these forces (Forces 1 and 2) are shown, using the thickness of the arrow to indicate strength. These same forces, acting unchanged, would result in the future state shown as an extrapolation (Scenario 1).

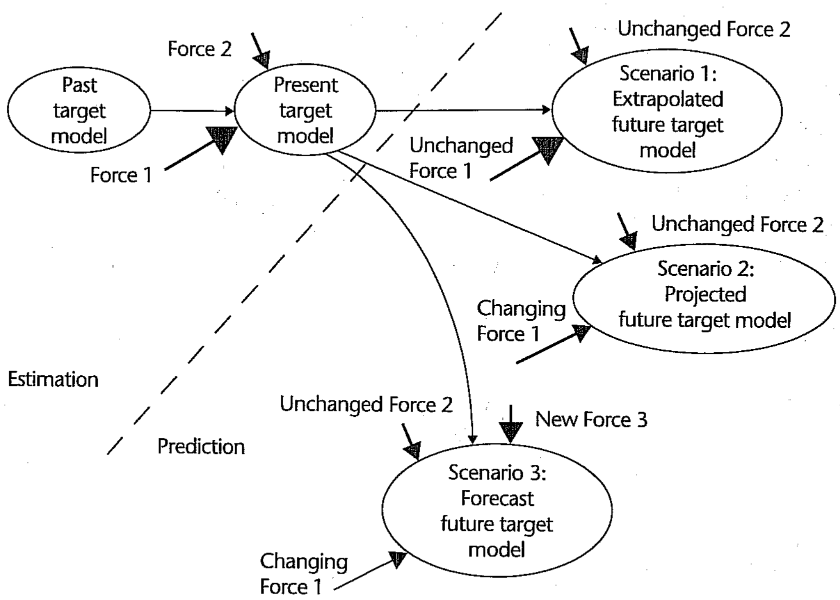
3. To make a projection, estimate the changes in existing forces that are likely to occur. In the figure, a decrease in one of the existing forces (Force 1) is shown as causing a projected future state that is different from the extrapolation (Scenario 2).

4. To make a forecast, start from either the extrapolation or the projection and then identify the new forces that may act on the entity, and incorporate their effect. In the figure, one new force is shown as coming to bear, resulting in a forecast future state that differs from both the extrapolated and the projected future states (Scenario 3).

5. Determine the likely future state of the entity based on an assessment of the forces. Strong and certain forces are weighed most heavily in this prediction. Weak forces, and those in which the analyst lacks confidence (high uncertainty about the nature or effect of the force), are weighed least.

Figure 12-2 shows how the process of Figure 12-1 works in practice: It is iterative. In this figure, we are concerned with a target (technology, system, person, organization, country, situation, industry, or some combination) that changes over time. We want to describe or characterize the entity at some

Figure 12-1 The Estimative Methodology



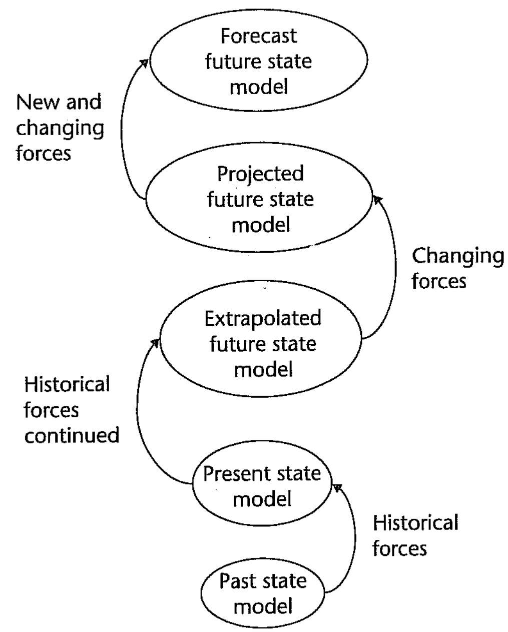
Note: Arrows vary in thickness to indicate the strength of their respective forces. Thicker arrows represent stronger forces; thinner arrows, weaker ones.

future point. We might want to establish the future performance of an aircraft or missile, the future state of a country's economy, the future morale and effectiveness of a terrorist organization, or the future economic health of an industry. The models are created in an iterative process, each one building on the results of the previous ones. They become more difficult to create as you move upward in the figure.[14]

Designing good predictive scenarios requires such an iterative process, as Figure 12-2 indicates. In fact, iteration is the key to dealing with complex patterns and complex models.[15] Again, the basic analytic paradigm is to create a model of the past and present state of the target, followed by alternative models of its possible future states, usually created in scenario form. Following are two brief historical anecdotes illustrating the outcomes of the process:

- The CIA's Office of Soviet Analysis in late 1987 estimated that Moscow could not effectively counter the U.S. Strategic Defense Initiative (SDI) without severely straining the Soviet economy, discounting Moscow's assertions that it could do so quickly and cheaply. The estimate was based on a straightforward extrapolation of the state of the Soviet economy without Soviet attempts to counter SDI. It concluded that the Soviets had no margin for increased rates of investment in the economy.

Figure 12-2 Applying an Iterative Approach to the Methodology



That was followed by a projection (adding in a new force—the burden on the economy of countering SDI). The analysts correctly predicted the alternative outcome: that Moscow instead would push arms control measures to gain U.S. concessions on SDI.[16]

- A CIA assessment of Mikhail Gorbachev's economic reforms in 1985–1987 correctly estimated that his proposed reforms risked "confusion, economic disruption, and worker discontent" that could embolden potential rivals to his power.[17] This projection was based on assessing the changing forces in Soviet society along with the inertial forces that would resist change.

The process we've illustrated in these examples has many names—*force field analysis* and *system dynamics* are two.[18] It is a technique for prediction that involves finding out what the existing forces are, how they are changing, in what direction, and how rapidly (see Analysis Principle 12-1). Then, for forecasting, the analyst must identify new forces that are likely to come into play. Most of the chapters that follow focus on identifying and measuring these forces. One of the most important forces comes from the feedback mechanism, which is discussed in chapter 13. An analyst can (wrongly) shape the outcome by concentrating on some forces and ignoring or downplaying the significance of others.

Analysis Principle 12-1

Force Analysis According to Sun Tzu

Factor or force analysis is an ancient predictive technique. Successful generals have practiced it in warfare for thousands of years, and one of its earliest known proponents was Sun Tzu. He described the art of war as being controlled by five factors, or forces, all of which must be taken into account in predicting the outcome of an engagement. He called the five factors Moral Law, Heaven, Earth, the Commander, and Method and Discipline. In modern terms, the five would be called social, environmental, geospatial, leadership, and organizational factors.

