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Critical Thinking in Intelligence Analysis

Critical thinking appears on almost every list of the essential skills for intelligence analysts.[1] But any corresponding attempt to define critical thinking more precisely is seldom encountered. And, on those rare occasions when definitions are offered, they inevitably (albeit quite understandably) amount to new applications of existing approaches.[2] Yet, these existing approaches derive from more general academic attempts to create better thinkers and not from any specific concern for the problems of intelligence analysis. Thus, despite the undeniable importance of critical thinking in intelligence analysis, few if any attempts are made to define critical thinking specifically for intelligence.

REASONING IN INTELLIGENCE ANALYSIS

In response, I offer an ambitious new definition of critical thinking designed specifically to address the unique challenges of intelligence analysis. This approach is offered as a new foundational paradigm. As such, its point of departure is not current accounts of critical thinking, but instead four major challenges to reasoning in intelligence. This is intended to be a bold, high-level, strategic concept approach for those concerned with transforming both the process of analysis and the education of analysts. Thus, the primary focus here is on exploring this new approach rather than directly criticizing its rivals.

The core concept of critical thinking, on every approach, is improving the quality of reasoning through greater conscious attention to the process of thinking. So, the central definition of critical thinking may be construed

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as: intentionally applying rigorous analytic procedures to relevant analyst problems for reliable analytic products. Each approach to critical thinking has, then, three dimensions: procedures, problems, and products. The procedures are methods of reasoning that the approach offers. The problems are the challenges that the procedures are designed to address. And, the products are the results of applying the procedures to the problems. So, the approaches can be distinguished in terms of differences in their procedures, problems, and products.

PROBLEMS OF REASONING IN INTELLIGENCE ANALYSIS

The problems of reasoning in intelligence analysis are not simply the general challenges of intelligence analysis, but the cognitive challenges that analysts face in forming well-justified true conclusions. More precisely, moving away from the outdated and excessively mechanistic ''production model'' of intelligence, I maintain that analysis occurs through navigation in multiple directions on a ''network of analysis'' with four major nodes: data, information, knowledge, and understanding: (1) *data node*: consists of sets of purported facts from observation, testimony, records, and/or technological devices; (2) *information node*: sets of purported facts that have been represented and structured (usually via technology) to be comprehensible and analyzable; (3) *knowledge node*: well-justified true conclusions that answer urgent real-life consumer questions; and, (4) *understanding node*: the consumer's acquisition of analyst knowledge and the application of that knowledge to their major challenges.

While analysts may, in ideal circumstances, move forward in a cycle through each major network node—from data to information to knowledge to understanding—they also may work backwards (e.g., via feedback loops) from understanding to knowledge, knowledge to information, information to data, etc. They may also go, in some contexts, directly from data to knowledge, information to understanding, etc.

On this model of analysis, the cognitive methods (such as critical thinking) that analysts employ will be most relevant on the pathways to knowledge. As such, the most critical problems of reasoning in intelligence will derive from the difficulties in reaching knowledge. These, in turn, follow from the place of knowledge in the network of analysis. Naturally, many other reasoning problems will still exist, but the focus here is on the most essential ones that help define critical thinking for intelligence analysis. For critical thinking is ultimately about the process of forming well-justified true conclusions (i.e., knowledge). And four central problems of reasoning in intelligence derive from the place of knowledge in the network of analysis.

Not Usually Enough

The first is insufficiency. This challenge derives from the relationship of data to knowledge in the network of analysis. The vast majority of the knowledge developed by analysts will ultimately be based on collected data. But this data is inevitably insufficient in at least two ways. First, it is limited in its scope and therefore does not cover all the issues that the analyst must consider. Second, it is limited in its reliability, because it consists of only purported facts, namely, those that always carry some risk of falsehood. Ultimately, therefore, analysts must always rely on data that is incomplete and often inaccurate. They can never assume that they have all the relevant data, or that the data they have is certain. Instead, they should assume that much of the relevant data is ultimately missing, and that some portion of the data is misleading or simply mistaken. Despite this, they must form, as best as possible, well-justified, true conclusions on the basis of this data.

