Critical Thinking in the Intelligence Community: The Promise of Argument Mapping

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Abstract

It is unfortunate that so much turns on the practices of argument construction and critique in intelligence analysis, for example, because these practices are fraught with difficulty. However, the recently developed technique of argument mapping helps reasoners conduct these practices more thoroughly and insightfully, as can be shown in an extended illustration concerning Iraqi nuclear activities circa 2002. Argument mapping offers other benefits, as well. Its ultimate value, though, will depend on how its advantages compare to those of competitor reasoning methodologies.

Keywords: argument mapping, intelligence analysis, critical thinking, argument analysis, reasoning, assumptions, Rationale, comity, disagreement, creativity, logical structure, standard form arguments

I. Introduction: The Challenges of Critical Thinking

Critical thinking is hard—really hard. There are several aspects to this. For one, it can be arduous, requiring great exertions, a feature that discourages its practice. For another, it can be psychologically painful to confront thinking challenges that test the limits of our abilities. But it is not the effort or the pain that is the most costly aspect; it is our general inability to execute critical thinking successfully. We invest the effort, perhaps suffer the pain, yet nevertheless fail to reach the goal of gaining whatever relatively solid degree of truth or insight ought to be attainable if only we could overcome our blind spots and reasoning deficiencies. If only thinking were arduous, even painful, but could be guaranteed to produce results without defects, we would be far better off than we now are.

Why is critical thinking so highly difficult—it's tempting to say "nearly impossible"—to execute fully effectively, that is, reliably without error or oversight? Well, issues that we wish to think through are often highly complex, with many and wide-ranging considerations that appear to be somehow relevant. And these diverse considerations are often relevant only in uncertain, and sometimes ultimately non-existent, ways. Moreover, generally there are considerations that are relevant yet hidden from us. In some cases, and perhaps in all, these considerations remain buried within assumptions that we unwittingly make during reasoning. Some of these may yield themselves up to mechanical methods of reflection upon our reasoning, but others lack helpful conceptual connections to our conscious reasons and so are elusive. And we possess no systematic procedure for searching the abstract space of ideas where these hidden considerations reside—no card catalog or google search. We seem to need to rely on the serendipity and mystery of individual insight to come up with novel angles on issues—and, moreover, we're unable to know when the set of consequential new angles becomes exhausted. Thus the task of uncovering all the possible considerations that might be germane to a given inquiry can be highly challenging. Still more challenging, perhaps, is the task of understanding and clarifying every one of the relevant considerations that do come to notice, and integrating each with all the rest so that it might interact edifyingly within a single, coherent overall inquiry. Even more difficult can be working out the precise logical relationships that define these many

interactions among the diverse considerations. Unfortunately, knowing about these pitfalls of informal reasoning does not dependably eliminate our vulnerability to them. And, finally, there remain the demands of evaluating all the distinct considerations, of formulating judgments in the absence of clear-cut criteria and then weighting and combining these.

The upshot is that an individual's thinking, even thinking that is critical, remains ever susceptible to error. Nor does collaborative thinking, in groups, overcome these difficulties. While it assists in some ways, it hinders in others, as it adds its own new layer of complication and possible disorganization, as well as its own characteristic processes of misguiding influence and bias.

And yet there are few abilities, if any, whose practical value exceeds that of critical thinking. Nearly all college faculty say that developing students' abilities to think critically is a "very important" or "essential" goal of undergraduate education" (Arum and Roksa 2011, p. 35). Hence we see educators' efforts—large, and still growing—to develop these abilities in students.

II. Growing Interest in Critical Thinking Skills: The Case of the U.S. Intelligence Community

The dawning awareness of critical thinking's vital importance extends outside the academy, too. Businesses, for example, are beginning to recognize the value of employees who, with improved thinking skills, can avoid costly stumbles and generate innovative solutions. The United States government, specifically its Intelligence Community, has recognized that its mission can be jeopardized if gathered intelligence fails to be analyzed and synthesized with precision, rigor, thoroughness, and the other traits of critical thinking (see, e.g., Elder & Paul 2010, 2008; Ennis 2013). A strong prod was provided by the WMD Commission Report (2005), a detailed critique of "one of the most public—and most damaging—intelligence failures in recent American history" (p. 3):

> On the brink of war, and in front of the whole world, the United States government asserted that Saddam Hussein had reconstituted his nuclear weapons program, had biological weapons and mobile biological weapon production facilities, and had stockpiled and was producing chemical weapons. All of this was based on the assessments of the U.S. Intelligence Community. And not one bit of it could be confirmed when the war was over. (p. 3)
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> …
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> This failure was in large part the result of analytical shortcomings; intelligence analysts were too wedded to their assumptions about Saddam's intentions. (p. 3)
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> …
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> [G]iven the difficulties inherent in analyzing WMD [weapons of mass destruction] programs—and the serious consequences for judging the capabilities and intentions of such programs incorrectly—it is imperative that the analysis on which such judgments are based be as rigorous, thorough, and candid as possible. In the case of Iraq, the analytical community fell short of this standard. (p. 168)

The Commission's assessment led it to propose "broad and deep change in the Intelligence Community" (p. 5), including improvements intended to correct serious flaws in the intelligence analysis process. For example:

> Analytic "tradecraft"—the way analysts think, research, evaluate evidence, write, and communicate—must be strengthened. In many instances, we found finished intelligence that was loosely reasoned, ill-supported, and poorly

> communicated. Perhaps most worrisome, we found too many analytic products that obscured how little the Intelligence Community actually *knew* about an issue and how much their conclusions rested on inference and assumptions. (p. 12)

The central problem is apparently not a matter of analysts having insufficient motivation, smarts, or devotion to duty; they are reputed to be "knowledgeable, dedicated, and conscientious" (Rieber 2011), "bright, dedicated, and deeply committed professionals" (WMD 2005, p.17; see also p. 4 and p. 389). It is, rather, analysts' ineffective methods for handling the challenges of analytical critical thinking.

One response to the perceived need for improvement was the stipulation, in a 2008 Intelligence Community Directive, that critical thinking is a "core competency" for all employees (ICD 610). Another was the creation of the *CIA Tradecraft Primer* (2009), apparently modeled after a similar primer developed in 2008 for the Defense Intelligence Agency's Directorate for Analysis in support of analyst training courses. It is noteworthy that the CIA version adds a Key Assumptions Check technique, evidently driven by a reasonable concern that the perspectives with which analysts make sense of the world—their "mental models," or "mind-sets," or "frames"—"can cause analysts to overlook, reject, or forget important incoming or missing information that is not in accord with their assumptions and expectations" (2009, p. 1):

> The key risks of mind-sets are that: analysts perceive what they expect to perceive; once formed, they are resistant to change; new information is assimilated, sometimes erroneously, into existing mental models; and conflicting information is often dismissed or ignored. (2009, p. 1).

Indeed, the WMD Commission had expressly faulted the Intelligence Community's inquiry into Iraqi WMD for its overreliance upon unacknowledged assumptions:

> The Community failed to explain adequately to consumers the fundamental assumptions and premises of its analytic judgments. … Flagging the logical premises and baseline assumptions for the ultimate judgment would produce a better understanding by policymakers of the possible logical weaknesses in the assessment. It also would likely improve the analytic process as well, by forcing analysts themselves to articulate clearly their operative assumptions. (2005, p. 176)

The *CIA Tradecraft Primer* notes that "analysts often rely on stated and unstated assumptions to conduct their analysis" (2009, p. 7), as when, for instance, "political analysts reviewing a developing country's domestic stability might unconsciously assume stable oil prices" (p. 7). Hence "Rechecking assumptions … can be valuable at any time prior to finalizing judgments, to insure that the assessment does not rest on flawed premises" (p. 7). The goal of the Key Assumptions Check is to make these key assumptions explicit.

Unfortunately, the Primer has no specific advice about how to do this. The closest it comes is recommending that an analyst "[a]rticulate all the premises, both stated and unstated in finished intelligence, which are accepted as true for this analytic line [i.e., the currently accepted contention or position] to be valid" (p. 9). A good idea, but it is supplemented with no concrete, practically-usable advice for how to achieve the objective.