The simplest approach to both projection and forecasting is to do it qualitatively. That is, an analyst who is an expert in the subject area begins the process by answering the following questions:

1. What forces have affected this entity (organization, situation, industry, technical area) over the past several years?[19]
2. Which five or six forces had more impact than others?
3. What forces are expected to affect this entity over the next several years?
4. Which five or six forces are likely to have more impact than others?
5. What are the fundamental differences between the answers to questions two and four?
6. What are the implications of these differences for the entity being analyzed?

The answers to those questions shape the changes in direction of the extrapolation or the projection shown earlier in Figure 12-1. At more sophisticated levels of qualitative synthesis and analysis, the analyst might examine adaptive forces (feedback forces) and their changes over time.

It is also possible to create a projection or forecast quantitatively. The methodology in fact has been implemented in simulation models. One example, described in chapter 15, is a model based on game theory and developed by New York University professor Bruce Bueno de Mesquita. It has successfully developed projections, based on changing forces, and forecasts, by identifying emerging forces, of political developments in several countries.

High-Impact/Low-Probability Analysis

Projections and forecasts focus on the most likely outcomes. But customers also need to be aware of the unlikely outcomes that could have severe

adverse effects on their interests. Creating such awareness is the objective of high-impact/low-probability analysis. It is useful for sensitizing both customers and analysts to think about the consequences of unlikely developments—events that typically arise from the divergent phenomena discussed in chapter 7 and earlier in this chapter. These are typically unexpected and come as unpleasant surprises—to some customers, at least. The events of the Arab Spring in 2011, the rise of Daesh in Iraq and Syria, and the Russian incursion into Crimea and Eastern Ukraine all are events that fit into this category. Possible but unlikely future events that could fit into this category are the implosion of China or Iran; an India-Pakistan nuclear exchange; or the release of a genetically engineered, lethal and highly contagious disease organism into a populated region.

The analysis requires describing how such a development might plausibly start and considering its consequences. This provides indicators that can be monitored to warn that the development actually may occur. It therefore takes the form of a scenario (discussed in chapter 14). The CIA's tradecraft manual describes the analytic process as follows:

- Define the high-impact outcome clearly. This definition will justify examining what most analysts believe to be a very unlikely development.
- Devise one or more plausible explanations for or "pathways" to the low-probability outcome. This should be as precise as possible, as it can help identify possible indicators for later monitoring.
- Insert possible triggers or changes in momentum if appropriate. These can be natural disasters, sudden health problems of key leaders, or new economic or political shocks that might have occurred historically or in other parts of the world.
- Brainstorm with analysts having a broad set of experiences to aid the development of plausible but unpredictable triggers of sudden change.
- Identify for each pathway a set of indicators or "observables" that would help you anticipate that events were beginning to play out this way.
- Identify factors that would deflect a bad outcome or encourage a positive outcome.[20]

The product of high-impact/low-probability analysis is a type of scenario called a *demonstration scenario*, which is discussed in more detail in chapter 14.

We now visit in more detail the three approaches introduced earlier for predicting the future state of a target: extrapolation, projection, and forecasting. Different terms for these three approaches are used in different books. Liam Fahey uses the term "simple projection" to refer to extrapolation, and "complex projection" to refer to both projection and forecasting.[21] Projection and forecasting are addressed separately in this text, to emphasize that different forces are involved. To reiterate: An extrapolation predicts future events by assuming that the *current* forces influencing the target go unchanged, and it does not consider new forces. A projection assumes current forces will change. A forecast begins from either an extrapolation or a projection, and considers what *new* forces may come to bear.

Two important types of bias can exist in predictive analysis: *pattern, or confirmation, bias*—looking for evidence that confirms rather than rejects a hypothesis; and *heuristic bias*—using inappropriate guidelines or rules to make predictions.[22] This chapter addresses how to deal with both—the first, by having alternative models for outcomes; the second, by defining a set of appropriate guidelines for making predictions, amplified on in succeeding chapters.

Two points are worth noting at the beginning of the discussion:

- One must make careful use of the tools in synthesizing the model, as some will fail when applied to prediction. Expert opinion, for example, is often used in creating a target model; but experts' biases, egos, and narrow focuses can interfere with their predictions. (A useful exercise for the skeptic is to look at trade press or technical journal predictions that were made more than ten years ago that turned out to be way off base. Stock market predictions and popular science magazine predictions of automobile designs are particularly entertaining.)
- Time constraints work against the analyst's ability to consistently employ the most elaborate predictive techniques. Veteran analysts tend to use analytic techniques that are relatively fast and intuitive. They can view scenario development, red teams (teams formed to take the opponent's perspective in planning or assessments), competing hypotheses, and alternative analysis as being too time-consuming to use in ordinary circumstances.[23] An analyst has to guard against using just extrapolation because it is the fastest and easiest to do. But it is possible to use shortcut versions of many predictive techniques and sometimes the situation calls for that. This chapter and the following one contain some examples of shortcuts.

Extrapolation

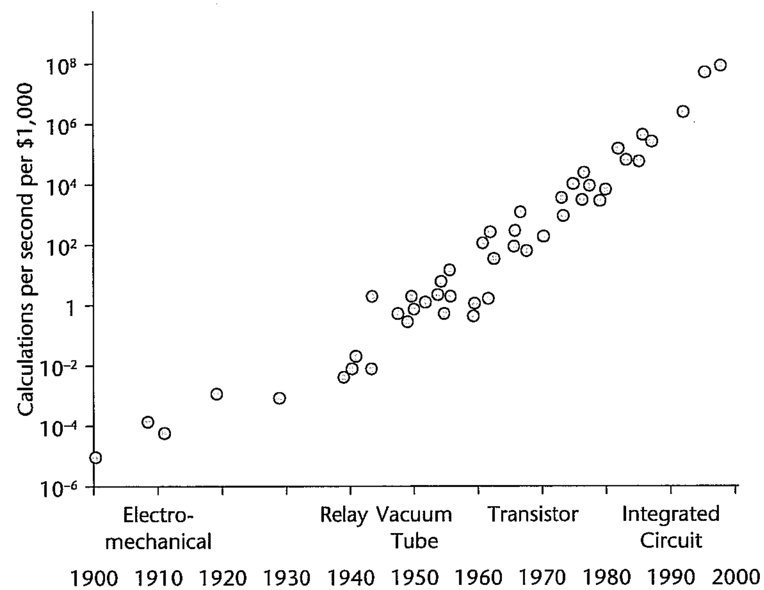
An *extrapolation* is a statement, based only on past observations, of what is expected to happen. Extrapolation is the most conservative method of prediction. In its simplest form, an extrapolation, using historical performance as the basis, extends a linear curve on a graph to show future direction. When there is little uncertainty about the present state of a target model, and when an analyst is confident that he or she knows what forces are acting on the target, the prediction begins from the present and propagates forward along the direction of an unchanged system (straight-line extrapolation). In this low-uncertainty, high-confidence situation, new information is given relatively low weight. But when uncertainty about the state of the model is high, new information is accorded high value; when uncertainty about the forces acting on the target is high, prediction uncertainty is high.