Not Always Relevant

The second central problem of reasoning in intelligence analysis is irrelevancy. This challenge derives from the relationship between information and knowledge in the network of analysis. The knowledge that analysts infer comes from the information to which they have access. But that information contains much more than what the analysts actually need in forming knowledge. In fact, most of the information will be irrelevant to the question at hand. If an analyst is concerned with what is affecting a particular outcome of interest, a multitude of factors will be present that seem statistically connected to that outcome. But only a select subset of those factors can truly affect the outcome. Therefore, analysts can never assume that the information they have is relevant to the issue they are investigating. Instead, they can assume that most of their information is, despite appearances, not relevant. And, they have to discern which of the various pieces of information truly affect the outcome of interest.

Not Ever Inevitable

The third central problem of reasoning in intelligence analysis is indeterminacy. This challenge derives from the relationship between knowledge and the entire network of analysis, and the world itself, i.e., the events being analyzed. Most of the events that analysts seek to understand, and especially those they try to anticipate, are not inevitable. That is not merely to say that analysts cannot have all the information necessary to project them. Instead, even if analysts knew everything to be known about a particular terrorist, it would still not be possible to infer with certainty what that terrorist would do. The decisions and actions of human agents, as well as many natural processes, are indeterministic. That is, they are not

the inevitable consequences of prior causal factors, but rather are only one of several different possible outcomes, each having some real possibility of occurring. While only one set of future events will actually occur, it is almost never the only set that had a real chance of occurring. Analysts can never assume that things might go in only one possible way. Instead, they can assume that a series of different, incompatible futures could occur. And they have to determine what would occur if each of the different alternatives were to happen.

Not Always Useful

The fourth central problem is instrumentality. This challenge derives from the relationship between understanding and knowledge. Analysts acquire knowledge not simply for its own sake, but instead to specifically address the challenges faced by their consumers. That creates substantial additional constraints on knowledge-acquisition, particularly in a feedback loop pathway from understanding to knowledge. Analysts cannot assume an indefinite, or even adequate, period of time to do analysis. Nor can they assume that their consumer is simply an objective observer without policy goals, as might, say, an academic inquirer. Instead, they should assume that the consumer has both very specific goals and a need to make timely decisions to further those goals. The analysts seek out knowledge specifically to improve that decisionmaking.

Without question, intelligence analysts face more than those four reasoning challenges. But, in developing a model for critical thinking in intelligence, only a select few challenges should be highlighted, otherwise the constructed model will be too complicated to be applicable in real-life situations. In addition, those four are particularly significant because each derives from a fundamental basis of knowledge and its relationship to the other major nodes in the analytical network. Thus, those four are both fundamental and undeniable.

PROCEDURES FOR REASONING IN INTELLIGENCE ANALYSIS

The two major extant approaches to critical thinking are: positive mental habits and informal deductive logic. They differ largely in terms of the rational procedures they offer.

Extant Approaches to Critical Thinking

The two extant approaches derive from specific historical challenges in the development of Western philosophy and education. Thus, a brief history is in order. Critical thinking is a relatively new field of study. Centuries ago Aristotle would have been studied instead. Aristotelian logic became a

central part of the Western tradition during the Middle Ages when it, along with grammar and rhetoric, formed the ''trivium''—the three foundational areas of study at all universities. Aristotelian reasoning emphasized ''syllogisms,'' arguments containing categorical propositions that relate classes by means of quantifiers such as ''all,'' ''some,'' and ''none.'' This logical tradition became increasingly less important, beginning in the late seventeenth century, as figures like Gottfried Leibniz began to develop a more exhaustive mathematical logic. In the mid-nineteenth century, modern symbolic propositional logic came into full fruition with Gottlob Frege and George Boole. Symbolic logic, while having the advantage of being able to account for many more relationships than can the older syllogistic logic, has the disadvantage of being much more formal and axiomatic, like mathematics. Thus, it is at once more powerful and yet less accessible. By contrast, syllogistic logic is almost always described by means of examples, making it much more accessible, yet more limited. By the mid-twentieth century, much of the teaching of logic, as part of foundational, or general, education in universities, became either rather outdated (purely syllogistic) or excessively formal and seemingly not helpful (symbolic logic). Yet, every educated person clearly needs a strong foundation in rigorous and reliable reasoning. As a result, some began to develop a new area of study designed to meet this need: critical thinking.

