



Anticipating Rare Events: The Role of ACH and Other Structured Analytic Techniques

Randolph H. Pherson, Pherson Associates
Alan R. Schwartz, Pherson Associates
Elizabeth Manak, Pherson Associates

This article appeared in "Anticipating Rare Events: Can Acts of Terror, Use of Weapons of Mass Destruction or Other High Profile Acts Be Anticipated? A Scientific Perspective on Problems, Pitfalls, and Potential Solutions" in November 2008. The article is part of a collection that was published by the Topical Strategic Multilayer Assessment, Multi-Agency/Multi-Disciplinary White Papers in Support of Counter-terrorism and Counter-WMD in the Office of the Secretary of Defense/DDR&E/RTTO.

By definition one is not expected to see the unexpected. Indeed as human beings, we all tend to assume that the future will be an extension of the past. Although we know intellectually that the past is not a reliable guide to the future, our brains are pre-wired to use the past to project what will happen because this is the most efficient way to process data. The good news is we do not have to accept defeat; there are tools that can help us imagine how the future might surprise us, help us wind tunnel possible strategies, and reliably track signposts that can tell us where we are, in fact, going.

Peter Schwartz said it simply: “What has not been imagined will not be foreseen . . . in time.” We discuss here the ways in which one can imagine the multiple futures that we must foresee—whether that future is tomorrow or months or years from now.

There are two related challenges. First, in some cases the evidence is in front of our eyes, but we do not see it, or do not recognize the significance of what we are seeing. We are surprised by the result. Alternatively, there are occasions when the evidence is not a reliable guide to sudden shifts. This is often referred to as the Black Swan problem. In both cases, surprise results.

The Value of Diagnostic and Reframing Techniques

Recent history has shown that engrained mindsets are a major contributor to analytic failures. Despite widespread recognition of the problem, past experience demonstrates that analytic traps and mindsets are easy to form and surprisingly difficult to change. There are myriad reasons why mindsets are difficult to dislodge. Most often, time pressures lead analysts to jump to conclusions and to head down the wrong path. As more information becomes available, analysts are increasingly inclined to select that which supports their lead hypothesis and to ignore or reject information that is inconsistent. Contradictory information becomes lost in the noise.ⁱ

A wonderful example is set out in a 1989 examination of the failure to anticipate the Japanese attack on Pearl Harbor.ⁱⁱ Analysts ignored available indicators of an imminent attack because they:

- Assumed that such an attack would be irrational behavior.
- Were disdainful of the capabilities of Japanese aviators.
- Discounted the technological, diplomatic and military capabilities of the Japanese.

Experience shows how difficult it is to overcome the tendency to reach premature closure, embrace “groupthink,” and avoid analytic traps. Overcoming mindsets relies on employing structured forcing mechanisms that require analysts to seek out new perspectives and possibilities. Without the use of structured analytic techniques analysts are less likely to

identify and challenge key assumptions, think critically about the evidence, reframe analysis, and, most importantly, avoid surprise. The techniques also impose a greater degree of transparency, consistency, and accountability. They work most robustly with the participation of a diverse set of participants bringing a variety of perspectives to the table.

One of the most valuable techniques an analyst can use is the **Key Assumptions Check**. By preparing a written list of one's working assumptions at the beginning of the project, the analyst will identify both the specific assumptions that underpin the basic analytic line as well as the developments that would cause him or her to abandon that assumption. By testing one's assumptions, i.e., explicitly recognizing that one is dealing with an assumption rather than a fact, the analyst is able to establish the level of confidence that should be accorded to what is, in essence, a belief.

Should new information become available that renders a key assumption invalid, surprise can be averted. It is a simple process: List the key assumptions and future events that would indicate that the assumption was no longer valid. If some of the indicators begin to appear, the assumption needs to be reevaluated. For example, in 1989 it might have been sensible, based on the evidence to date, that the primary threat to aviation was from bombs in unaccompanied luggage. The assumption was based on two underlying assumptions: (i) that the hijacking problem had been largely solved, and (ii) that bombers would not knowingly go down with the plane. But by 2001, the latter assumption, i.e., that people did not want to kill themselves, had been undermined by the large-scale use of suicide bombers in Sri Lanka, Israel, and the West Bank. Unfortunately, in 2001 it had been seven years since a hijacking had been attempted on an American flag carrier. The assumption appeared valid because it had not been tested.