At this point, the story shifts to Office of the Director of National Intelligence (ODNI), created by act of Congress in 2004 to serve at the head of the 15 agencies, offices, and elements of organizations within the Executive Branch of the U.S. government that constitute the Intelligence Community and to serve as principal adviser to the President on intelligence matters related to national

security (WMD 2005, pp. 579-85). Within the ODNI's Analytic Integrity and Standards Group, there arose an initiative to improve intelligence analysis, first, by creating testable proficiency standards for critical thinking—these could inform analysts of their needs for additional training, guide incentive systems for development and maintenance of critical thinking skills, pinpoint those who might serve as mentors and expert reviewers, and allow for comparative evaluation of the efficacy of analytic techniques (Rieber 2010). The second route to improvement of intelligence analysis would be the development of improved courses for raising analysts' critical thinking skills demonstrably on the new proficiency tests.

At the time, intelligence analysts received only one or two weeks of training in critical thinking—by contrast with the one or two *years* of full-time study provided for study in a foreign language (Rieber 2010). It might have been expected that any needed upgrade could be provided by analysts simply taking a semester-long critical thinking course of the type that has become standard at universities in the English-speaking world. Yet recent research paints a bleak picture of the effectiveness of such courses: not only is there little measured development of critical thinking abilities derivable from the taking of college courses generally (e.g., Arum & Roksa 2011; Pascarella & Terenzini 2005), but even for those taking dedicated critical thinking courses the story is not as much better as would be hoped (Alvarez 2007). Standard critical thinking courses apparently do not provide the degree of improvement in reasoning ability that educators seek and expect from them.

However, tantalizingly promising results have been obtained in recent years with a novel approach: critical thinking courses that employ "Lots of Argument Mapping Practice" (LAMP). Utilizing computers loaded with software, such as *Rationale*™, that is specifically designed for displaying the logical architecture of an argument (i.e., of the reasoning for and/or against some contention) in graphical form (as a tree-structure diagram) and in ordinary language (without needing the symbolisms of formal logic), students repeatedly construct, manipulate, and assess such 'maps' of textual arguments. As a result, they display encouraging improvements in critical thinking (see Davies 2012b, pp. 20-23).

Hence the Intelligence Community, via its Intelligence Advanced Research Projects Activity (IARPA, the intelligence correlate of the more well-known Department of Defense's DARPA) sponsored a "Seedling Project" for development of a LAMP course aimed at "Significantly Increasing Intelligence Analysts' Critical Thinking Ability." My own involvement with this project, which was headquartered at the University of Melbourne under Dr. Neil Thomason, came about by chance. An early 2011 presentation on argument mapping given by Dr. Steven Rieber of the ODNI alerted me to the method's potential and the prospects for teaching a well-thought-out LAMP course to my own students.

The IARPA-project critical thinking course turned out to be fascinating to construct and challenging to implement, and it became clear that there are variables in course design and delivery that may have important impacts upon the course's effectiveness in improving critical thinking. (Additional issues are raised by the imperative to provide objective measurements of critical thinking ability.) But I leave discussion of these classroom experiments to a follow-up article.

III. The Utility of Argument Mapping in Reasoning: A Detailed Illustration

We see, then, that the U.S. Intelligence Community has perceived a need for better analytical performance, particularly in the awareness and handling of assumptions within analysts' lines of reasoning. And it conjectures, quite reasonably given the recent research, that critical thinking training based

upon computer-aided argument mapping will significantly improve these crucial skills of analysts.

But might argument mapping be more than merely a way to enhance reasoning competence generally? Can it serve directly as a tool to enhance critical thinking performance in particular cases? Can it be productively used, that is, not merely in a training regimen, as a developmental aid to be set aside when the focus shifts from growth of skills to exercise of skills, but also as a cognitive prosthesis that augments reasoners' mental abilities in concrete instances?

An affirmative answer will present itself if we consider, in detail, a specific example coming out of the WMD Commission's critique of the intelligence failures regarding Iraq's nuclear program in the early 2000s. This will demonstrate how, in actual moment-to-moment practice, analysts—or higher-up reviewers or supervisors—might, with the aid of argument mapping, effectively articulate, elaborate, critique, and revise lines of reasoning that have been created by more traditional means.

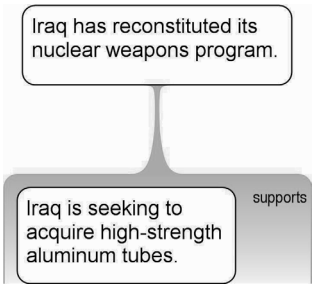
Much of the U.S. Intelligence Community, circa 2002, took the position that Iraq had reconstituted, or was in the process of reconstituting, its nuclear weapons program. Most of those who reached this conclusion relied, in significant part, on the following sort of reasoning:

> ***We believe that Iraq has reconstituted its nuclear weapons program. In outrageous defiance of the international community, Iraq is seeking to acquire high-strength aluminum tubes from abroad. These tubes, because they are made of 7075-T6 aluminum and are built to such high tolerances, are suitable for constructing centrifuges to make highly enriched uranium, but not for constructing conventional rockets that Iraq might use for other aggressive purposes.***

This seems, on the face of it, to be quite straightforward and credible. But is that because we are failing to assess the reasoning critically? Because we are unwittingly content to make the same assumptions as are made in the argument—assumptions that might turn out to be dubious or false?

With the tool of argument mapping, our goal is to reconstruct this argument in a more revealing text+graphics form that will facilitate insightful development and critique of it. We aim at producing a reconstruction that is both *accurate*, capturing what reasoners offering such a textual argument actually thought, and *charitable*, crediting them with as good an argument as their words will reasonably allow.

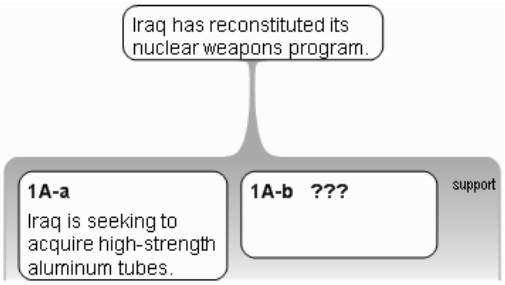
We can begin by displaying, with the *Rationale* software, the overall contention with which the statement of the argument begins, along with (below it) the central reason offered immediately afterward for believing this contention true.



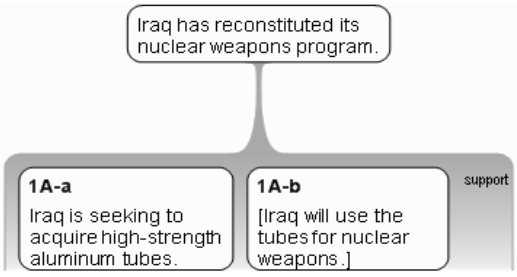
The map says, in essence, "Given that Iraq is seeking to acquire high-strength aluminum tubes, we infer (conclude) that Iraq has reconstituted its nuclear weapons program." Notice that we have pared away the 'editorial commentary' ("In outrageous defiance of the international community") and other superfluous verbiage ("We believe that," "from abroad") that, while it might serve various communicative, expressive, and psychological functions, has no apparent bearing upon the truth of the contention or how that truth is supposedly derivable from the offered reason. And notice that the use of mapping does not itself tell the mapper either *that* this refinement of the claim ought to be done, or *how* it ought

to be done. Mapping makes argument analysis easier in some ways, but it is just a tool whose effectiveness depends upon the artfulness with which it is used. Even if its use does enlarge the capacities of its user, as seems to be the case (and as is the case with, say, hand tools, by contrast with self-contained, autonomous tools, like mathematical calculators, that leave their users basically unchanged), successful argument mapping does draw heavily upon the pre-existing logical and interpretive abilities and background knowledge brought to it by the mapper.

But the reason offered in the map we have created, even if true, surely doesn't entitle anyone to draw the conclusion above it. The reason as mapped contains one premise, but clearly needs something additional for logic to permit the contention to be inferred. (A single reason may, and typically does, consist of a number of distinct statements serving as premises.)



