

# **Taxonomy of Structured Analytic Techniques**

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# Taxonomy of Structured Analytic Techniques

by Richards J. Heuer, Jr.

**Abstract:** This paper is the first part of a broader project to define and further develop the domain of what are now called structured analytic techniques for intelligence analysis. It distinguishes these techniques from three other broad categories of intelligence analysis methods and then presents a taxonomy of the structured techniques. The structured techniques are categorized by how they help analysts overcome one or more of the well-known human cognitive limitations or pitfalls that often inhibit effective analysis. It describes five categories of structured analytic techniques: decomposition and visualization; indicators, signposts, and scenarios; challenging mindsets; hypothesis generation and testing; and group process techniques.

I am best known for my book, *Psychology of Intelligence Analysis*, which describes the cognitive limitations and pitfalls typically encountered by intelligence analysts and has been used for many years now in training new analysts throughout the Intelligence Community.<sup>1</sup> Many readers of my book are discouraged to learn of the extent of our cognitive limitations and the multitude of pitfalls encountered when intelligence analysts must cope with incomplete, ambiguous, and often deceptive information. As one reader told me, it makes you wonder if it is possible to ever get *anything* right.

There is, of course, no magic formula for always making the right analytic judgment. There are, however, well-established procedures for reducing the frequency and severity of error. These are what the Intelligence Community now calls structured analytic techniques, or SATs for short, and this is the area I'm working on now.

Those of you familiar with the various Commission reports on reforming intelligence analysis will be familiar with the recommendations to conduct more "alternative analysis." That term is no longer being used, because it came to be thought of as something one does occasionally as an *alternative* to traditional analysis. We now think those tools and other similar techniques should be used regularly and normally as "best practices," and this is what are now called structured analytic techniques.

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<sup>1</sup> Richards J. Heuer, Jr., *Psychology of Intelligence Analysis* (Washington, DC: CIA Center for the Study of Intelligence, 1999).

With financial support from the ODNI Intelligence Advanced Research Projects Activity (IARPA), I have been working with Least Squares Software on a multifaceted project to define and help further develop the domain of structured analytic techniques. What I will talk about today is a taxonomy that defines the domain of structured techniques, how they relate to other methods used in intelligence analysis, and how they contribute to providing a better analytic product.

A taxonomy is a classification of all the elements of some domain of information or knowledge. It defines a domain by identifying, naming, and categorizing all the various element in that domain. The elements are organized into related groups based on some factor that is common to each element in the group.

Let's look first at four general categories of methods used for intelligence analysis to see where structured analytic techniques fit into this overall picture.

- *Quantitative methods using empirical data:* For intelligence analysis, the empirical data we work with may be collected by some type of sensor and used, for example, in analysis of a weapons system. Econometric modeling is another common example of this method. Training in such methods is generally obtained through graduate education in economics or the hard sciences.
- *Quantitative methods using expert-generated data:* We don't have empirical data for many of the things we have to analyze. In the absence of empirical data, many methods are designed to use quantitative data generated by expert opinion or judgment. Special procedures are used to elicit subject matter experts' quantitative judgments. This includes many decision analysis methods, Bayesian inference projects, dynamic modeling, and simulation. Training for this type analysis is provided through graduate education in fields such as information science, operations research, business, or the hard sciences.

- *Unaided judgment:*<sup>2</sup> This is how most strategic and political analysis is now being done. It includes evidentiary reasoning, the basics of critical thinking, historical method, case study method, and reasoning by analogy.<sup>3</sup> *One very distinctive characteristic of unaided judgment is that it is usually an individual effort in which the thinking remains largely in the mind of the individual analyst until it is written down in a draft report.* Training in this type of analysis is generally provided through graduate education, especially in the social sciences and liberal arts.
- *Structured analysis:* This uses structured techniques to mitigate the adverse impact on our analysis of known cognitive limitations and pitfalls. The most distinctive characteristic is that structured techniques *externalize* and decompose our thinking in a manner that enables it to be reviewed and critiqued piece by piece, or step by step, by other knowledgeable analysts. These techniques can be used by the average analyst who lacks advanced training in statistics, math, or the hard sciences. For most analysts, training in structured analytic techniques is obtained only within the Intelligence Community.