Extrapolation is usually accurate in the short run, assuming an accurate starting point and a reasonably accurate understanding of the direction of movement. The assumption is that the forces acting on the target do not change. Inertia (the tendency to stay on course and resist change, discussed in chapter 13) is what typically causes a straight-line extrapolation to work. Where inertial effects are weak, extrapolation has a shorter "lifetime" of accuracy. Where they are strong, extrapolation can give good results over time.

Let's look at some examples of extrapolation. Everyone in the digital age has encountered Moore's law—the observation that, over the history of computing hardware, the number of transistors that can be placed in an integrated circuit has doubled approximately every two years. American inventor and futurist Ray Kurzweil has extended the basic idea of Moore's law backward in time, by plotting the speed (in instructions per second) per $1,000 (in constant dollars) of forty-nine well-known calculators and computers spanning the twentieth century.[24] The result is shown in Figure 12-3.

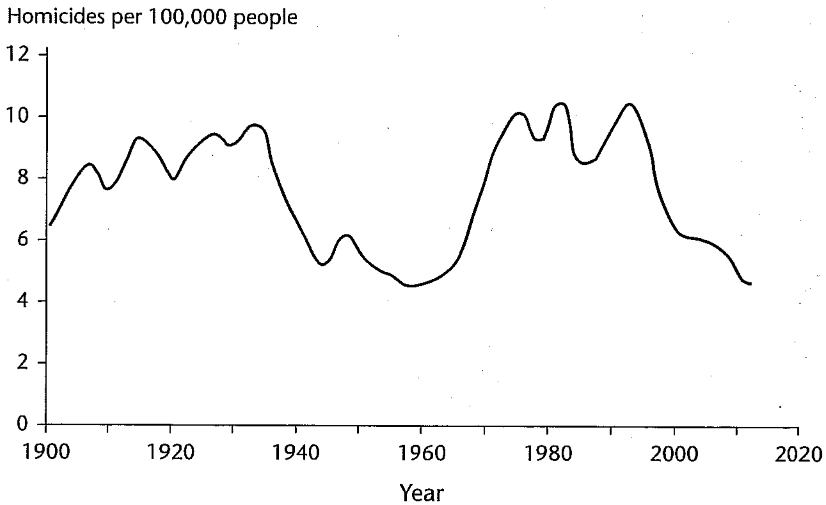
The graph reinforces the point made about a pitfall of a trend extrapolation. The apparent exponential growth shown in Figure 12-3 could be the early part of the S curve (illustrated earlier, in Figure 6-3). In such a case, the curve will not continue its climb indefinitely but will level off. Many industry observers recently have argued that is exactly what is happening.

Figure 12-3 Kurzweil's Extrapolation of Moore's Law



Source: "Moore's Law: The Fifth Paradigm," courtesy of Ray Kurzweil and Kurzweil Technologies, Inc. / Wikimedia Commons / CC BY 1.0. http://creativecommons.org/licenses/by/1.0/.

Figure 12-4 Homicides in the United States per 100,000 Persons, 1900–2012



Source: Data drawn from David Solinsky, *Homicide and Suicide in America, 1900–1998* (Macon, Ga.: Hacienda Publishing, 2001), http://haciendapublishing.com/medicalsentinel/homicide-and-suicide-america-1900-1998, and U.S. Department of Justice, Bureau of Justice Statistics, http://www.bjs.gov/index.cfm?ty=pbdetail&iid=2221.

Figure 12-4 shows a type of extrapolation that is used to predict periodic (repeating) phenomena. The technique used, called *autocorrelation*, works well when one is dealing with a cyclical (sinusoidal) behavior such as wave action. Cyclical behavior is a familiar concept to economists. Economic cycles and the cycle of automobile and lawnmower sales are examples. The curve in Figure 12-4 shows a different type of cyclical behavior. This pattern of homicides over a century plus is intriguing because it appears to have two cycles superimposed; a shorter (approximately eight- to ten-year) pattern and a "long wave" spanning about seventy years. The curve would be useful in an analysis to identify the driving forces that may shape the increases and declines.

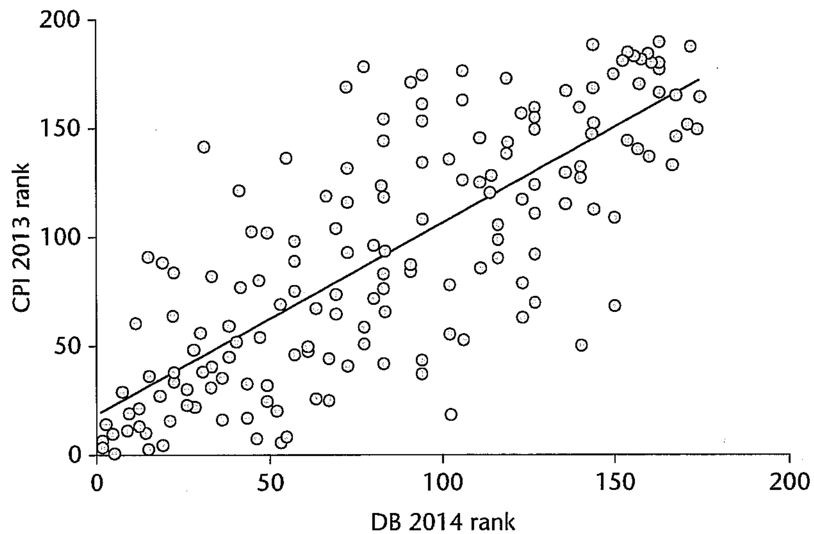
Extrapolation also makes use of correlation and regression techniques. *Correlation* is a measure of the degree of association between two or more sets of data, or a measure of the degree to which two variables are related. *Regression* is a technique for predicting the value of some unknown variable based only on information about the current values of other variables. Regression makes use of both the degree of association among variables and the mathematical function that is determined to best describe the relationships among variables. If values from only one independent variable are used to predict values for another, dependent variable, then the process is referred to

as *bivariate regression. Multivariate regression* involves using values from more than one independent variable to predict values for a dependent variable.

Figure 12-5 illustrates the use of correlation. It supports the argument that corruption is strongly correlated with the existence of excessive business regulation. The figure shows the rankings for 175 countries using Transparency International's Corruption Perceptions Index (CPI) versus the World Bank's rankings on ease of doing business (DB 2014). High CPI scores indicate less corruption; high DB 2014 scores indicate a favorable business climate. As the figure indicates, the more bureaucracy and red tape involved in doing business, the more corruption is likely in the country. The correlation coefficient is nearly .80, indicating a high level of correlation. Graphics such as this are useful in extrapolating the effects of government actions, for example, the likely reduction in corruption that would result from a government's easing restrictions on doing business.