Yet the original argument does not specify what this extra something is. Looking at the offered premise 1A-a, however, together with the contention above it that is the reasoning's objective, and utilizing our intuitive understanding of logic, we can see that something like the following claim 1A-b seems to be required:

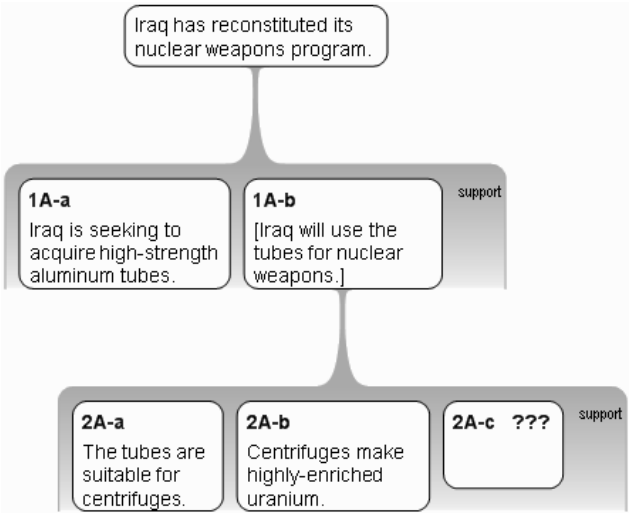


1A-b is an *unstated* part of the argument, an implicit assumption, and is helpfully designated as such by being placed within brackets.

Now look at the further reasoning offered in the original text's third and final sentence.

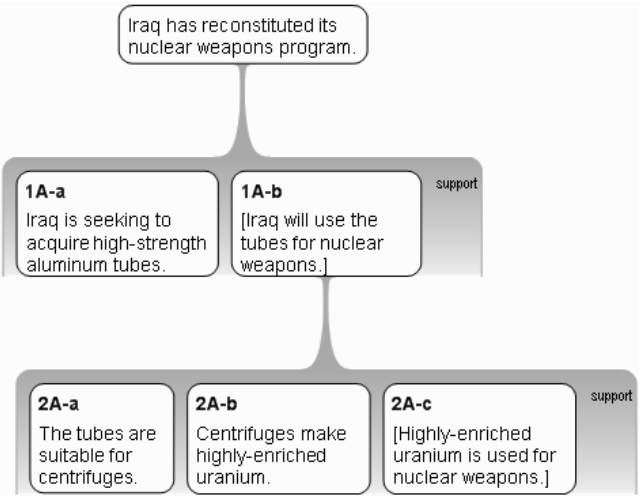
> ***… These tubes, because they are made of 7075-T6 aluminum and are built to such high tolerances, are suitable for constructing centrifuges to make highly enriched uranium, but not for constructing conventional rockets that Iraq might use for other aggressive purposes.***

To support which claim(s) in our map are these further considerations offered? The central idea in the sentence is that the aluminum tubes, due to such-and-such, "are suitable for constructing centrifuges to make highly enriched uranium" but not for other purposes. Integrating this idea into our map, it seems to offer support not for 1A-a—as it has nothing to do with the truth of whether or not Iraq is actually seeking the tubes—but for 1A-b. It's because of the tubes' utility for enriching uranium that Iraq will use them for nuclear weapons. Let's modify the map to reflect this.

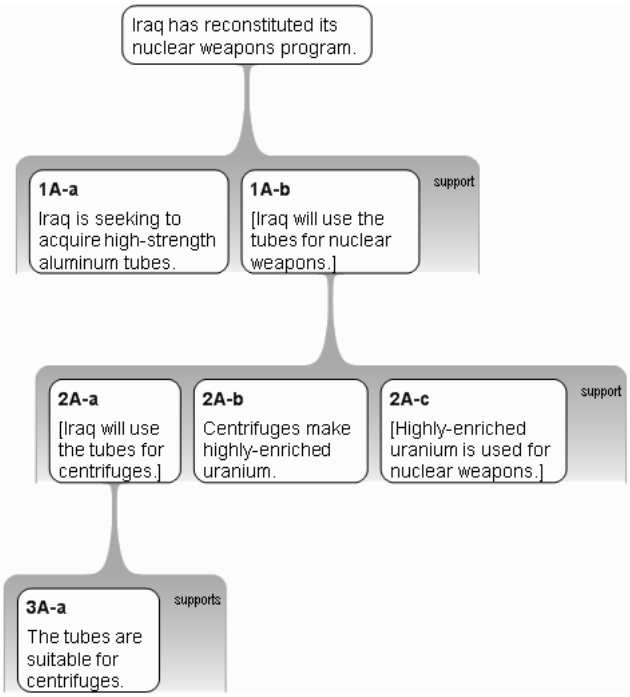


There is a need to leave space within reason 2A for a 2A-c 'copremise' because without more, 2A-a and 2A-b will not by themselves permit any inference about nuclear weapons.

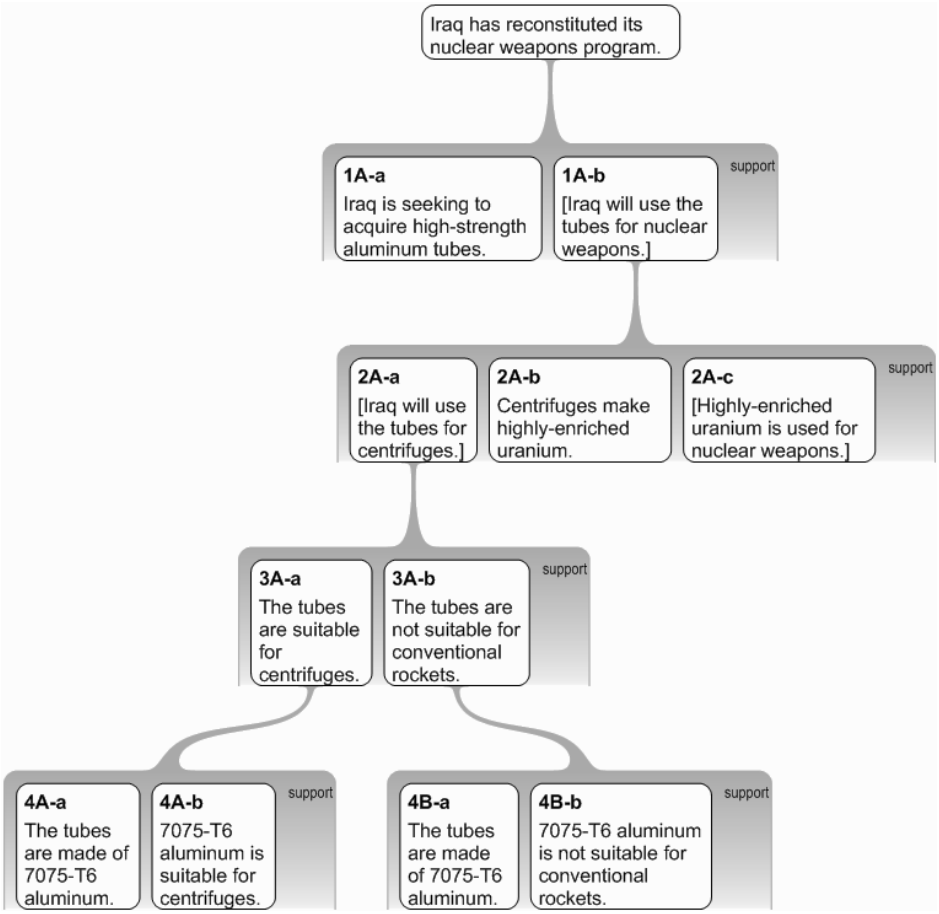
Their claims concern only tubes, centrifuges, and uranium; any linkage to nuclear weapons is merely assumed. But *in reconstructing arguments, and charitably rendering them as plausible as realistically possible, we need to make all such assumptions overt in order that we can then critically examine them.* So within reason 2A there must be an explicit connection drawn to the nuclear weapons that are referred to in 1A-b—perhaps by adding an additional premise like this one in 2A-c:



The entire reason 2A does now warrant a conclusion that these special aluminum tubes are suitable for use in constructing nuclear weapons. But there is still some reasoning to the statement in 1A-b that remains below ground. For the copremises constituting reason 2A say nothing about *Iraq* specifically, and whether Iraq *will* so use the tubes. So it seems that the intelligence analysts making this argument are thinking, not just what was stated in the argument text, namely that the tubes are *suitable* for centrifuges, but also that *the Iraqis will use them for this purpose*. It is this latter claim that properly belongs in position 2A-a. In other words, the more general assertion, that "the tubes are suitable for centrifuges," is actually only *support for* a claim that expresses a more specific hidden assumption about what the Iraqis will do with the tubes. To appropriately depict this logical support relationship, the general assertion needs to be placed in the map *underneath* the specific claim:



Now when we consider the support relationship between 3A-a and 2A-a, it is clear that even if something is *suitable* for use U, this gives little reason to believe that it *will be used* for U by a given party. So reason 3A needs to be expanded beyond premise 3A-a if it is to support 2A-a adequately. As it happens, the original argument's third sentence does offer additional reason to believe that Iraq will use the tubes for centrifuges: their material makes them suitable for centrifuges *but not conventional rockets*. Skipping ahead a bit, we can map the argument this way:

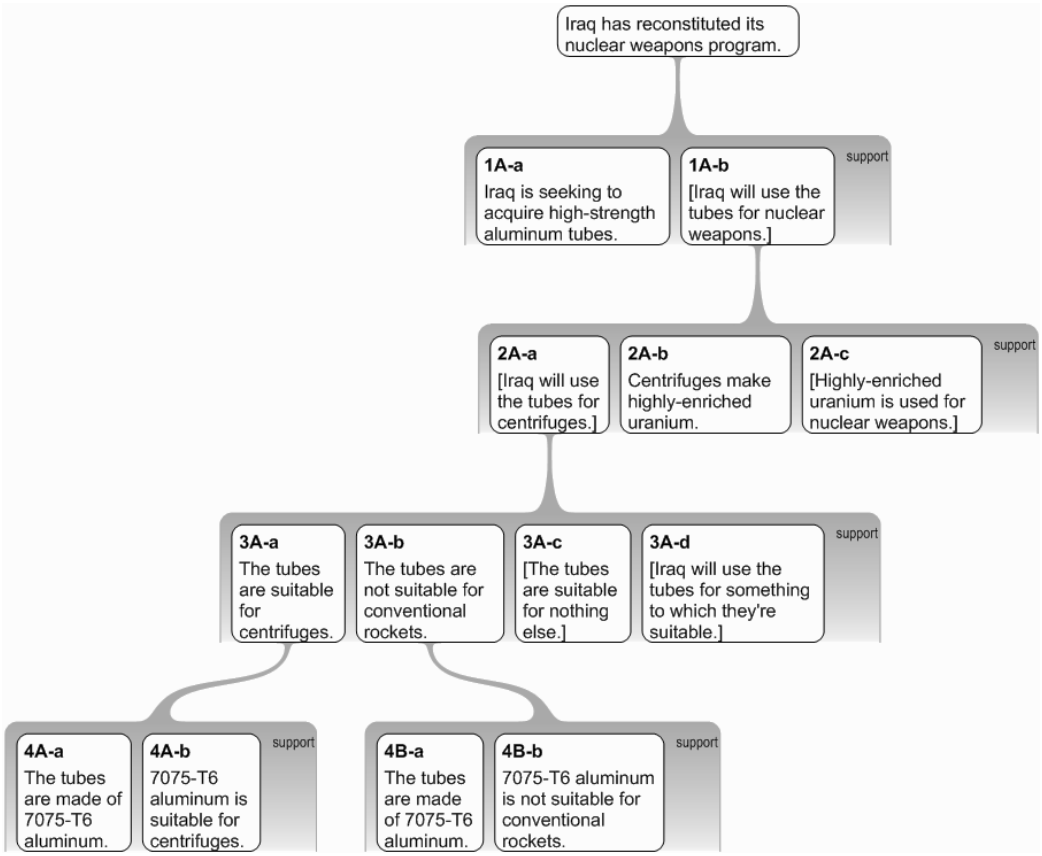


With the addition of copremise 3A-b and reasons 4A and 4B, we seem now to have integrated into our map all but one piece of the relevant explicit content in the analysts' argument that Iraq has reconstituted its nuclear weapons program. But we are far from done with the argument reconstruction.

For one thing, we have not yet exhausted the ready opportunity afforded us by the map to scrutinize the logic of the argument and see if other pieces of the reasoning remain covert. Faced with an argument map, the critical thinker—perhaps an enlightened supervisory analyst in this case—can readily examine every vertical relationship between a reason ("support" box) and the conclusion that it supposedly supports (the white claim box above it), asking whether the requisite support is actually present. We most recently applied such scrutiny to the vertical relation between 3A and 2A-a, and were led to add a second copremise, 3A-b, to reason 3A.

But wait: are we satisfied that 3A has thus been made adequate to justify a belief in 2A-a?

Surely not. For one thing, we have not ruled out *other* possible uses for the aluminum tubes, uses that the Iraqis might perhaps have had in mind. For another—a somewhat subtler point—the analysts are assuming, perhaps questionably, that the Iraqis will abide by the realities of the tubes' suitability.

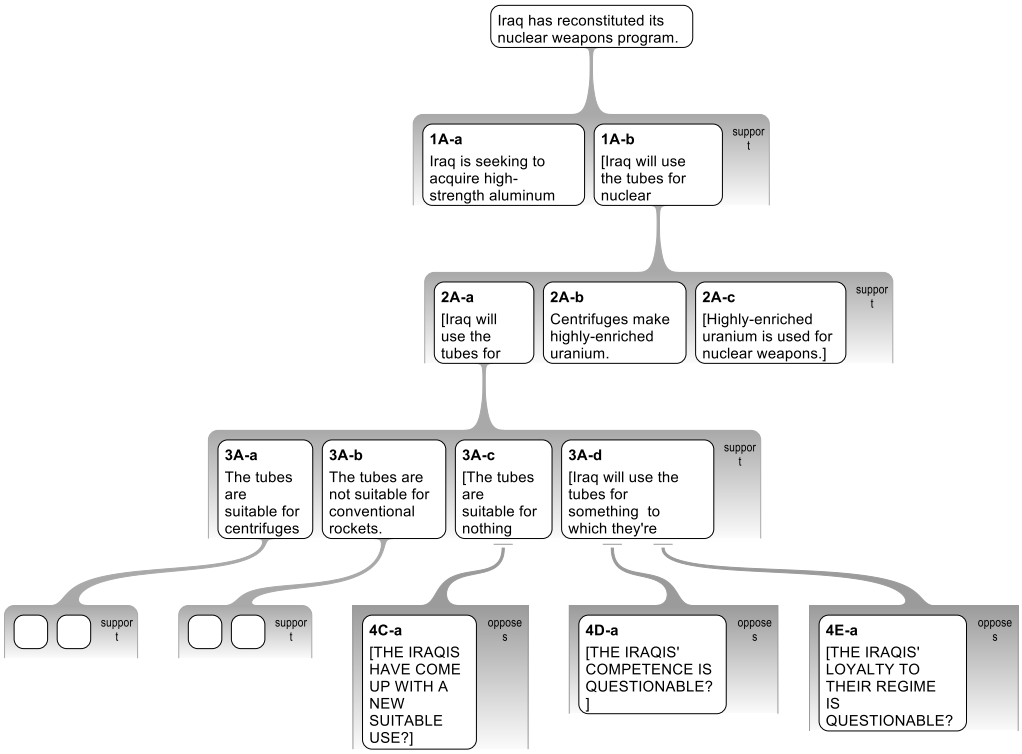


So we need to add at least two unstated premises to reason 3A: 3A-c and 3A-d.