Another technique that forces analysts to challenge mindsets is **Analysis of Competing Hypotheses (ACH)**, which involves the identification of a complete set of alternative explanations (presented as hypotheses), the systematic evaluation of each, and the selection of the hypothesis or hypotheses that fit best by focusing on evidence that tends to disconfirm rather than to confirm each of the hypotheses. ACH helps analysts overcome three common traps or pitfalls that can lead to intelligence failures: being overly influenced by a first impression based on incomplete data, an existing analytic line, or a single explanation; failing to generate a full set of explanations or hypotheses at the outset of a project; and relying on evidence to support one's favored hypothesis that also happens to be consistent with alternative hypotheses and, therefore, has no diagnostic value. ACH can help overcome what is called "confirmation bias," the tendency to search for or interpret new information in a way that confirms one's preconceptions and avoids interpretations that contradict prior beliefs.

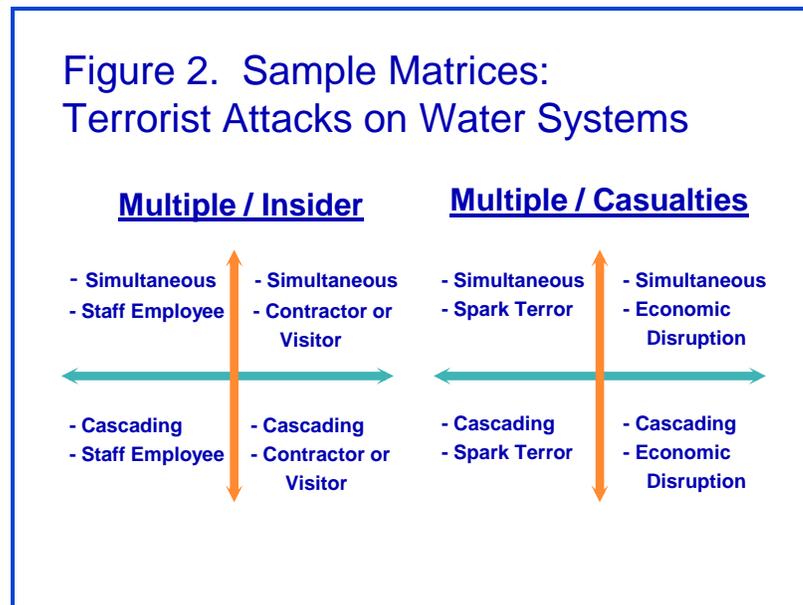
Related to the Key Assumptions Check, is a technique known as **Quadrant Crunching**. Rather than testing key assumptions, the technique forces the analyst to move away from their comfort zone by systematically exploring the implications of contrary assumptions. Should new information become available that renders a key assumption invalid, surprise can be averted. For example, if analysts assumed that the Japanese would attack the Philippines; this technique would assume another target, e.g., Pearl Harbor. The technique initially was developed to help counterterrorism analysts and decision-makers discover all the ways radical extremists might mount a terrorist attack. But analysts can apply it more broadly to generate a wide range of potential outcomes—many of which have not previously been contemplated. The technique forces analysts to rethink an issue from a broad range of perspectives, systematically flipping all the assumptions that underlie the lead hypotheses.

So, for example, one might test the conventional wisdom that a terrorist attack against the water supply would involve the following assumed elements: (i) a single large attack, (ii) carried out by a terrorist group, (iii) against drinking water, (iv) by contaminating the water, (v) to kill a large number of people. Using quadrant crunching, each element is flipped, so the attack might involve the following new elements: (i) multiple attacks, (ii) carried out by an insider, (iii) against waste water, (iv) by using water as a weapon, (v) to cause economic injury. By combining these new and old elements in matrices (each with four quadrants, hence the term quadrant crunching), the analyst can examine the implications of a variety of new attack scenarios, as set out below. ⁱⁱⁱ

**Figure 1. Quadrant Crunching:
Terrorist Attacks on Water Systems**

<u>Key Assumption</u>	<u>Contrary Assumption</u>	<u>Contrary Dimensions</u>
Single attack	Multiple attacks	- Simultaneous - Cascading
Contamination	Other strategies	- Denial of service - Water as a weapon
Drinking water	Waste water	- Treatment plants - Sewage pipes
Outsider	Insider	- Staff employees - Contractors/visitors
Major casualties	Minor casualties	- Terrorize population - Economic disruption

Figure 2. Sample Matrices:
Terrorist Attacks on Water Systems



The Pre-Mortem Assessment is a systematic assessment of how a key analytic judgment, decision, or plan of action could go spectacularly wrong. It is conducted prior to finalizing an analytic judgment or decision. The primary goal of the Pre-Mortem Assessment is to reduce the risk of surprise and the subsequent need for a post-mortem investigation.