Critical thinking began primarily out of a practical educational need. In the end, it is part of the contempory core university education instead of outdated Aristotelian logic or overly formal symbolic logic. In a sense, the discipline exists in order to play a specific educational role. Because of this, much confusion exists about the nature of critical thinking. But a clear core concept of what critical thinking is supposed to be remains. As described earlier, it is the intentional application of rigorous analytic procedures to relevant analyst problems for reliable analytic products. Critical thinking is never merely thinking critically. That is, it does not simply raise questions or challenge the views of others. Critical thinking always seeks to determine the true answer to some real-life problem by means of applying the most rigorous and relevant standards.

How to Think Critically. As for the procedures of critical thinking, all paradigms recommend the self-conscious application of a specific set of standards to a specific set of subjects. They differ in terms of their conception of those standards and subjects. The first approach, through ''informal deductive logic,'' responded to the excessive formality of modern logic by offering an informal version of that logic to teach reasoning in real-life scenarios.[3] The second, the ''positive mental habits'' approach, emerged in response to the first. This rival approach holds that critical thinking is less about applying rules for argumentation, whether formal or

informal and more about developing the right mental dispositions, as illustrated by the great thinkers.[4]

More precisely, regarding the informal deductive logic paradigm, the standards to be applied in critical thinking are taken to be rules for rational argumentation. That is, they are rational techniques. For example, they are concerned with how to identify inferences, identify the structure of arguments, reconstruct arguments, construct counterexamples (exceptions) to argument structures, assess the validity of arguments, and assess the soundness of arguments. Each will, in turn, involve a series of clear steps that can be applied in order to establish if, for example, an argument is valid or invalid. In the positive mental habits paradigm, the standards to be applied in considering a real-life problem are taken to be dispositions of a rational agent. That is, they are rational traits, such as self-awareness, self-evaluation, fair-mindedness, clarity, thoroughness, and rational independence. Each of these is to be understood as not so much rule-following, but as behaving in a particular way.

Both paradigms accept the importance of rational techniques and rational traits. But they differ as to which is the primary standard to be consciously applied in critical thinking. In the informal deductive logic paradigm, the rational techniques are foundational, and rational traits are secondary. Whereas, in the positive mental habits model, the rational traits are foundational, and rational techniques are secondary.

The two paradigms may also be contrasted in terms of what they take to be the proper subjects of critical thinking. In informal deductive logic, these will be claims and inferences (i.e., arguments). The standards should be applied to propositions—things that can be true or false—and the relations between them (i.e., evidential connections). By contrast, in the positive mental habits model, the proper subject of critical thinking is the element of the mind. In other words, the standards should be applied to all possible thoughts. The standards apply to purposes, questions, concepts, points of view, information, and so on. Both paradigms accept the importance of thinking critically about propositions and possible thoughts. Their difference concerns the proper object upon which the standards in critical thinking are applied. In the informal deductive logic approach, propositions and the relations between them are foundational, whereas on the positive mental habits model they are not.

DIFFICULTIES OF EXTANT APPROACHES TO CRITICAL THINKING

To think that these two approaches differ only in emphasis would vastly oversimplify things. Their rivalry over the foundational standards and

subjects of critical thinking has significant implications, especially in terms of their relevance to the real-life aspects of intelligence analysis. Informal deductive logic provides a much more rigorous framework because it follows the standard rules of argumentation and thereby offers clear principles in reasoning problems. And the object of that standard relates to statements and inferences, and the focus on the claims and assumptions being made is always clear, as is whether they are reliable or not. Conversely, because the positive mental habits model does not focus on rules or on propositions and inferences, it offers a much less precise framework for reasoning.