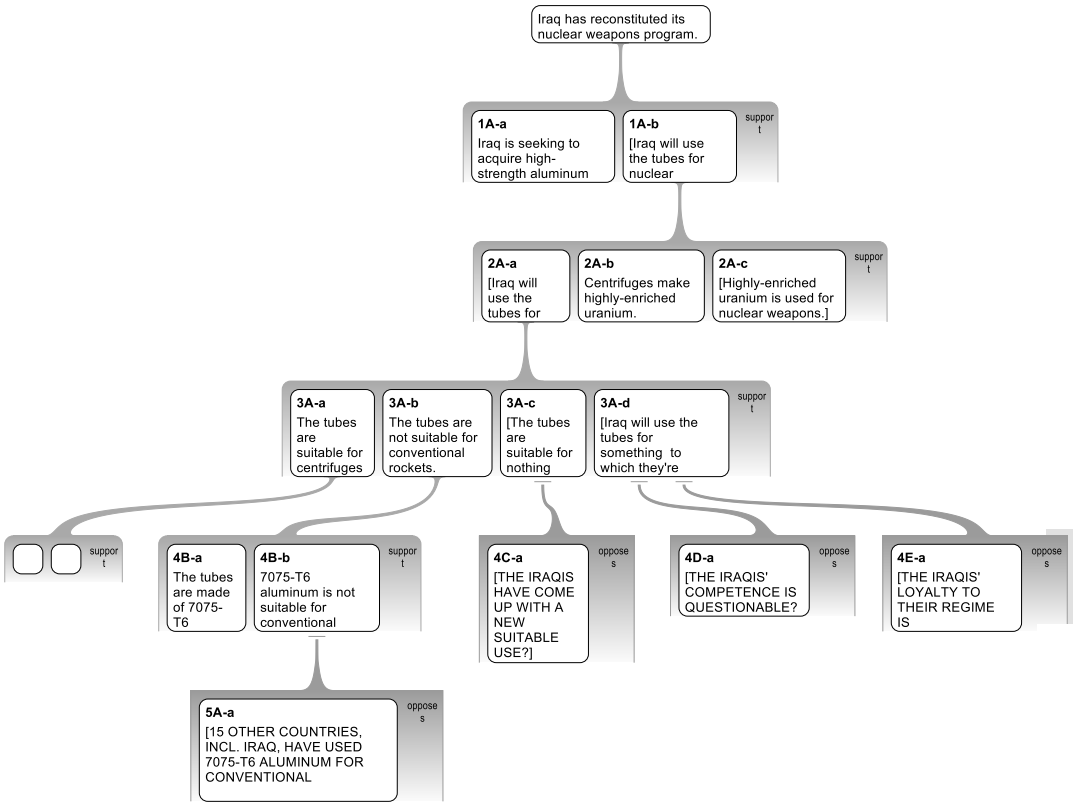
This is one way to reconstruct 'what the analysts were thinking here.' But it's not the only way. We could, for instance, impute to them an alternative 3A-c, "The tubes are *less* suitable for all other possible uses," plus an alternative 3A-d, "Iraq will use the tubes for something to which they're *most* suitable." In general, there are multiple reasonable maps that can be built from any given argument text, because given a text in which only some of the pieces are explicit, there are multiple ways to supplement it with implicit pieces that allow all to be woven into a coherent whole.

But let's stick with our original 3A reconstruction, so that we may embark upon the next phase of our analysis. In an argument map constructed with *Rationale*, *objections* that oppose particular claims appear in red, making it easy to distinguish these from the green reasons in favor of the claims. Since these colors cannot be reproduced here, we will put objections in UPPER-CASE LETTERING to distinguish them from reasons. If we then see an expanse of green (or, in our case, lower-case lettering) in a *Rationale* map, we can take this to indicate that the premises relied upon have likely not been subjected to sufficient critical questioning. We are then called upon to search out additional objections, in order to ensure that our reasoning relies only on premises that have withstood serious challenge.

Applying this to our two most recent copremise additions to the map, we (or a hypothetical supervisor analyst) can quickly think of some possible objections. Let's display these, conserving space by using *Rationale*'s handy option for collapsing claim boxes:

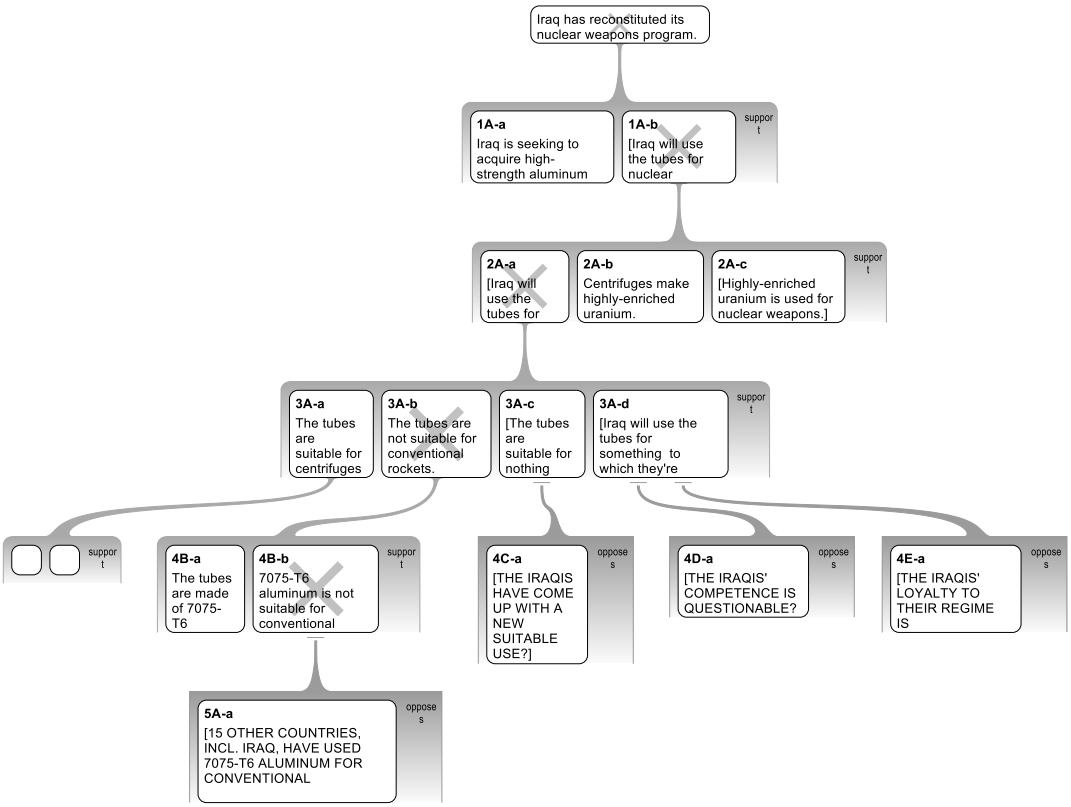


In fact, the WMD Commission found reason to doubt also the support offered for 3A-b, namely the claim in 4B-b that "7075-T6 aluminum is not suitable for conventional rockets." As it turns out, numerous countries have managed to use this aluminum for just that purpose—including Iraq itself (WMD 2005, p. 67). So we can add another objection 5A-a to the map:

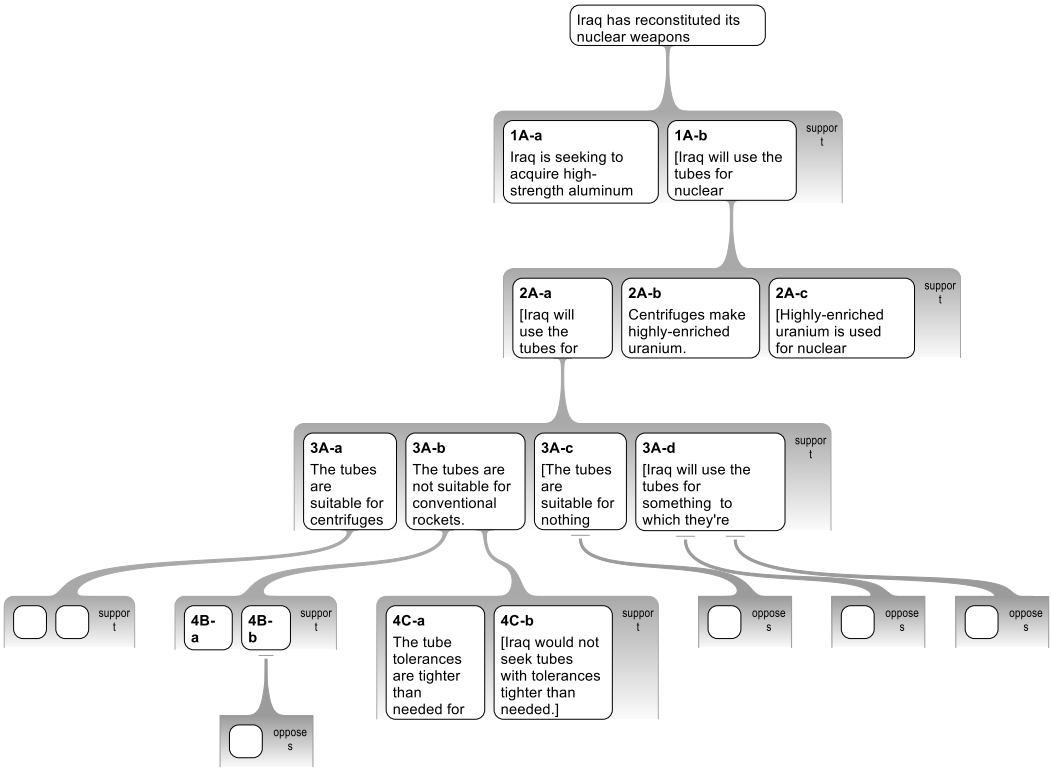


There are still further questions that remain to be added to the map—directions for further inquiry that a careful mapping will have helped uncover—but first notice how mapping helps reasoners grasp the larger, structural significance of individual argument units. Not only does a map show which considerations belong to which lines of reasoning, and which claims work together (horizontally) as contrasted with supporting one another (vertically); it also makes it easy to see the logical implications of a successful objection to any given claim. If a particular claim should be undermined, discovered to be untrue, does this also undermine an entire line of argument? If so, are there other lines that survive unscathed to support the ultimate contention?