Poor group decisions are often driven by the desire for consensus; group members tend to go along with the group leader, with the first group member to stake out a position, or with an emerging majority viewpoint. The tendency is to support the consensus because members of a group assume the rest know what they are doing, are concerned that their views will be critically evaluated by others, or believe dissent will be perceived as an obstacle to progress or disloyalty. The benefit of The Pre-Mortem Assessment is that it empowers those who have unspoken reservations about the team consensus to speak out in a context that is consistent with perceived group goals. The technique provides them with both a totally unbounded and a highly structured mechanism to explore all the ways an analysis could turn out to be wrong.

Other techniques that can be employed to reduce the chances of surprise include:

- **Devil's Advocacy.** It should be performed if there is widespread unanimity on a critical issue or if analysts have been working the issue so long that they have developed a mindset. Devil's Advocates can expose hidden assumptions or mindsets, identify contrary data that was ignored or faulty logic that undercuts the analysis, and suggest the need for alternative hypotheses.

-
- **Deception Detection.** This consists of a set of checklists analysts can use to help them determine when to look for deception, whether deception actually is present, and what to do to avoid being deceived. Without such aides, analysts have to consider the possibility that all the evidence is open to question and no valid inferences can be drawn from the reporting.
 - **Red Hat Analysis.** This technique prompts an analyst to change his or her point of reference from that of an analyst observing or predicting an adversary or competitor's behavior to someone who must make decisions within an existing operational culture. The technique works best when you are trying to predict the behavior of a specific person or adversary.

Using Imagination Techniques to Anticipate Black Swans

The diagnostic and reframing techniques described above provide a systematic and rigorous check for analysts to assure themselves that their assessment about “what is” is as accurate as possible. They are designed to uncover untested assumptions, examine alternative explanations and perspectives, and uncover hidden analytic traps. But what if the problem is not with what you know now, but in anticipating changes that could occur that would alter your assessment? Take, for example, the challenge of anticipating that someone would use an airplane as a weapon. How does one anticipate events that have few, if any, historical antecedents?^{iv}

The answer is not to try to predict the future. Instead, the analyst's task is to anticipate multiple futures (i.e., the future is plural) and identify observable indicators that can be used to track the future as it unfolds. Armed with such indicators, the analyst can warn policymakers and decisionmakers of possible futures and alert them in advance, based on the evidence.

The cornerstone of any technique to anticipate the future is **Indicators**. Indicators provide an objective baseline for tracking events if they are: observable, accurately measure, reliable (mean the same thing to those observing them), stable (useful over time) and ideally are unique (only measure one thing or phenomenon, alone or with other indicators). Indicators provide the early warning to avoid surprise. But how does one develop indicators if one does not know what the future will look like? The answer is to envision several futures that can plausibly develop, and develop stories that describe how each future might unfold.

One way to develop those futures is **Alternative Futures Analysis**, which is most useful when a situation is viewed as too complex or the outcomes too uncertain to trust a single point prediction. Usually there is high uncertainty surrounding the topic in question and a wide range of factors that are likely to influence the outcome. Alternative Futures Analysis has proven highly effective in helping analysts, decision-makers, and policymakers contemplate

multiple futures or scenarios, challenge their assumptions, and anticipate surprise developments.

- Scenario analysis is based on an understanding of underlying forces and trends, and of the uncertainty related to the development of those forces and of the impacts they may have.
- Scenario analysis makes no assumptions regarding historical continuity or change. Instead, scenario analysis requires that possible outcomes be justified by plausible developments in underlying forces and trends.
- Because scenario analysis recognizes and embraces the uncertainty inherent in complex situations, multiple outcomes and the developments that produce them are always considered. Single-outcome forecasts are not allowed.
- The analytic goal of multiple scenario analysis is not to forecast what a system will look like in the future. The goal is to estimate the range of behaviors the system can exhibit within a given time period.