Although the lack of focus on rules, propositions, and inferences has the drawback of making the positive mental habits model less rigorous, it has the advantage of making it more relevant. Offering several rules of reasoning also offers rules relative to a specific form of reasoning. And, in the informal deductive logic model, those rules apply to deductive inference and, sometimes, to inductive inference. But the primary challenges to reasoning in intelligence analysis clearly concern insufficiency, irrelevancy, indeterminacy, and instrumentality. These are the sorts of things for which deductive and inductive inference are not especially helpful.[5] Thus, the informal deductive logic model provides precision and accuracy, but only at something of at best secondary importance in intelligence analysis. By contrast, the positive mental habits model has greater generality with its emphasis on rational propensities applied to all possible thoughts. While the rules for deductive validity have somewhat limited application to insufficiency, irrelevancy, indeterminacy, and instrumentality, things like rational self-awareness, self-evaluation, fair-mindedness, clarity, thoroughness, and rational independence have many applications. Therefore, the positive mental habits model would seem to have something important to offer in intelligence analysis: a series of rational behaviors that can be applied to reason about anything, and more relevantly, about the core challenges in intelligence.

Each of the two paradigms of critical thinking has a major advantage and a major disadvantage in addressing the challenges of intelligence analysis. The informal deductive logic model offers rigor at the expense of relevance, while the positive mental habits model offers relevance at the expense of rigor. Ultimately, this makes them both unsatisfactory as the final solution to the problems of insufficiency, irrelevancy, indeterminacy, and instrumentality, though each probably has some utility as an intermediate means to address the needs of intelligence. The only completely satisfying solution to these problems would be a means to reason both reliably and relevantly about these challenges. And that will require another, different model of the procedures of critical thinking.

THE ALTERNATE APPROACH TO CRITICAL THINKING

By making rational techniques fundamental, the informal deductive logic approach offers rigor to intelligence analysis but not relevance, for the types of reasoning it covers have little connection to the four core challenges identified earlier. By contrast, through making rational traits fundamental, the positive mental habits approach offers relevance to intelligence analysis by virtue of the generic nature of the procedures, but not rigor. Rational traits improve precision only when informed by specific rational techniques. Now, the most natural response to these two diagnoses would be to try to synthesize the two approaches. That is, to develop a system on which both rational traits and rational techniques are fundamental in order to achieve the rigor and reliability that reasoning in intelligence demands.

While such an approach may have merit, the ultimate solution requires a deeper transformation: the addition of a third dimension. Ideally, critical thinking would feature not only a ''trait dimension'' and a ''technique dimension'' but also, and more importantly, a ''taxonomy dimension.'' This third dimension differentiates among types of reasoning, and more specifically, the core varieties of reasoning. A third dimension is absolutely essential to any adequate approach that seeks to employ both traits and techniques, because they play out differently, depending upon the sort of reasoning problem being addressed. The rules of rationality differ, depending on the kind of thinking involved. While some generic rules apply to all, they are far too high-level to be the complete solution to challenges to reasoning in intelligence. Therefore, a third dimension that recognizes distinct types of reasoning, specifically suited to address the challenges to reasoning in intelligence, is essential.

Types of Reasoning

What Happened? The first is hypothesis testing. This targets the first reasoning challenge in intelligence of insufficiency. As noted earlier, analysts must always rely on data of limited reliability and scope. Hypothesis testing is not merely the well-known strategy of the ''analysis of competing hypotheses,'' but a complete system of principles designed to compare alternate theories in terms of their explanatory power and predictive success. As such, this would also include Bayesian inference, as well as confirmation theory in general, inference to best explanation (sometimes termed ''abduction''), and contrastive explanation (explaining why something occurred rather than something else).[6] In hypothesis testing, analysts have three major tasks: they recognize and employ the most useful strategy, given the limitations of time and the available information. Second, they integrate seemingly unrelated facts into unified

and plausible explanatory theories. And third, they compensate for the uncertainty of information by properly qualifying explanatory theories and reevaluating them at the appropriate time. Thus, hypothesis testing is the first major reasoning type for critical thinking in intelligence analysis.