Extrapolation often is a valuable predictive methodology. But it must be used properly and its limitations recognized. First, it usually is inaccurate in the long run because it is narrowly focused and assumes that the static forces that operate on the model will continue unchanged, with no new forces being added. As noted earlier, the method depends on inertia. Second, extrapolation will be inaccurate if the original target model is inaccurate. If the extrapolation starts from the wrong point, it will almost certainly be even farther off as it is

Figure 12-5 Correlation of Perceived Corruption with Ease of Doing Business



Source: Augusto Lopez-Claros, "What Are the Sources of Corruption," The World Bank, February 10, 2014, http://blogs.worldbank.org/futuredevelopment/what-are-sources-corruption.

extended forward in time. Both problems were present in the national intelligence estimates predicting the future development of Soviet military forces from 1974 to 1986. They all overestimated the rate at which Moscow would modernize its strategic forces.[25] All these estimates relied on extrapolation, without fully considering restraining forces, and used starting points that were, at best, shaky.

Projection

Before moving on to projection and forecasting, let's reinforce the differentiation from extrapolation. An extrapolation is a simple assertion about what a future scenario will look like. In contrast, a projection or a forecast is a *probabilistic* statement about some future scenario. The underlying form of such a statement is, "If *A* occurs (plus some allowance for unknown or unknowable factors), then we can expect *B* or something very much like *B* to occur, or at least *B* will become more probable."

Projection is more reliable than extrapolation. It predicts a range of likely futures based on the assumption that forces that have operated in the past will change, whereas extrapolation assumes the forces do not change. The changing forces produce a deviation from the extrapolation line, as shown by Figure 12-1.

Projection makes use of two major analytic techniques. One technique, *force analysis*, was discussed earlier in this chapter. After a qualitative force analysis has been completed, the next technique is to apply *probabilistic reasoning* to it. *Probabilistic reasoning* is a systematic attempt to make subjective estimates of probabilities more explicit and consistent. It can be used at any of several levels of complexity (each successive level of sophistication adds new capability and completeness). But even the simplest level of generating alternatives, discussed next, helps to prevent premature closure and adds structure to complicated problems.

Generating Alternatives

The first step to probabilistic reasoning is no more complicated than stating formally that more than one outcome is possible. One can generate alternatives simply by listing all possible outcomes to the issue under consideration. Remember that the possible outcomes can be defined as alternative scenarios.

Ideally the alternatives should be mutually exclusive (only one can occur, not two or more simultaneously) and exhaustive (nothing else can happen; one of the listed alternatives must occur).[26] For instance, suppose that an analyst is tracking an opponent's research and development on a revolutionary new technology. The analyst could list two outcomes only:

- The technology is used in producing a product (or weapons system).
- The technology is not used.

This list is mutually exclusive and exhaustive. If a third option, "The technology will be used within two years," were added, the mutually exclusive principle will have been violated (unless the first outcome has been reworded to "The technology is used after two years").

This brief list of outcomes may or may not be very useful with just two alternative outcomes. If the analyst is interested in more details, then the outcome can (and should) be decomposed further. A revised list containing four alternative outcomes might be as follows:

- The technology is used:
  - — successfully.
  - — but the result is a flawed product.
- The technology is not used:
  - — and no new technology is introduced into the process.
  - — but a variant or alternative technology is used.

This list illustrates the way that specifying all possible (relevant) outcomes can expand one's perspective. The expanded possibilities often can generate useful insights into problems. For example, the alternative that a different technology is used in lieu of the technology in question suggests that intelligence analysis should focus on whether the target organization has alternative research and development under way.

The key is to list all the outcomes that are meaningful. It is far easier to combine multiple outcomes than it is to think of something new that wasn't listed or to think of separating one combined-event outcome into its subcomponents. The list can serve as both a reminder that multiple outcomes can occur and as a checklist to decide how any item of new intelligence might affect an assessment of the relative likelihoods of the diverse outcomes listed. The mere act of generating a complete, detailed list often provides a useful perspective on a problem.

When generating a set of possible outcomes, one should beware of using generic terms (such as "other"). As the story of the automobile mechanics in chapter 7 illustrates, we do not easily recall the vast number of things that could fall under that seemingly simple label. A catchall outcome label should be included only when a complete list of all alternatives cannot be generated first. In intelligence, it is rare that all possible future states can be included. Also, you should not overlook the possibility of nothing happening. For instance, if an analyst is creating a list of all the things that the French government might do regarding a tariff issue, one item on the list should be "Nothing at all."

Influence Trees or Diagrams

A list of alternative outcomes is the first step. A simple projection might not go beyond this level. But for more rigorous analysis, the next step typically is to identify the things that influence the possible outcomes and indicate the interrelationship of these influences. This process is frequently done by using an influence tree. Influence trees and diagrams represent a systematic approach to the force analysis introduced earlier.

For instance, let's assume that an analyst wants to assess the outcome of an ongoing African insurgency movement. There are three obvious possible outcomes: The insurgency will be crushed, the insurgency will succeed, or there will be a continuing stalemate. Other outcomes may be possible, but we can assume that they are so unlikely as not to be worth including. The three outcomes for the influence diagram are as follows:

- Regime wins
- Insurgency wins
- Stalemate

The analyst now describes those forces that will influence the assessment of the relative likelihoods of each outcome. For instance, the insurgency's success may depend on whether economic conditions improve, remain the same, or become worse during the next year. It also may depend on the success of a new government poverty relief program. The assumptions about these "driver" events are often described as *linchpin premises* in U.S. intelligence practice, and these assumptions need to be made explicit.[27]

After listing all of the influencing or driver events, the analyst next focuses on two questions:

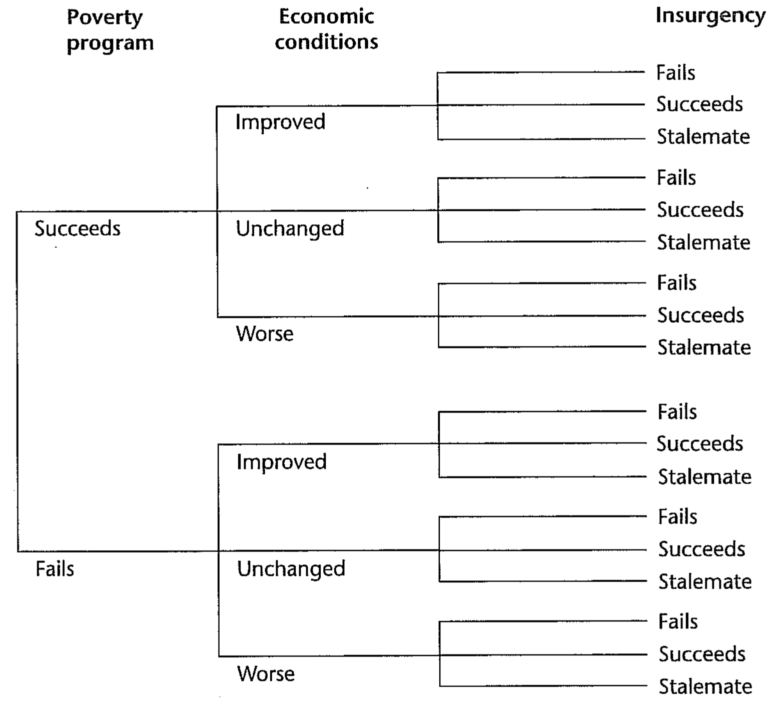
- Do any of the influencing events influence each other?
- Is it possible to assess the relative likelihood of the outcomes of the influencing events directly, or do the outcomes of these events depend in turn on other influencing events (and outcomes)?