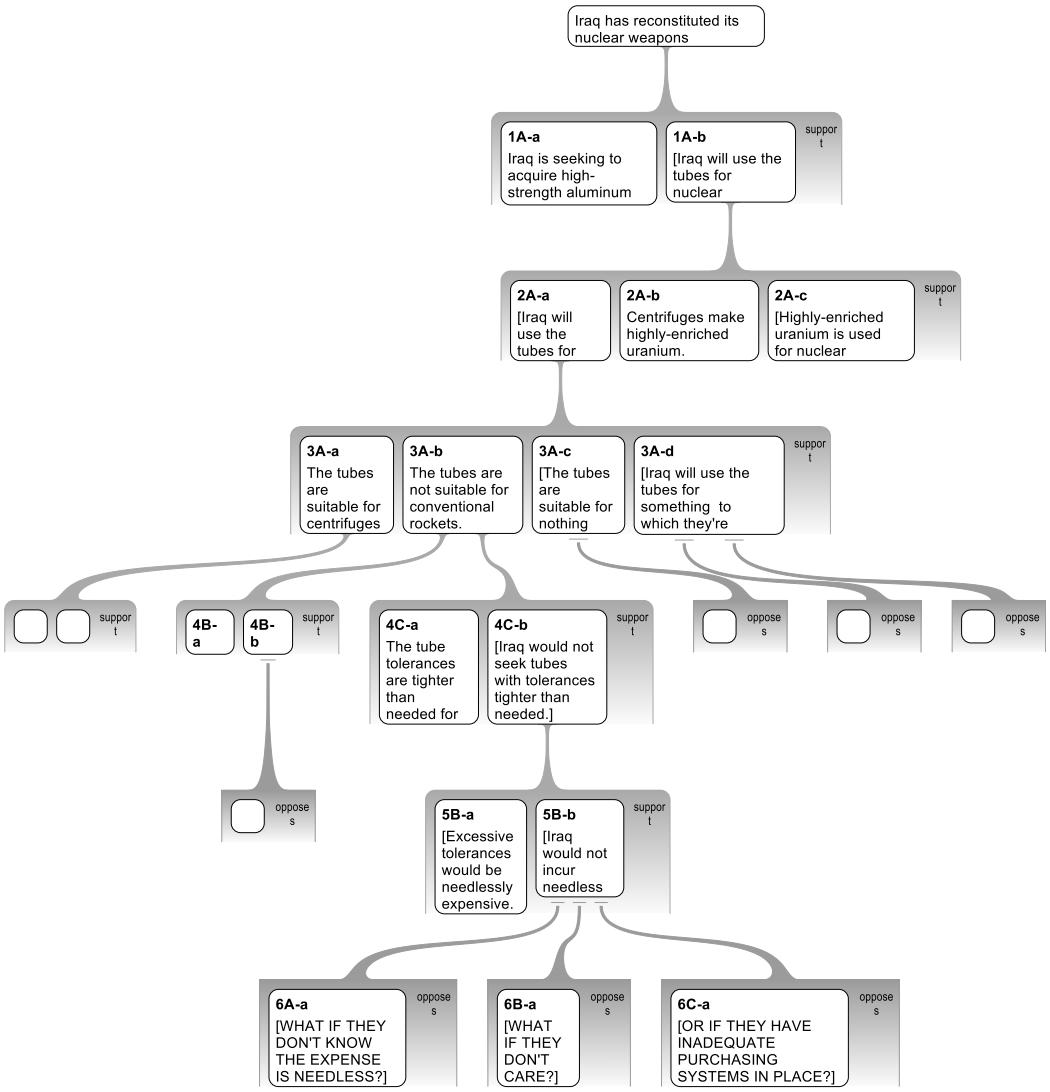
In our example, the potent objection 5A-a seems to spell potential catastrophe for the analysts' overall position: If it renders 4B-b false, this removes 4B as a support for 3A-b, which, unless some *other* support can be found, cancels the reason to believe 3A-b … which does likewise for 2A-a … then 1A-b … then the overall contention itself. The upwardly spreading logical infection can be nicely highlighted in *Rationale* by superimposing X's on the affected components:



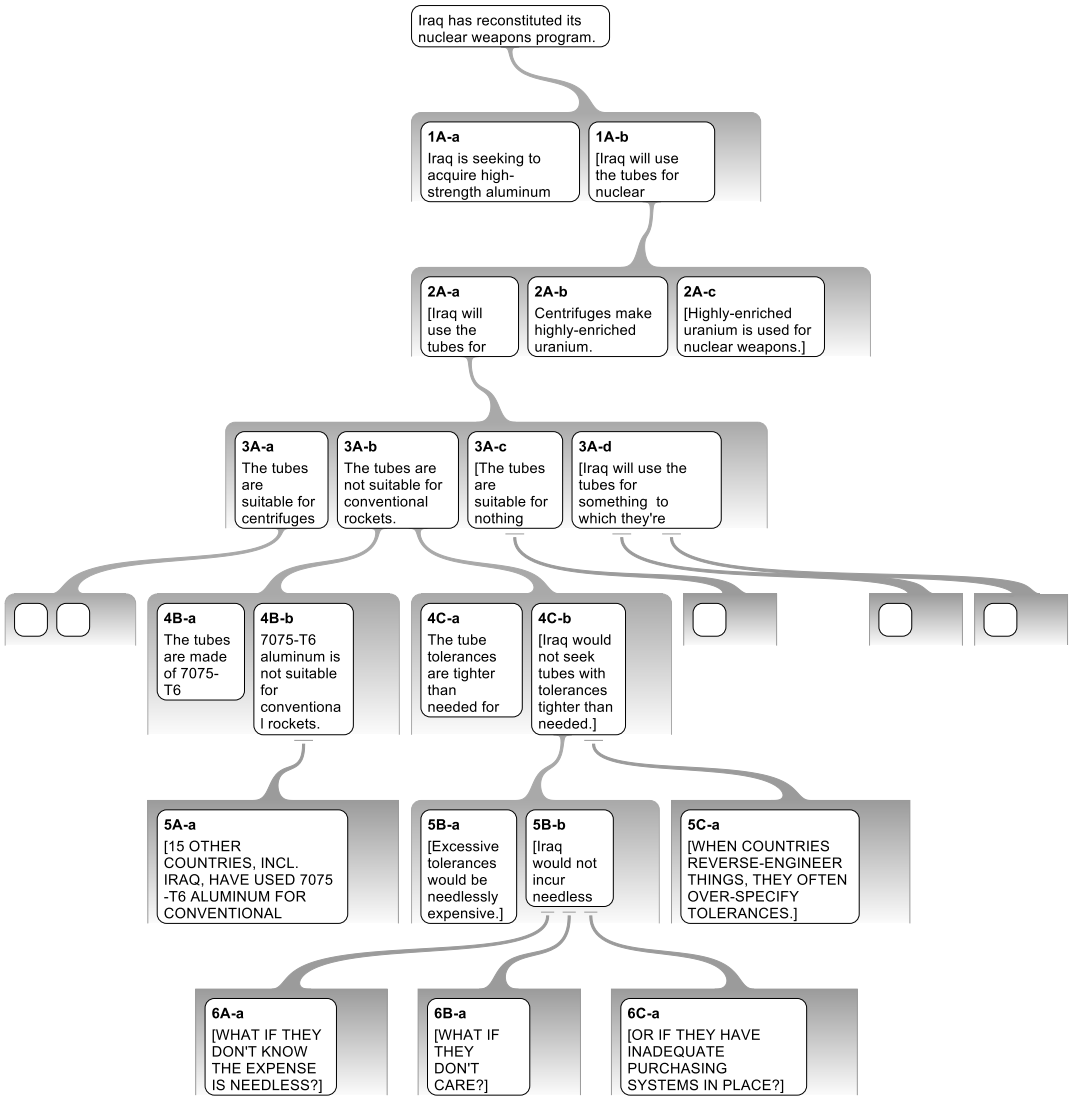
We can continue by adding to the map the final relevant consideration explicitly mentioned in the argument text, a second independent reason that analysts thought the tubes unsuitable for conventional rockets: the tolerances to which the tubes were machined were needlessly tight for conventional rockets. But again, logic dictates that the reasoners must have assumed some additional copremise(s) if they took the tight tube tolerances to justify concluding in 3A-b that the tubes were unsuitable for conventional rockets. We can add the explicit and unstated copremises as reason 4C under 3A-b as follows:



The essential unstated assumption 4C-b, that "Iraq would not seek tubes with tolerances higher than needed," invites further skeptical questioning. What unstated reasoning was it that supported the analysts believing this? And can that reasoning stand up to scrutiny? Let's add in a plausible supporting reason 5B, along with some potential objections:



In fact, the WMD Commission pointed out another weakness in the reasoning here, an objection 5C-a aimed directly at the claim 4C-b that Iraq would not seek tubes with needlessly high tolerances:

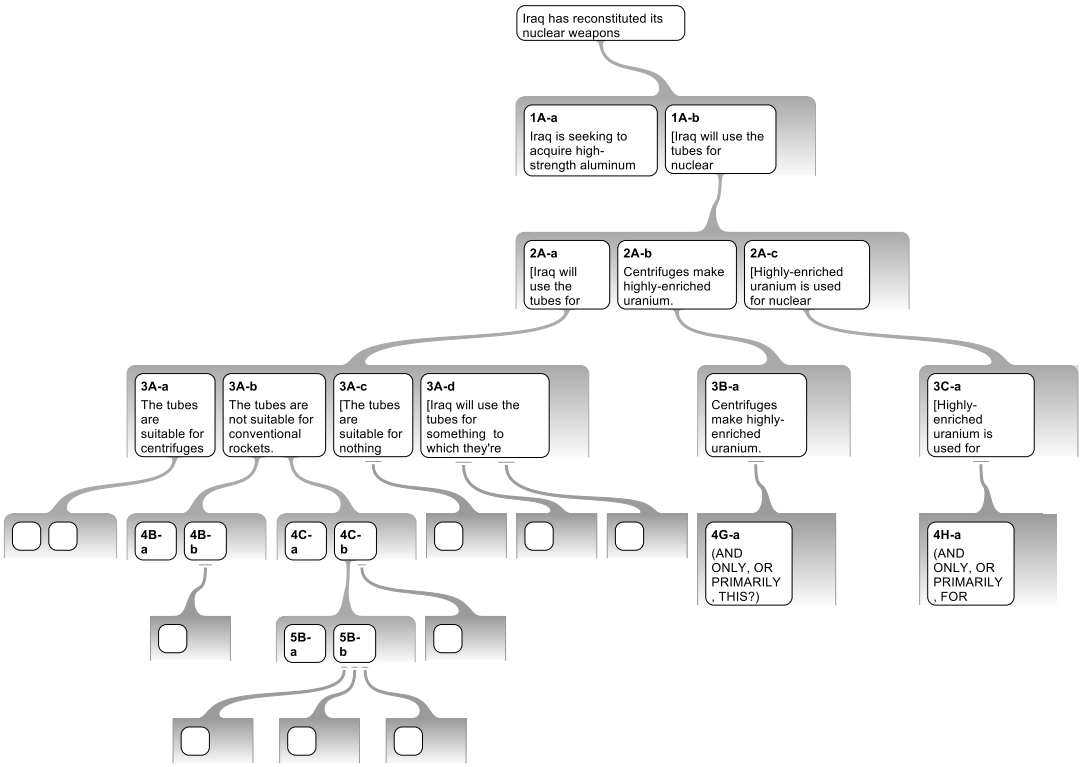


The WMD Commission learned that the Iraqis had indeed reverse-engineered a relevant conventional rocket, from an Italian model (2005, p. 62; see also p. 72). So both of the lines of reasoning that the Intelligence Community relied upon for their crucial premise 3A-b that the aluminum tubes sought by Iraq were unsuitable for conventional rockets turn out to be highly dubious.

Starting with what seemed like a straightforward, strong argument about Iraq's behavior, we have arrived at quite a complex map, one that raises numerous serious doubts about the contention. Yet even at this point we have not done our "due diligence" in examining the argument for possible flaws. There are numerous claims within (green/lower-case-lettered) supporting-reason boxes whose support has not yet been investigated. To consider just two, look back at reason 2A. Recall that premise 2A-a had originally been the more general claim that "The tubes are suitable for centrifuges," but that we determined that 2A-a required a claim about

what *Iraq* would actually *do* with the tubes, not merely what the tubes were suitable for. So the general claim was pushed down to become support 3A-a for the new 2A-a unstated assumption that we attributed to the analysts.

However, ought not the same critique be applied also to the other premises within reason 2A, that is, 2A-b and 2A-c? In order to justify the conclusion in 1A-b that Iraq will use the tubes that it is seeking for nuclear weapons, we need to be assured (i) that *Iraq will use* the tubes for centrifuges, (ii) that *Iraq will use* those centrifuges to make highly-enriched uranium, and (iii) that *Iraq will use* that uranium for nuclear weapons. It's not enough to have (in 2A-a) the first of these three copremises along with two general claims about the *possible* use of centrifuges for making highly-enriched uranium and the *possible* use of such uranium for nuclear weapons—yet those are the two copremises currently depicted in reason 2A! So a complete map of even this one small piece of the Iraq WMD puzzle would require that the map we have reached be elaborated for premises 2A-b and 2A-c in ways parallel to how we elaborated the reasoning underlying 2A-a. (For instance, were there perhaps other uses, besides nuclear weapons, to which Iraq might have wished to put highly-enriched uranium?) I will do no more than hint at these important complications in our map:



This demonstration of the power of argument mapping could be continued. But this seems a suitable point at which to desist, with the charitably reconstructed fleet of analysts' claims now faced off against a broadly arrayed armada of objections. Did the analysts' ultimate contention about Iraq's nuclear program deserve to be believed? We cannot resolve that, having examined only a small subset of the considerations that needed to be assessed by the intelligence world in 2002. But would those analysts, and their superiors, have been better armed to decide the question—and maybe to retract, qualify, or weaken the position they urged upon government policymakers—had they utilized argument mapping to handle the enormous cognitive demands of tracing out the many strands of reasoning?

That seems to be the important question for those interested in promoting a future flowering of critical thinking, and its answer would seem to be "Yes." When faced with issues of any significant complexity, mapping seems to make the practice of argument development and assessment substantially more productive—still highly challenging, but perhaps no longer impossibly so.

So argument mapping may be an important educational tool, but it is also much more than that. While it may well prove useful for training people to become better critical thinkers, for improving these skills in ways that transfer from mapping activities to other contexts, e.g., purely verbal ones, it is demonstrably useful also on its own for assisting critical reasoners who are engaged in practically important inquiries. It helps them (1) keep track of an argument's logical architecture; (2) test and clarify inferences; (3) unearth unstated assumptions; (4) reveal possible weak links that had been previously invisible and, because of this, especially threatening to the reliability of the reasoning; and ultimately (5) avoid falling into an unwarranted confidence, an illusory security, in the reasoning on matters of perhaps grave significance.

IV. Five Benefits of Argument Mapping

With our demonstration in hand, let us begin compiling a catalogue of the various benefits promised by argument mapping, including benefits to those who never themselves engage in the practice.

1. Improvements in practitioners' general critical thinking *abilities*—abilities to comprehend, critique, and manage textual arguments and their logical structures, likely bringing about secondary improvements in other reason-using activities (like reading, listening, discussing, writing, reflecting, theorizing, and decisionmaking), and then the downstream beneficial consequences of these various primary and secondary improvements.

2. Improvements in particular critical thinking *performances* when these are assisted by mapping, plus the downstream beneficial consequences for the practitioners and for the larger world.

3. Creative insights and innovative problem solutions to theoretical and practical problems. Once reasoners excavate hidden assumptions—that oil prices will remain stable, say, or, in our map, that the Iraqis would not incur needless expense in their national-defense expenditures—then they are called upon to question the assumptions and ponder alternative scenarios and states of affairs that probably would never have occurred to them but for the analytical stimulus of the mapping.

4. Increased comity in public and private discourse among the parties to disagreements, along with its benign ripple effects, such as greater policymaking cooperation in social organizations ranging in scope from families up to governments and international bodies. The benefits for comity flow from two directions.