Why Did It Happen? The second type of reasoning in the taxonomy dimension is causal analysis. This targets the challenge of irrelevancy: analysts must discern which of many factors truly affect the outcome of interest. Causal analysis is not merely the use of John Stuart Mill's widely known methods, such as those of agreement and difference, but also the more sophisticated methods, such as probabilistic and counterfactual causal inference.[7] Causal analysis is a complete approach to ascertaining a factor's amount and kind of efficacy. In causal analysis, analysts have three major tasks. First, they must identify and exclude all possible ''pseudo-causes'' with the appropriate strategy. This is one of the most difficult of all analytic challenges, for mere statistical correlation is no implication of causation. Analysts have to screen out dozens of different types of pseudo-causes. Second, analysts must assess an event or factor's importance by ascertaining its degree and type of efficacy. And third, analysts must anticipate the second and third order effects in a causal sequence before they happen.

What Could Happen? The third type of reasoning is counterfactual reasoning. This targets the challenge of indeterminacy: analysts must evaluate events that are not the inevitable consequences of prior causal factors, but rather one of several different possible outcomes. A ''counterfactual'' is a subjunctive conditional about some particular possibility and its consequences. That is, counterfactuals are answers to ''What If'' questions. Counterfactual reasoning is not merely simple scenario analysis, but a comprehensive system for generating, integrating, and assessing past and future possibilities and their consequences.[8] It covers all stages of analyzing alternate scenarios and their consequences. Three major tasks are present in counterfactual reasoning. First, analysts can substantiate ''after-action'' reports with an assessment of what would have happened if things had been done differently. Next, analysts can structure futures analyses with rigorous examinations of what would occur under different possible scenarios. And finally, analysts can develop creative thinking through a new sensitivity to alternate possibilities in general, and how to integrate them into precise analysis.

What Can Be Done About It? The fourth type of reasoning, strategy assessment, targets the challenge of instrumentality. Analysts must assist decisionmakers having very specific goals in the world, and the timely

decisions that they have to make to further those goals. Strategy assessment encompasses a whole series of reasoning types, including decisionmaking under risk, such as decision theory, and decisionmaking under uncertainty, including game theory.[9] It includes all forms of reasoning in which possibilities, probabilities, and goals are applied to potential threats and opportunities. Analysts have several major tasks in strategy assessment. They must formulate and evaluate possible courses of action based on the values and goals of a particular agent. Analysts seek to project an agent's actions by identifying the course of action that best advances their goals. And third, analysts explain an agent's actions by reconstructing their reasoning and clarifying how one decision came to be regarded as the best.

So, the proposed model for critical thinking's procedures in intelligence analysis runs as follows, with the procedures to be understood as a three-dimensional reality. The first consists of the *trait-axis*, that is, positive mental habits, such as rational self-evaluation (humility), clarity, precision, and fair-mindedness. The second is the *technique-axis*, or ways to assess propositions and their relationships, such as inference structure identification, assumption identification, inference structure (i.e., validity) assessment, and soundness assessment. And the last, the *taxonomy-axis*, or kinds of reasoning, such as hypothesis testing, causal analysis, counterfactual reasoning, and strategy assessment. The taxonomy-axis is fundamental to this approach for two reasons. It contains the specific thinking types that directly address the core challenges to reasoning in intelligence. And, by virtue of a trait or technique's being relevant to these reasoning types, it appears on the trait or technique axis. Therefore, any attempt to define critical thinking for intelligence analysis should take these four types of reasoning to be fundamental to the rigorous analytic procedures which ought to be applied to relevant analyst problems to produce reliable analytic products. Any approach to critical thinking that does not do so risks failing to address the real-life challenges of intelligence.

PRODUCTS OF REASONING IN INTELLIGENCE ANALYSIS

Critical thinking has been deemed almost universally to be a core skill area for intelligence analysts for two major reasons. First, critical thinking improves the analytical process. Critical thinking is better thinking. And, analysts who think critically thereby improve their thinking process. Second, critical thinking improves the products of analysis. Thus, it is better, not only in terms of the process itself, but in terms of what it produces. It substantially improves the analytical process through much more precise and sophisticated procedures, while offering the prospects of substantial improvements to the products of analysis.

Perhaps the defining of reliable analytic products should come first. After all, a more reliable product is a major reason for adopting critical thinking. But the product produced through critical thinking is always determined by the analytic procedures it employs and the problems being addressed.