If the answer to the first question is that the events influence each other, the analyst must define the direction of influence. In the case at hand, we have two influencing events—economic conditions and the poverty relief program. One can argue that each event influences the other to some extent; but it seems reasonable that the poverty relief program will have more influence on economic conditions than the converse. So we are left with the following relationship:

> Poverty relief program influences economic conditions, which influence the outcome of the insurgency.

Having established the uncertain events that influence the outcome, the analyst proceeds to the first stage of an influence tree, which is shown in Figure 12-6. This tree simply shows all of the different outcomes in the hierarchy of dependency.

Figure 12-6 An Influence Tree for Insurgency



The thought process that is invoked when generating the list of influencing events and their outcomes can be useful in several ways. It helps identify and document factors that are relevant to judging whether an alternative outcome is likely to occur. The analyst may need to document the process (create an audit trail) by which he or she arrived at the influence tree. The audit trail is particularly useful in showing colleagues what the analyst's thinking has been, especially if he desires help in upgrading the diagram with things that may have been overlooked. Software packages for creating influence trees allow the inclusion of notes that create an audit trail.

In the process of generating the alternative lists, the analyst must address the issue of whether the event (or outcome) being listed actually will make a difference in his assessment of the relative likelihood of the outcomes of any of the events being listed. For instance, in the economics example, if the analyst knew that it would make no difference to the success of the insurgency whether economic conditions improved or remained the same, then there would be no need to differentiate these as two separate outcomes. The analyst should instead simplify the diagram.

The second question, having to do with additional influences not yet shown on the diagram, allows the analyst to extend this pictorial representation of influences to whatever level of detail is considered necessary. Note, however, that the analyst should avoid adding unneeded layers of detail. Making things more detailed than necessary can degrade, rather than improve, the usefulness of this diagramming technique.

The thought process also should help identify those events that contain no uncertainty. For example, the supply of arms to both government and insurgent forces will have a strong influence on the outcomes. We assume that, in this problem, these are not uncertain events because intelligence officers have high confidence in their estimates of the future arms supply. They are not linchpins. The analyst will undoubtedly take these influences into account in the analysis. In fact, the analyst would make use of this information when assessing the relative likelihoods of the main event (insurgency) outcome, which will be done next, but the information does not need to be included in the diagram of uncertain events.

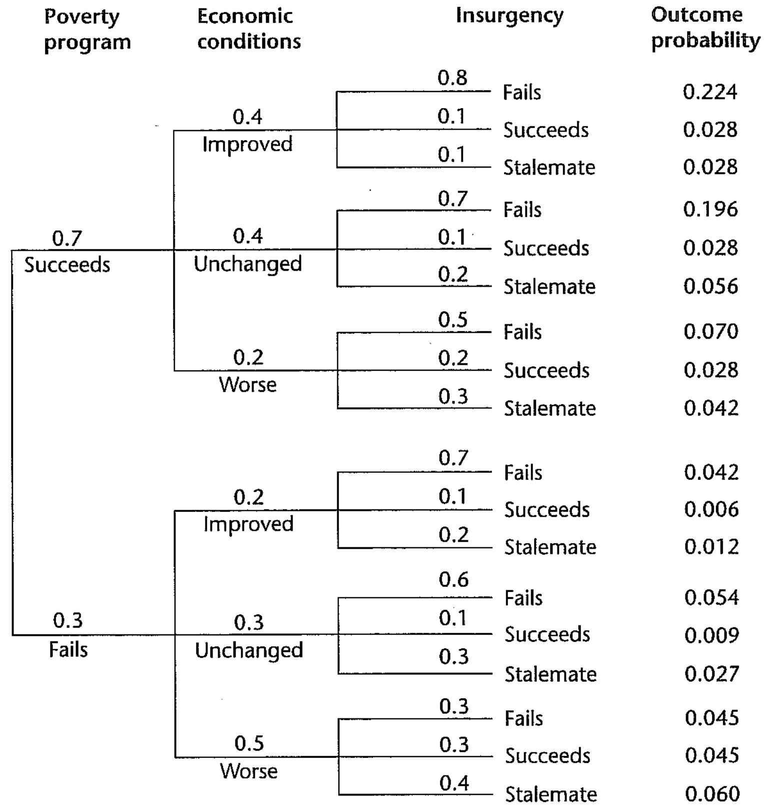
Probabilistic reasoning is used to evaluate outcome scenarios. A relative likelihood must be assigned to each possible outcome in the influence tree in Figure 12-6. We do this by starting at the left and estimating the likelihood of the outcome, given that all of the previous outcomes in that branch of the tree have occurred. This is a subjective process, done by evaluating the evidence for and against each outcome using the evaluative techniques discussed in chapter 7. Figure 12-7 shows the result. Note that the sum of the likelihoods for each branch in the tree equals 1.00 and that the cumulative likelihood of a particular outcome (on the far right) is the product of the probabilities in the branches that reach that point. (For example, the outcome probability of the poverty program succeeding, economic conditions improving, and the insurgency failing is .224 = .7 × .4 × .8.)

The final step in the evaluation is to sum the probabilities on the right in Figure 12-7 for each outcome—"fails," "succeeds," and "stalemate." When we do this we find the following probabilities:

Insurgency fails	.631
Insurgency succeeds	.144
Stalemate	.225

This influence tree approach to evaluating possible outcomes is more convincing to customers than would be an unsupported analytic judgment about the prospects for the insurgency. Human beings tend to do poorly at such complex assessments when they are approached in a totally unaided, subjective manner; that is, by the analyst mentally combining the force assessments in an unstructured way. Conversely, though, numerical methods such as the influence tree have the inherent disadvantage of implying (merely because numbers are used) a false degree of accuracy. The numbers are precise

Figure 12-7 Influence Tree with Probabilities



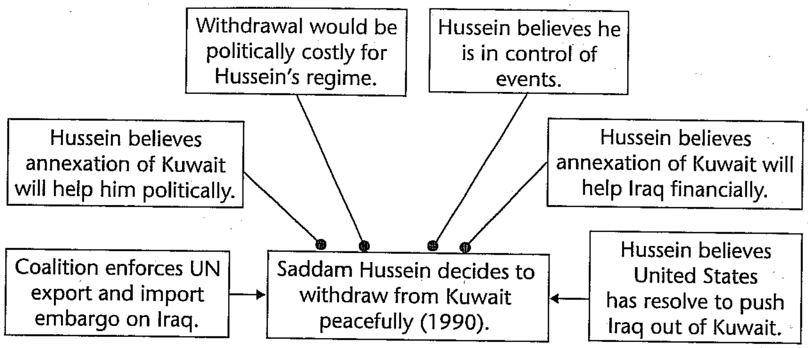
and unambiguous in meaning, but they are no more accurate than the subjective judgments they represent.