(a) First, as disputants utilize mapping to unearth assumptions being implicitly made by their opponents, they can better understand, and even appreciate, those opponents' positions. Rather than remain mutually mystified by each other's thinking, and thus dismissive or contemptuous, the parties can feel rational pressure from revelations produced by mapping to become mutually comprehending, and hence respectful. The understanding and goodwill thus engendered should render progress in discussion or negotiation far more likely.

For example, consider Jaded Joe's insistence that X has been a terrible, failed President, whose election was a mistake (and who is therefore undeserving of re-election), on the grounds that U.S. citizens are now worse off than four years ago, under his predecessor. There are numerous skeptical questions to address to this argument—e.g., which U.S. citizens? why only U.S. citizens?

worse off in what way(s)? and is someone's *prior* record in office a conclusive basis on which to decide whether to prefer him to his opponent in an election for *future* office holding?—but one blatant problem with the reasoning is this: what is rationally relevant in deciding whether an officeholder's election was a mistake is not how conditions have altered during his office holding, but whether his presence made those conditions better or worse than they would have been under his electoral opponents. Supposing that X's predecessor had bequeathed him multiple crises that he could not fully overcome but that he had navigated more ably than would have his electoral opponents—or that a climate crisis had threatened the Earth early in X's term and only through his effective interventions were the consequences for humanity reduced from near extinction to heavy taxation—would we be warranted in inferring, from the undeniable new hardships facing Americans, that X has been a failed President whose election was a mistake?

From this perspective, Joe's reasoning is terrible—not subtly, but egregiously, so. So our reaction may be to regard this as an inexcusable, even laughable, gaffe (especially if Joe regards himself a serious thinker), and to view Joe with disdain, as someone we should not take seriously, at least on certain matters.

But what if Joe's reasoning can be explained by his having spent decades in the military, thus being steeped in a culture that in theory, and sometimes in reality, holds senior leaders accountable on what lawyers would call a "strict liability" standard—for example, where a ship's captain is supposed to lose his or her position of command if the ship has an accident at sea, *regardless of the captain's fault or lack thereof*? If we were to assume such an expansive principle of personal responsibility, rather than the alternative standard that was a subterranean assumption in our self-confident demolition of Joe's argument, then it could make some sense of Joe's position. (President X's responsibility for the country's hardships would not be mitigated by the fact that he handled the challenges of office better than anyone else could have.) We might, in the end, still not see eye to eye with Joe; but we would now be less inclined to view him, and his allies, with scorn, and less inclined to avoid collaborating with them.

With luck, experiences of this kind, especially if repeated, might be transformative for some of us, causing us more generally to be less dogmatic and less simplistic in our thinking; to be more sympathetically aware of the dependence of people's stances upon their assumptions and of the frequent reasonableness of divergent assumptions; and to be more realistic and humble about the ever-present possibilities of non-obvious discrepancies of understanding and the difficulties of being clear, logical, and unambiguous in our communications.

(b) The second contribution of mapping to comity arrives from the opposite direction: not increased regard for opponents, but lesser regard for self. As researchers have found that merely asking people to explain political policies they support causes them to feel less confidence in those positions (Fernbach, et al. 2013), and asking people to explain to themselves the significance of each part of a text they're reading causes them to be much more accurate in assessing their own level of comprehension (Griffin et al. 2008) the exercise of mapping our own positions will very likely encourage humility in us. As we come to see the various assumptions upon which our own contentions are built, and how open some of these are to reasonable doubt, we will be less inclined to press these contentions unyieldingly upon others and to feel a dismissive intolerance toward those who disagree with us. Again, there is reason to hope that repeated particular experiences like this may result in more global personal gains in humility and openmindedness. (This may also produce reduced tendencies toward boldness in action, which seems likely to have both good and bad aspects.)

5. Argument maps of important issues are enduring, shareable representations. This means that they can over time be expanded or revised *collectively*, thus helping organizational and societal planning and policymaking. With discourse participants no longer needing to repeatedly reinvent the wheel (often overlooking various spokes in the process), and with a shared construct to which all can refer, reviews, consultations, and critiques can be more focused and effective, debates and decisions more constructive and productive. The ability of interested parties to consult thorough maps of issues should serve also as a multiplier of the comity effect mentioned above, as people gain understandings of their opponents' positions and of the reasonableness, or at least the complexity and subtlety, of those positions.

This enumeration of the benefits of argument mapping must surely be incomplete. More important, it may prompt a stance toward mapping that is excessively favorable. As will be discussed in the next section, a more contextual evaluation of mapping seems required.

V. Conclusion: A *Comparative* Advantage for Argument Mapping?

Pharmaceutical companies are notorious for stacking the deck in favor of their new drugs by testing their efficacy against placebos, rather than against the most effective existing treatments. Favorable results are trumpeted widely, prompting blockbuster sales, even though similarly safe and effective existing therapies remain available at a fraction of the cost.

Those of us who are enthusiasts for argument mapping ought to be wary of misleading our audiences in a similar way. This article, for instance, is entitled " Critical Thinking in the Intelligence Community: The Promise of Argument Mapping," and its central demonstration should make plain the utility of argument mapping in critically thinking through an argument. But the most apposite question is whether argument mapping promises *greater utility than the alternatives*. When the comparison is made to traditional 'techniques' such as oral discussion of arguments followed by note-taking, or prose descriptions and dissections of arguments, mapping seems to be clearly superior. But what of other approaches that utilize special formats for presentation of arguments, such as spelling out arguments in so-called "standard form" (e.g., Sinnott-Armstrong & Fogelin 2015, pp. 49-50, 79-108)? When argument mapping is lauded for the practical advantages it brings to the hard-pressed, cognitively-stressed critical thinker, it is not commonly compared to practices like standard-form reconstruction ("SFR").

SFR aims at the same targets as mapping—for example, the construction of strong new arguments and the accurate and charitable reconstruction of arguments previously offered—and the textual content of an SFR is basically identical to that of an argument map. But the process of SFR is directed toward producing a vertically arrayed logical progression or *list* of premises (explicit and assumed, as in mapping) and of the inferences drawn from them (along with specifications of just which premises justify each inference, sometimes supplemented by citations of the reasoning rules that license each inference). How does this different method help or hinder the reasoner, and in the process alter the benefits obtained, by comparison with argument mapping?

One set of interesting questions that has just begun to be investigated, asks about the comparative effects of reading maps or SFRs created by others. Horn (2014), for instance, found that undergraduate philosophy students better comprehended philosophical arguments when presented as maps than when presented as SFRs or in prose.

But our interest here is in the effects of *doing* mapping vs. SFR, of creating one's own maps or standard-form reconstructions, rather

than of reading others' creations. Is it mapping as such that is the key to improving comity, say, or would widespread adoption of SFR produce the same benefit? But does SFR face greater obstacles to widespread adoption than mapping? And do both techniques empower reasoners equally, or is one superior on the most important dimensions? For instance, might SFR, in the hands of adepts, facilitate the excavation of unstated assumptions more effectively than mapping, or does mapping hold the advantage here? Does one method better promote cognizance of the overall architecture of the argument, with its pros and cons, and thereby greater thoroughness in argument development? Does one method have a significantly less steep learning curve than the other?

These are important directions for future research. Some possibilities for specific projects: (1) A comparative analysis of the features and resources of mapping and SFR, how these are employed, how they are phenomenologically experienced, and what psychological demands they impose on users. (2) A demonstration of SFR in action, comparable to our WMD case above. (3) A survey of those who are experienced in both methods, in order to see whether (following Mill in *Utilitarianism*) it is mapping or SFR "to which all or almost all who have experience of both give a decided preference, irrespective of any feeling of moral obligation to prefer it" (1863, ch. 2). (4) A critical thinking study, teaching both methods to all subjects (in different sequences), then randomly assigning some subjects to work through an argument analysis with mapping, and others to work through the same task with SFR, comparing the results and the subjects' experiences. (5) An examination of the comparative effectiveness of LAMP and LSFRP (Lots of Standard Form Reconstruction Practice) critical thinking courses.

In such a contest, my wager is placed firmly on argument mapping. Indeed, armchair speculation seems to warrant such a great degree of confidence that it would be hard to find fault with anyone who plunges ahead with the use of mapping without awaiting the results of research. Or am I falling victim here to faulty hidden assumptions of my own?

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