The first reliable such product is best explanations. That is, analysts will infer the most plausible reason for the known facts at the present time. This is the best response to the problem of insufficiency caused by the reliance on incomplete and imperfect information. That problem leads to selecting hypothesis testing as part of the core taxonomy of reasoning, as analysts compare alternate theories in terms of their explanatory power and predictive success. Analysts who employ the most rigorous methods of hypothesis testing can be generally expected to produce best explanations.

Another product is relevant causes, whereby analysts determine the primary factors affecting an outcome. This is the best response to the problem of irrelevancy wherein analysts must discern which of many possible factors is affecting an outcome. Analysts adept at utilizing the most important methods of causal analysis can be expected to discern relevant causes.

A third product of reasoning is plausible scenarios. Here, analysts anticipate the most likely outcomes obtaining from each alternate possibility. This is the best response to the problem of indeterminacy. That problem leads to the inclusion of counterfactual reasoning as part of the core taxonomy in critical thinking's procedures, analyzing alternate scenarios and their consequences. Analysts with a background in counterfactual reasoning generally produce the likeliest scenarios.

Next are optimal decisions, where analysts identify the most useful short- and long-term conclusions of all agents. This is the best response to the problem of instrumentality, where analysts must report to decisionmakers with short- and long-term goals and time constraints. That problem led to involving strategy assessment as part of the core taxonomy of reasoning types in critical thinking's procedures. Analysts with rigorous training in strategy assessment methods can be expected to produce optimal decisions.

In offering a bold new definition of critical thinking for intelligence analysis, I did not mean to describe the specific principles of critical thinking for intelligence. Instead, I sought to illustrate the ideal cognitive skills in intelligence analysis as a ground for both education and practice and to show the need to go well beyond what normally falls under the title ''critical thinking,'' to include hypothesis testing, causal analysis, counterfactual reasoning, and strategy assessment. But the development of these methods, the vindication of their reliability, and the selection of the specific approaches within them that are most applicable in intelligence are separate issues.

While there are other challenges, the four core challenges to reasoning in intelligence are fundamental. The three-dimensional account of the

procedures for intelligence reasoning are simply those that would answer these four challenges. And, the proposed account of the products of reasoning in intelligence are the results of those procedures, when done correctly. The specific theories of the procedures on which analysts should rely are a matter for another occasion. My purpose has been to offer an ambitious new big picture of critical thinking in intelligence. On that basis, these four products should be an essential part of the reliable analytic products that result from applying rigorous analytic procedures to relevant analyst problems. Any approach to critical thinking that does not do so risks failing to address the real-life challenges of intelligence analysis.

NEW OPPORTUNITIES FOR REASONING IN INTELLIGENCE ANALYSIS

Definitions are important—they guide thinking about a subject. Hopefully I have been able to offer an ambitious and expansive new definition of critical thinking in intelligence analysis. Its problems are to be understood as the four core challenges to reasoning in intelligence: insufficiency, irrelevancy, indeterminacy, and instrumentality. Critical thinking's procedures to address these problems are construed as a three-dimensional reality of traits, techniques, and taxonomies, the latter being the most fundamental, and include: *hypothesis testing, causal analysis, counterfactual reasoning*, and *strategy assessment*. And critical thinking's products are the four ideal results of applying its procedures to its problems: *best explanations, relevant causes, probable scenarios*, and *optimal decisions*. While this is only a definition, its bold and expansive nature opens the door for many new research projects and educational development opportunities to enhance both the process of analysis and the education of analysts. Therefore, academics, educators, and practitioners interested in intelligence analysis have a new challenge to consider, and a new approach to develop, in intentionally applying rigorous analytic procedures to relevant analyst problems for reliable analytic products. They finally have a definition of critical thinking specifically for intelligence analysis.