That shows where structured techniques fit into the overall spectrum of methods used in intelligence analysis. Now we look at the structured techniques in greater detail and categorize them by how they help analysts overcome one or more of the well-known human cognitive limitations or pitfalls that inhibit effective analysis.

- *Decomposition and Visualization:* The number of things most people can keep in working memory at one time is seven, plus or minus two.<sup>4</sup> Complexity increases geometrically as the number of variables increases. In other words,

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<sup>2</sup> This is often referred to as traditional analysis. It is also called intuitive analysis, but I do not like that term. The American Heritage online dictionary definition of intuition is “the act or faculty of knowing or sensing without the use of rational processes.” Unaided judgment often involves very careful and systematic reasoning.

<sup>3</sup> Reasoning by analogy can also be a structured technique. See Kesten C. Green and J. Scott Armstrong, “Structured Analogies for Forecasting” (Monash University Econometrics and Business Statistics Working Paper No. 17/04 (2004). Available at SSRN: <http://ssrn.com/abstract=675363>

<sup>4</sup> 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).

it is very difficult to do error-free analysis only in our heads. The two basic tools for coping with complexity in analysis are: (1) break things down into their component parts, so that we can deal with each part separately, and (2) put all the parts down on paper or a computer screen in some organized manner such as a list, matrix, map, or tree so that we and others can see how they interrelate as we work with them. Many common techniques serve this purpose.

- *Indicators, Signposts, Scenarios:* The human mind tends to see what it expects to see and to overlook the unexpected. Change often happens so gradually that we don't see it, or we rationalize it as not being of fundamental importance until it is too obvious to ignore. Identification of indicators, signposts, and scenarios creates an awareness that prepares the mind to recognize change.
- *Challenging Mindsets:* A simple definition of a mindset is “a set of expectations through which a human being sees the world.”<sup>5</sup> Our mindset, or mental model of how things normally work in another country, enables us to make assumptions that fill in the gaps when needed evidence is missing or ambiguous. When this set of expectations turns out to be wrong, it often leads to intelligence failure. Techniques for challenging mindsets include reframing the question in a way that helps break mental blocks, structured confrontation such as devil's advocacy or red teaming, and structured self-critique such as what we call a key assumptions check. In one sense, all structured techniques that are implemented in a small team or group process also serve to question your mindset. Team discussions help us identify and evaluate new evidence or arguments and expose us to diverse perspectives on the existing evidence or arguments.
- *Hypothesis Generation and Testing:* “Satisficing” is the tendency to accept the first answer that comes to mind that is “good enough.” This is commonly followed by confirmation bias, which refers to looking at the evidence only from the perspective of whether or not it supports a preconceived answer.

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<sup>5</sup> Roger Z. George, Fixing the Problem of Analytical Mindsets: Alternative Analysis,” in *Intelligence and the National Security Strategist: Enduring Issues and Challenge*, ed. Roger Z. George and Robert D. Kline (Washington, DC: National Defense University Press, 2004).

These are among the most common causes of intelligence failure. Good analysis requires identifying, considering, and weighing the evidence both for and against all the reasonably possible hypotheses, explanations, or outcomes. Analysis of Competing Hypotheses is one technique for doing this.

- *Group Process Techniques:* Just as analytic techniques provide structure to our individual thought processes, they also provide structure to the interaction of analysts within a team or group. Most structured techniques are best used as a collaborative group process, because a group is more effective than an individual in generating new ideas and at least as effective in synthesizing divergent ideas. The structured process helps identify differences in perspective between team or group members, and this is good. The more divergent views are available, the stronger the eventual synthesis of these views. The specific techniques listed under this category, such as brainstorming and Delphi, are designed as group processes and can only be implemented in a group.

This taxonomy is one part of a larger project to define and support further development and use of structured analytic techniques in the Intelligence Community. Another major part of the project deals with evaluation and validation of structured analytic techniques and how we need to go about that. There is a tool to help analysts select the most appropriate technique for their needs, and this is combined with a catalogue that describes and provides instructions for using about 50 structured analytic techniques. Finally, there is a vision for a knowledge management system to help analysts use structured analytic techniques.