The probability calculations and the tree structuring technique demand that feedback loops do not exist, or that the feedback is so small that it can be ignored. A feedback loop would exist if, for example, the economic conditions significantly affect the poverty relief program, or if a continuing insurgency stalemate affects economic conditions. If feedback loops emerge and are needed in influence diagrams, the analyst will need to use techniques designed to handle dynamic feedback situations, such as simulation modeling.

Influence Nets

Influence net modeling is an alternative to the influence tree. It is a powerful tool for projection of complex target models where the influence tree would be too cumbersome for practical use. Influence net modeling is a combination of two established methods of decision analysis: Bayesian inference

Figure 12-8 An Example Influence Net Model



Source: Julie A. Rosen and Wayne L. Smith, "Influencing Global Situations: A Collaborative Approach," *Air Chronicles* (Summer 1996).

net analysis, originally employed by the mathematical community, and influence diagramming techniques, such as the insurgency example, that were originally employed by operations researchers. Influence net modeling is an intuitive, graphical method.

To create an influence net, the analyst defines *influence nodes*, which depict events that are part of cause-effect relationships within the target model. The analyst also creates "influence links" between cause and effect that graphically illustrate the causal relation between the connected pair of events. The influence can be either positive (supporting a given decision) or negative (decreasing the likelihood of the decision), as identified by the link "terminator." The terminator is either an arrowhead (positive influence) or a filled circle (negative influence). The resulting graphical illustration is called the "influence net topology." An example topology, showing some of the influences on Saddam Hussein's decision whether to withdraw from Kuwait in 1990, is pictured in Figure 12-8.[28] The decision is stated as "Hussein decides to withdraw from Kuwait peacefully."

The influence net is one of the most important tools in implementing the target-centric approach. It can be shared with customers, and it encourages customers to provide feedback from their knowledge of the target—adding influencing factors, and increasing or decreasing the influence of existing factors in the diagram. (A variant that is useful for this purpose is to make the influence link lines larger or smaller to indicate the weight given to a factor.)

Making Probability Estimates

Probabilistic projection is used to predict the probability of future events for some time-dependent random process, such as the health of the Japanese economy. A number of these probabilistic techniques are used in industry for projection. Two techniques that we use in intelligence analysis are as follows:

- *Point and interval estimation.* This method attempts to describe the probability of outcomes for a single event. An example would be a country's economic growth rate, and the event of concern might be an economic depression (the point where the growth rate drops below a certain level).
- *Monte Carlo simulation.* This method simulates all or part of a process by running a sequence of events repeatedly, with random combinations of values, until sufficient statistical material is accumulated to determine the probability distribution of the outcome. Monte Carlo simulations are discussed in chapter 15.

Most of the predictive problems we deal with in intelligence use subjective probability estimates. We routinely use subjective estimates of probabilities in dealing with broad issues for which no objective estimate is feasible. An estimate about the probability of a major terrorist attack occurring somewhere in the United Kingdom next week, for example, would inevitably be subjective; there would not be enough hard data to make a formal quantitative estimate. In contrast, an estimate of the probability that the Chinese economy will grow by more than 5 percent next year could be made by using formal quantitative techniques, because quantitative data are available.

Even if a formal probability estimate is used, it will always have a subjective element. A subjective component is incorporated into every estimate of future probability; it is a basis for the weighting of respective outcomes to which no numerical basis can be assigned.

Sensitivity Analysis

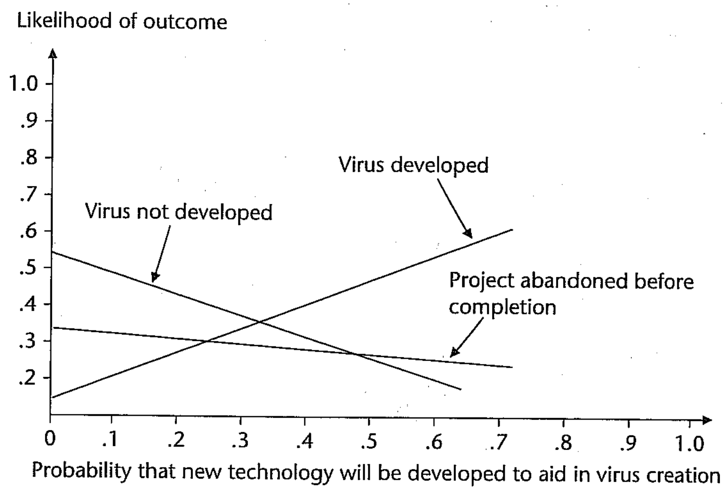
When a probability estimate is made, it is usually worthwhile to conduct a sensitivity analysis on the result. For example, the occurrence of false alarms in a security system can be evaluated as a probabilistic process. The effect of introducing alarm maintenance procedures can be included in the evaluation by means of sensitivity analysis.

The purpose of sensitivity analysis is to evaluate the relative importance or impact of changes in the values assigned to influencing event outcomes. The inputs to the estimate are varied in a systematic manner to evaluate their effect on possible outcomes. This process lets an analyst identify variables whose variation has little or no effect on possible outcomes.

A number of tools and techniques are available for sensitivity analysis. Most of them are best displayed and examined graphically. Figure 12-9 shows the results of an analysis of the likelihood of a manufacturer successfully creating a new biological warfare virus. Three possibilities are assumed to exist: The process will create the new virus, the process will fail, or the manufacturer will abandon the project before it is completed. These three possibilities add up to a likelihood of 1.0 at any point on Figure 12-9.