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[1] This is so ubiquitous that it almost does not even deserve a supporting endnote. Just for the sake of thoroughness, however, here are a few examples: critical thinking is listed as one of the "core competencies" for intelligence analysis at the National Security Agency in David T. Moore and Lisa Krizan, "Core Competencies for Intelligence Analysis at the National Security Agency," in *Bringing Intelligence*

About (Washington, D.C.: JMIC Press, 2003), pp. 95–132. The DIA's (Defense Intelligence Agency) Objective 3.3, in its *Strategic Plan: 2007–2012* is to "foster critical thinking and promote long-term strategic analysis and warning through the use of advanced research methods and techniques" (http://www.dia.mil/thisisdia/strategicplan.htm). In testimony to Congress on 10 September 2007, FBI Director Robert Mueller stated that the FBI had developed basic training for its analysts in "foundational skills in critical thinking, writing, and speaking—core competencies of the analytic art" (http://www.fbi.gov/congress/congress07/mueller091007.htm). ONCIX lists critical thinking in its account of the "universal counterintelligence core competencies" in its *Fundamental Elements of the Counterintelligence Disciple, Vol. 1: Universal Counterintelligence Core Competencies*, 2006. http://www.ncix.gov/publications/reports/UCR_formatted_UNCLASSIFIED_version_with_cover.pdf

[2] A notable exception to this occurs in David T. Moore, *Critical Thinking and Intelligence Analysis* (Washington, D.C.: JMIC Press, 2006). While Moore's primary intention is to demonstrate the general utility of critical thinking in intelligence analysis by illustration of what I term the positive mental habits model, he goes on to, in effect, urge that intelligence analysis requires a further model of critical thinking. For example, he suggests the importance of distinguishing between types of reasoning, such as deductive/inductive/abductive. Nothing in this article should be construed as in any way hostile to Moore's proposals. In fact, my intention is intended to reflect and extend that same spirit, but from an academic/education/external perspective rather than a practitioner/training/internal perspective.

[3] This approach to critical thinking is found in many sources: a few examples include: Gregory Bassham, William Irwin, Hendry Nardone, and James M. Wallace, *Critical Thinking: A Student's Introduction* (Boston: McGraw Hill, 2005); Irving I. Copi, Carl Cohen, and Daniel E. Flage, *Essentials of Logic* (Upper Saddle River, NJ: Pearson Prentice Hall, 2007); William Hughes and Jonathan Lavery, *Critical Thinking: An Introduction to the Basic Skills* (New York: Broadview Press, 2004); Ronald Munson, David Conway, and Andrew Black, *The Elements of Reasoning* (Belmont, CA: Wadsworth, 2004); Joel Rudinow and Vincent E. Barry, *Invitation to Critical Thinking* (Belmont, CA: Wadsworth, 2004); Lewis Vaughn, *The Power of Critical Thinking* (New York: Oxford University Press, 2008).

[4] Without question, this approach is most intimately associated with, and best represented by, the work of Paul and Elder. See Richard Paul and Linda Elder. *Critical Thinking: Learn the Tools the Best Thinkers Use* (Upper Saddle River, NJ: Pearson Prentice Hall, 2006).

[5] A properly structured deductive argument will be such that it is impossible that the premises are true and the conclusion false. Thus, deductive inference is limited to contexts where it is possible for there to be certain (i.e., probability 1.00) consequences or implications of particular events or facts. A properly structured inductive argument, i.e., generalization, particularization, or analogy, will be such that the conclusion will infer that some entity has a property shared by the entities in one's premises. Thus, inductive inference is limited to contexts that conclude that something similar to the past will occur in the future. But neither of these contexts

seems generally appropriate in intelligence where the challenges of *insufficiency, irrelevancy, indeterminacy*, and *instrumentality* are fundamental. Thus, these forms of reasoning are at best of only secondary importance in intelligence.

[6] The literature on hypothesis testing from contemporary philosophy of science is enormous. A few varying sources include: Luc Bovens and Stephan Hartmann, *Bayesian Epistemology* (New York: Oxford University Press, 2003); John Earman, *Bayes or Bust: A Critical Examination of Bayesian Confirmation Theory* (Cambridge, MA: MIT Press, 1992); Colin Howson and Peter Urbach, *Scientific Reasoning: The Bayesian Approach* (Open Court, 2006); Peter Lipton, *Inference to Best Explanation* (London and New York: Routledge, 2004); Richard Swinburne, *Epistemic Justification* (New York: Oxford University Press, 2001). While none of these has any particular focus on intelligence, they discuss the kinds of approaches to hypothesis testing that, in my mind, should be developed and applied to intelligence analysis as part of this new approach to critical thinking.