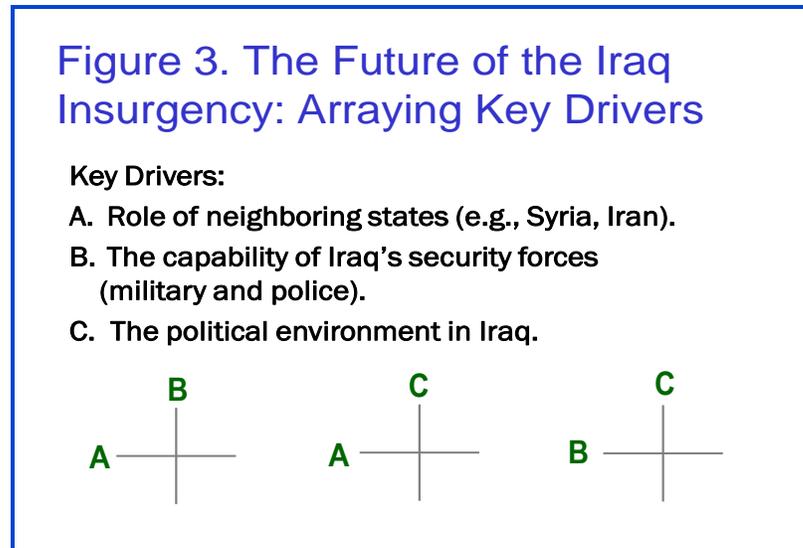
Moreover, as an analytic strategy, scenario analysis allows for the inclusion of a wide range of disciplines, conceptual frameworks, and analytic techniques. While individuals can undertake scenario analyses on their own, teams generally produce better results, especially if their members differ on the perspectives they bring to bear on the focal issue.

Unlike most academic and intelligence analyses—which focus mostly on information that is known with confidence—scenario analysis focuses equal attention on uncertainties. The term “uncertainties” refers to factors or forces the development or impacts of which are impossible to forecast accurately. Although it is impossible to forecast the future state of uncertainties, there is much value in exploring how uncertainties might behave. It is possible to speculate on how rapidly a factor might change or how much improvement or deterioration in a condition is possible within a given time period. This kind of speculation provides insights into the volatility of situations and the constraints on change that exist in complex systems; it opens our eyes to what is possible and what is impossible.

Another technique is **Multiple Scenarios Generation**, which helps analysts and decisionmakers expand their imagination and avoid surprise by generating large numbers of potential scenarios. In Multiple Scenarios Generation, analysts build upon combinations of drivers or matrices. By generating multiple matrices, each with four quadrants, the analyst is exposed to a much larger, but manageable, number of scenarios. The analyst then selects the scenarios that are most deserving of the attention of the policymaker or decisionmaker based on a set of criteria, such as which scenarios:

- Are most likely to come about.
- Reflect key trends that are just now beginning to emerge.
- Represent a serious downside risk.
- Would have major repercussions despite their low probability.

The following is an example of how three drivers concerning the future of the insurgency in Iraq might be arrayed^v:



Conclusion

None of these diagnostic, reframing, or imagination techniques guarantees that all unforeseen events will be anticipated. Intelligence surprises are inevitable, but use of these techniques will ensure a greater rigor to the analysis and reduce the chances of surprise. If analysts continually test, probe, and indeed attack their assumptions and mindsets, they will be more capable of knowing what they know and discovering what they did not realize they did not know. Use of these techniques helps analysts anticipate what might occur in the future and better prepare themselves to track developments that presage dramatic change. In the end, decisionmakers will benefit from the more thoughtful, comprehensive analysis that results from employing these techniques.

ⁱ This essay draws largely from Richards J. Heuer, Jr., *Psychology of Intelligence Analysis*, Pherson Associates, LLC, 2007, and Randy Pherson, *Handbook of Analytic Tools and Techniques*, Pherson Associates LLC, 2008.

ⁱⁱ Nelson P. Ford, "Avoiding another Pearl Harbor, The Primary Purpose of National Estimating," published as part of *The Purposes and Problems of National Intelligence Estimating* (1989) published by the Defense Intelligence College.

ⁱⁱⁱ Figures 1 and 2 are taken from Randy Pherson, *Handbook of Analytic Tools and Techniques*, Pherson Associates, LLC, 2008.

^{iv} Interestingly enough, there was some precedent for the use of aircraft as a weapon. In 1994 terrorists hijacked a French airliner with the goal of crashing it into the Eiffel Tower. This prior evidence was essentially lost because analysts saw it as an anomalous event and not a potential harbinger.

^v This illustration is drawn from a report prepared by PolicyFutures, LLC, "Scenarios for the Insurgency in Iraq" published by the United States Institute of Peace (Special Report 174, October 2006).