One of the elements in the analysis is the probability that a new genetic engineering technology will be developed to aid the development of the

Figure 12-9 Sensitivity Analysis for Biological Warfare Virus Prediction



biological warfare virus (the horizontal axis in the figure). The sensitivity analysis indicates that success in producing the virus is relatively sensitive to the genetic engineering technology (the success line goes up sharply with an increase in the probability that the technology works). If the probability of success for the new technology is above .55, the process is more likely to succeed (likelihood of new virus creation above .5 on the vertical scale); it is more likely to fail if the probability of success is less than .55. The figure also indicates that the manufacturer's possible decision not to complete the project is relatively insensitive to the technology's success, because the project abandonment likelihood does not change much as the probability of technology success increases; such a decision might be made for political or economic reasons, for example, rather than technical reasons. The chart is simplistic, of course; in fact, the straight lines would typically be curves with sharp "knees" at points where the probabilities start changing at different rates.

Forecasting

Projections often work out better than extrapolations over the medium term. But even the best-prepared projections often seem very conservative when compared to reality years later. New political, economic, social, technological, or military developments will create results that were not foreseen even by experts in a field. Typically, these new developments are described as disruptive technologies or disruptive events. To take these disruptive developments into account, we are forced to move to forecasting techniques. Forecasting uses many of the same tools that projection relies on—force

analysis and probabilistic reasoning, for example. But it presents a stressing intellectual challenge, because of the difficulty in identifying and assessing the effect of new forces.

A major objective of forecasting in intelligence is to define alternative futures of the target model, not just the most likely future. These alternative futures are usually scenarios, which are covered in chapter 14. The development of alternative futures is essential for effective strategic decision-making. Since there is no single predictable future, customers need to formulate strategy within the context of alternative future states of the target. To this end, it is necessary to develop a model that will make it possible to show systematically the interrelationships of the individually forecast trends and events. A forecast attempts to identify new forces that will affect the target—to consider the possible effects of new developments in distantly related fields, such as new technologies in the realm of artificial intelligence, or new constraints posed by the sociological impact of pollution, or new forms of life created through genetic engineering—and to present them to the customer as possibilities. In forecasting, one also must look at forces such as inertia, countervailing forces, contamination, synergy, and feedback—all discussed in chapter 13.

Customers generally prefer to have the highest possible level of predictive analysis (forecasting) be provided so that they can be aware of possible outcomes for a situation and the forces driving toward those outcomes.

A forecast is not a blueprint of the future, and it typically starts from extrapolations or projections. Forecasters then must expand their scope to admit and juggle many additional forces or factors. They must examine key technologies and developments that are far afield but that nevertheless affect the subject of the forecast.

The Nonlinear Approach to Forecasting

Obviously, a forecasting methodology requires analytic tools or principles. But for any forecasting methodology to be successful, analysts who have significant understanding of many PMESII factors and the ability to think about issues in a nonlinear fashion are also required. Just as the intelligence process discussed in chapter 3 is not linear, an analyst cannot effectively approach forecasting in a linear manner—gathering data, analyzing it, and formulating a solution. Such a linear and mechanistic view of the universe has never served well for forecasting, and it is inappropriate for dealing with complex targets. Futuristic thinking examines deeper forces and flows across many disciplines that have their own order and pattern. In predictive analysis, we may seem to wander about, making only halting progress toward the solution. This nonlinear process is not a flaw; rather it is the mark of a natural learning process when dealing with complex and nonlinear matters. The natural pattern of thinking about the future appears chaotic on the surface, but it is chaos with a purpose.

The sort of person who can do such multidisciplinary analysis of what is likely to happen in the future has a broad understanding of the principles that cause a physical phenomenon, a chemical reaction, or a social reaction to occur. People who are multidisciplinary in their knowledge and thinking can pull together concepts from several fields and assess political, economic, and social, as well as technical, factors. Such breadth of understanding recognizes the similarity of principles and the underlying forces that make them work. It might also be called "applied common sense," but unfortunately it is not very common. Analysts instead tend to specialize, because in-depth expertise is highly valued by both intelligence management and the intelligence customer. The CIA, for example, once had a Soviet canned-goods analyst and a Soviet timber analyst.[29]

The failure to do multidisciplinary analysis is often tied closely to mindset. Chapter 1 illustrated this relationship in the examples of the Yom Kippur War and the Soviet incursion into Afghanistan. The mindset of the Israeli and Soviet leadership constrained their consideration of the broader forces acting on Egyptian president Anwar Sadat and in Afghani society.

Similarly, in 1950, U.S. intelligence had two major failures in prediction in six months, as a result of a combination of mindset and failure to do multidisciplinary analysis. On June 25 of that year, the North Korean People's Army invaded South Korea. The United Nations (UN) forces intervened to defend South Korea and pushed the invading forces back into the North. In October and November, responding to the impending defeat of the North Koreans, The Chinese People's Liberation Army attacked and drove UN forces back into South Korea. Both the North Korean and the Chinese attacks were surprises.

The belief in Washington that permeated political, military and intelligence thinking at the time was that the Soviet Union was the dominant communist state, exercising near-absolute authority over other communist states. The resulting perception was that only the Soviet Union could order an invasion by its "client" states, and that such an act would be a prelude to a world war. Washington was confident that Moscow was not ready to take such a step; so no attack was expected. This mindset persisted after the invasion, with the *CIA Daily Summary* reporting the invasion was a "clear-cut Soviet challenge to the United States." As evidence mounted of a subsequent Chinese intervention, CIA analyses continued to insist that the Soviets would have to approve any Chinese action in Korea.[30]

In fact, quite the opposite was true. Moscow opposed Chinese intervention, fearing that it could lead to a general war involving the Soviet Union. The U.S. mindset of Soviet decision-making supremacy was abetted by the failure of the CIA to consider the multidisciplinary factors that led to both invasions. Cultural, historic, and nationalistic factors in fact dominated the North Korean and Chinese decision-making processes. Kim Il-sung, North Korea's leader, was determined to unify Korea under his leadership; he apparently believed that the South Korean population would rise up to support the invasion and that the United States would not intervene.[31] After the U.S. advance into North Korea, China's strategic interests were threatened by the possibility of a hostile Korea on its border. The CIA analyses took none of this into account.

Techniques and Analytic Tools of Forecasting

Both projection and forecasting use the tools described in this and succeeding chapters. Chapter 5 introduced the idea of a conceptual model. The conceptual model on which projection and forecasting are based is the assessment of the dynamic forces acting on the entity being studied. Forecasting is based on a number of assumptions, among them the following:

- The future cannot be predicted, but by taking explicit account of uncertainty, one can make probabilistic forecasts.
- Forecasts must take into account possible future developments in such areas as organizational changes, demography, lifestyles, technology, economics, and regulation.[32]

For policymakers and executives, the aim of defining alternative futures is to try to determine how to create a better future than the one that would materialize if we merely keep doing what we're currently doing. Intelligence analysis contributes to this definition of alternative futures, with emphasis on the likely actions of others—allies, neutrals, and opponents.