[7] Sources in causal analysis are also plentiful. A few worth mentioning include: John Collins, Ned Hall, and L.A. Paul, eds., *Causation and Counterfactuals* (Cambridge, MA: MIT Press, 2004); Ellery Eells, *Probabilistic Causality* (New York: Cambridge University Press, 1991); Ronald N. Giere, John Bickle, and Robert F. Mauldin, *Understanding Scientific Reasoning* (Belmont, CA: Wadsworth, 2006). Again, while none of these sources takes up intelligence analysis, the approaches they discuss are the sorts of things that should be expanded and applied to form an adequate approach to critical thinking in intelligence analysis.

[8] As yet, there really is no formal field investigating counterfactual reasoning *per se.* Instead, several specialized approaches to counterfactuals emanate from different perspectives. Logical approaches to the relationships between counterfactual statements include Jonathan Bennett, *A Philosophical Guide to Conditionals* (New York: Oxford University Press, 2003); Igal Kvart, *A Theory of Counterfactuals* (Indianapolis, IN: Hackett, 1986); David Lewis, *Counterfactuals* (New York: Basil Blackwell, 1973). More practical "thought experiment" approaches to past-directed counterfactuals include Philip E. Tetlock and Aaron Belkin, eds., *Counterfactual Thought Experiments in World Politics* (Princeton, NJ: Princeton University Press, 1996); Philip E. Tetlock, Richard Ned Lebow, and Geoffrey Parker, eds., *Unmaking the West: "What If" Scenarios That Rewrite World History* (Ann Arbor, MI: University of Michigan Press, 2006). Descriptive psychological approaches to counterfactuals include Daniel Kahneman and Dale Miller, "Norm Theory: Comparing Reality to Its Alternatives," *Psychological Review*, Vol. 93, 1986, pp. 136–153; Daniel Kahneman, "Varieties of Counterfactual Thinking," in Neal J. Roese and James M. Olson, eds., *The Social Psychology of Counterfactual Thinking* (Mahwah, NJ: Lawrence Erlbaum Associates, 1995), pp. 1–56; Neal J. Roese and James M. Olson, "Counterfactual Thinking: A Critical Overview" and "Functions of Counterfactual Thinking," in Neal J. Roese and James M. Olson, eds., *The Social Psychology of Counterfactual Thinking* (Mahwah, NJ: Lawrence Erlbaum Associates, 1995), pp. 1–56, 169–198. And, while not counterfactual reasoning by name, some related approaches to future-directed scenario analysis include Edward Cornish, *Futuring: The*

Exploration of the Future (Bethesda, MD: World Futures Society, 2004); Gill Ringland, *Scenario Planning* (New York: John Wiley & Sons, 1998); Peter Schwartz, *The Art of the Long View: Planning for the Future in an Uncertain World* (New York: Doubleday, 1991). I recommend a unified approach that synthesizes elements of these perspectives in order to address the multifaceted challenge of indeterminacy in intelligence.

[9] The fields of decision theory and game theory are also enormous. Some more introductory approaches include: Steven J. Brams, *Game Theory and Politics* (New York: The Free Press, 1975), *Rational Politics* (Washington, D.C.: CQ Press, 1985); Peter Gärdenfors and Nils-Eric Shalin, *Decision, Probability, and Utility: Selected Readings* (Cambridge, MA: Cambridge University Press, 1988); Richard Jeffrey, *The Logic of Decision* (Chicago: University of Chicago Press, 1983); Rose McDermott, *Risk-Taking in International Politics* (Ann Arbor, MI: University of Michigan Press, 1998); James D. Morrow, *Game Theory for Political Scientists* (Princeton, NJ: Princeton University Press, 1994). Again, these sources do not necessarily directly address intelligence analysis, but represent the sorts of approaches that I advocate be developed and adapted in intelligence analysis for a more adequate theory of critical thinking.