Forecasting starts through examination of the changing political, military, economic, and social environments. We first select issues or concerns that require attention. These issues and concerns have component forces that can be identified using a variant of the strategies-to-task methodology. Forecasts of changes to these forces (mostly in the form of trends and events) are generated and subsequently interrelated through techniques such as cross-impact analysis. The result is a "most likely" forecast future created in a scenario format from the trend and event forecasts. In complex forecasts, a technique called cross-impact modeling, discussed in chapter 14, is sometimes used.

If the forecast is done well, these scenarios stimulate the customer of intelligence—the executive—to make decisions that are appropriate for each scenario. The purpose is to help the customer make a set of decisions that will work in as many scenarios as possible.[33]

Evaluating Forecasts

Forecasts are judged on the following criteria:

- *Clarity*. Can the customer understand the forecast and the forces involved? Is it clear enough to be useful? For example, users may not be able to accurately define "gross national product" or "the strategic nuclear balance," but they still can deal with forecasts on these subjects. Alternatively, they may not understand that there is a difference between households and families and thus be puzzled by forecasts in this area.

- *Credibility*. Do the results make sense to the customer? Do they appear valid on the basis of common sense?
- *Plausibility*. Are the results consistent with what the customer knows about the world outside the scenario and how this world really works or is likely to work in the future?
- *Relevance*. To what extent will the forecasts affect the successful achievement of the customer's mission?
- *Urgency*. To what extent do the forecasts indicate that, if action is required, time is of the essence in developing and implementing the necessary changes?
- *Comparative advantage*. To what extent do the results provide a basis for customer decision-making, compared with other sources available to the customer?
- *Technical quality*. Was the process that produced the forecasts technically sound? Are the alternative forecasts internally consistent?[34]

A "good" forecast is one that meets all or most of these criteria. A "bad" forecast is one that does not. The analyst has to make clear to customers that forecasts are transitory and need constant adjustment to be helpful in guiding thought and action. Customers typically have a number of complaints about forecasts. Common complaints are that the forecast is obvious; it states nothing new; it is too optimistic, pessimistic, or naïve; or it is not credible because it overlooks obvious trends, events, causes, or consequences. Such objections are actually desirable; they help to improve the product. There are a number of appropriate responses to these objections: If something important is missing, add it. If something unimportant is included, get rid of it. If the forecast seems either obvious or counterintuitive, probe the underlying logic and revise the forecast as necessary.

Summary

Intelligence analysis, to be useful, must be predictive. Some events or future states of a target are predictable because they are driven by convergent phenomena. Some are not predictable because they are driven by divergent phenomena.

Intelligence estimates may not come true. But a good estimate—one that accurately describes the forces acting on a target model and the assumptions about those forces—has lasting value for the intelligence customer. As a situation develops, the customer can revise the prediction if the intelligence analyst gets the forces right.

Predictive analysis must take into account unlikely events that could have severe adverse effects on customer interests. To do that, we make use of high-impact/low-probability analysis. It sensitizes customers and analysts to the consequences of unlikely developments. The analysis product—a demonstration scenario—describes how such a development might plausibly start and identifies its consequences. This provides indicators that can be monitored to warn that the improbable event is actually happening.

Analysis involves predicting the future state of a target by using one of three means—extrapolation (unchanging forces), projection (changing forces), and forecasting (changing and new forces). The task is to assess, from the present state of the intelligence target, the transition process that takes the target to its future state and the forces that shape the transition.

Extrapolation is the easiest of the three methods, because it simply assumes that the existing forces will not change. Over the short term, extrapolation is usually reliable, but it seldom gives an accurate picture over the medium to long term, because forces do change. Extrapolation can be used to predict both straight-line and cyclic trends. Correlation and regression are two frequently used types of extrapolation.

For analysts predicting systems developments as many as five years into the future, extrapolations work reasonably well; for those looking five to fifteen years into the future, projections usually fare better. Projection assumes a probability that the forces will change, and it uses several techniques to evaluate the probabilities and the effects of such changes. This probabilistic reasoning relies on techniques such as influence trees and influence nets. Sensitivity analysis can help the customer to identify the significance of changes in the probabilities that go into a projection.

Forecasting is the most difficult predictive technique. It must include the probabilities of changing forces, as projection does. It must also identify possible new forces from across the political, economic, social, and technical arenas and assess their likely impact. Because of the resulting complexity of the problem, most forecasting relies on the use of scenarios. Forecasting, like projection, also takes into account the effects of shaping forces, which are discussed in the next chapter.

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3. Barbara W. Tuchman, *The Guns of August* (New York: Random House, 1962).
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13. Andrew Sleigh, ed., *Project Insight* (Farnborough, U.K.: Centre for Defence Analysis, Defence Evaluation and Research Agency, 1996), 17.
14. Figure 12-2 assumes that the existing forces change to produce a projection. It is possible that existing forces don't change, and that only new forces come into play. In that case, you would iterate directly from the extrapolation to the forecast.
15. Gharajedaghi, *Systems Thinking*, 51.
16. CIA Center for the Study of Intelligence, "Watching the Bear," Chapter II.
17. Ibid.
18. Gharajedaghi, *Systems Thinking*, 122.
19. The time frame for most predictions extends over years. On a fast-developing situation, the appropriate time frame for force analysis may be months or even days, not years.
20. CIA Directorate of Intelligence, *A Compendium of Analytic Tradecraft Notes* (Washington, D.C.: Author, February 1997), http://www.oss.net/dynamaster/file_archive/040319/cb27cc09c84d056b66616b4da5c02a4d/OSS2000-01-23.pdf.
21. Liam Fahey, *Competitors* (New York: Wiley, 1999), 448.
22. Rob Johnson, *Analytic Culture in the U.S. Intelligence Community* (Washington, D.C.: CIA Center for the Study of Intelligence, 2005), 66.
23. Ibid., 15.
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13

Estimative Forces

Estimating is what you do when you don't know.

Sherman Kent,
former chief of CIA's Office
of National Estimates; often described
as the "father of intelligence analysis"

Chapter 12 introduced the idea of force analysis. The factors or forces that have to be considered in estimation—primarily PMESII factors—vary from one intelligence problem to another. I do not attempt to catalog them in this book; there are too many. But an important aspect of critical thinking, discussed earlier, is thinking about the underlying forces that shape the future. This chapter deals with some of those forces.

The CIA's tradecraft manual describes an analytic methodology that is appropriate for identifying and assessing forces. Called "outside in" thinking, it has the objective of identifying the critical external factors that could influence how a given situation will develop. According to the tradecraft manual, analysts should

> develop a generic description of the problem or the phenomenon under study. Then, analysts should:
>
> - List all the key forces (social, technological, economic, environmental, and political) that could have an impact on the topic, but over which one can exert little influence (e.g., globalization, social stress, the Internet, or the global economy).
> - Focus next on key factors over which an actor or policymaker can exert some influence. In the business world this might be the market size, customers, the competition, suppliers or partners; in the government domain it might include the policy actions or the behavior of allies or adversaries.