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Using Concept Maps to Improve the Practice and Organization of Intelligence in Canada

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Intelligence production is a vital state function that supports military and policy decision making (Davis, 2006; Herman, 1996; Jervis, 1991). The process of intelligence analysis is inherently challenging. It involves a great deal of uncertainty (Davis, 1992; Heuer, 1999; Lefebvre, 2004) and, with today's "information tsunami" only gaining strength, it is increasingly likely to prompt cognitive overload (Johnson, 2007; Treverton, 2001; Woods, Patterson, & Roth, 2002). While the intelligence function goes largely unnoticed by the public eye, intelligence failures that significantly impact human lives or international relations bring it acutely into the spotlight. Recent intelligence failures, such as those associated with the 9/11 terrorist attacks on the U.S. and misjudgment of Iraqi WMD capability, drew considerable public attention to the intelligence community and triggered a number of commissions of inquiry tasked with recommending reformative measures (Butler, Chilcot, Inge, Mates, & Taylor, 2004; The 9/11 Commission Report, 2004).

Although intelligence misjudgments are inevitable due to the uncertainty of events and inherent low predictability of human behavior (Brady, 1993; Heuer, 1999), the tendency to form poor judgments may be affected by several factors, including poor leadership, lack of inter-organizational coordination and information sharing (Hulnick, 2008), low quality of available information (Pritchard & Goodman, 2009), misinterpretation of available information due to

cognitive biases and mindsets (Butterfield, 1993; Heuer, 1999), the necessity “to rely on fallible assumptions and inconclusive evidence” as a consequence of substantive uncertainty (Davis, 2008), “lack of analytical imagination”, that is an inability to generate unlikely hypotheses, which may subsequently impede proper collection requirements from being developed (e.g., see Bruce, 2008), too much emphasis on current reporting and quantity of production (Johnston, 2005), organizational culture and incentive structure (Davis, 2008; Johnston, 2005), and dynamics of the decision maker-analyst relationship that could result in politicization of intelligence or failures of decision makers to heed accurate intelligence assessments and failure to dismiss inaccurate ones (Steinberg, 2008; Treverton, 2008).

Not surprisingly, due to recent intelligence failures, intelligence organizations in many countries are under significant pressure to review and improve their processes in order to overcome the aforementioned challenges. In an effort to address these issues and explore potential contributions of cognitive and behavioral sciences to intelligence analysis, the Global Futures Forum’s Community of Interest on the Practice and Organization of Intelligence (now under the direction of the US Department of State) in collaboration with Defence R&D Canada and Canada’s Privy Council Office hosted a workshop in February 2009 (Campbell & Mandel, 2010). Among the workshop’s recommendations was the importance of developing visualization techniques to support analysis and communication of analytic products. The Concept Mapping exercise that we report in this chapter represents one of our early attempts to address this issue through research and development.

Novakian Concept Mapping (Novak, 1998; Novak & Cañas, 2008) is a knowledge representation and diagramming method that is suitable as a tool to support various forms of intelligence analysis activity (Heuer & Pherson, 2010; Moore & Hoffman, 2010). Unlike some

other knowledge representation techniques (cf. Moon & Hoffman, 2005) Novakian Concept Mapping is rooted in learning theory (Ausubel, 1963; Novak & Cañas, 2008). It has over a three-decade history of diverse application within an international community of practice, and is supported by a substantial body of research and practitioner literature (Cañas & Novak, 2006; Cañas, Novak, & González, 2004; Cañas, Reiska, Åhlberg, & Novak, 2008; Coffey, Carnot, et al., 2003; Hoffman, 2008). The development of Concept Maps and Concept Map knowledge models has been greatly facilitated by IHMC's creation of the CmapTools open software program (Cañas, Hill, & Lott, 2003).

Concept Mapping and Concept Map-based knowledge modeling has attracted the attention of some defense and security agencies of Canada's allies. For example, Hoffman (2008) described current applications of Concept Mapping within the US Department of Defense, including the evaluation of expertise in social network analysis, mapping the "true work" of intelligence analysts and revealing leverage points for aiding analytic work, and improving methods for capturing and sharing a commander's intent.

One of our goals was to introduce Concept Mapping to the Canadian defense and security community and examine its applications. In this chapter, we report on our efforts and preliminary findings. Our efforts consisted of two main activities: First, we developed a Concept Map knowledge model of intelligence analysis as a comprehensive resource on the topic, which we plan to make freely available to Canadian stakeholders. Second, we hosted a workshop in February 2010 for Canadian intelligence professionals in order to introduce them to Concept Mapping and the specific knowledge model we developed and to elicit their feedback on the model and on Concept Mapping, more generally.

The remainder of the chapter is organized as follows: We begin by explaining how our

current Concept Mapping efforts developed out of prior intelligence-related research activities in our lab. We then report on the organization and preliminary findings of the aforementioned workshop, especially the participants' feedback. We conclude the chapter by outlining directions for future research on, and future applications of, Concept Mapping in support of rigorous intelligence analysis.

Model development

In 2008, we conducted an exploratory interview study with a small sample of managers from two Canadian intelligence organizations, the results of which are summarized in a technical report (Derbentseva, McLellan, & Mandel, forthcoming). One of us (ND) started developing a Concept Map knowledge model of intelligence analysis that would be a supplementary to the report. The initial aim of the model was to help us organize our own conceptual understanding of various issues involved in intelligence analysis. Another aim was to organize the key contents of the report in an interactive and visual manner for potential stakeholders.

Although it is not our aim here to review the model itself, we show in Figure 1 the top map of the knowledge model in order to provide the reader with some sense of the model's scope. The model presently consists of 23 Concept Maps, which contain 490 concepts, over 700 propositions, and 290 links to various resources, including text files, images, audio, web addresses, and Concept Maps. The model is not nearly a finished product in terms of depth or breadth of coverage, although such knowledge models should never be thought of as "finished" (Hoffman & Lintern, 2006). The model is expanding and is subject to reorganization based on new information and feedback we receive.

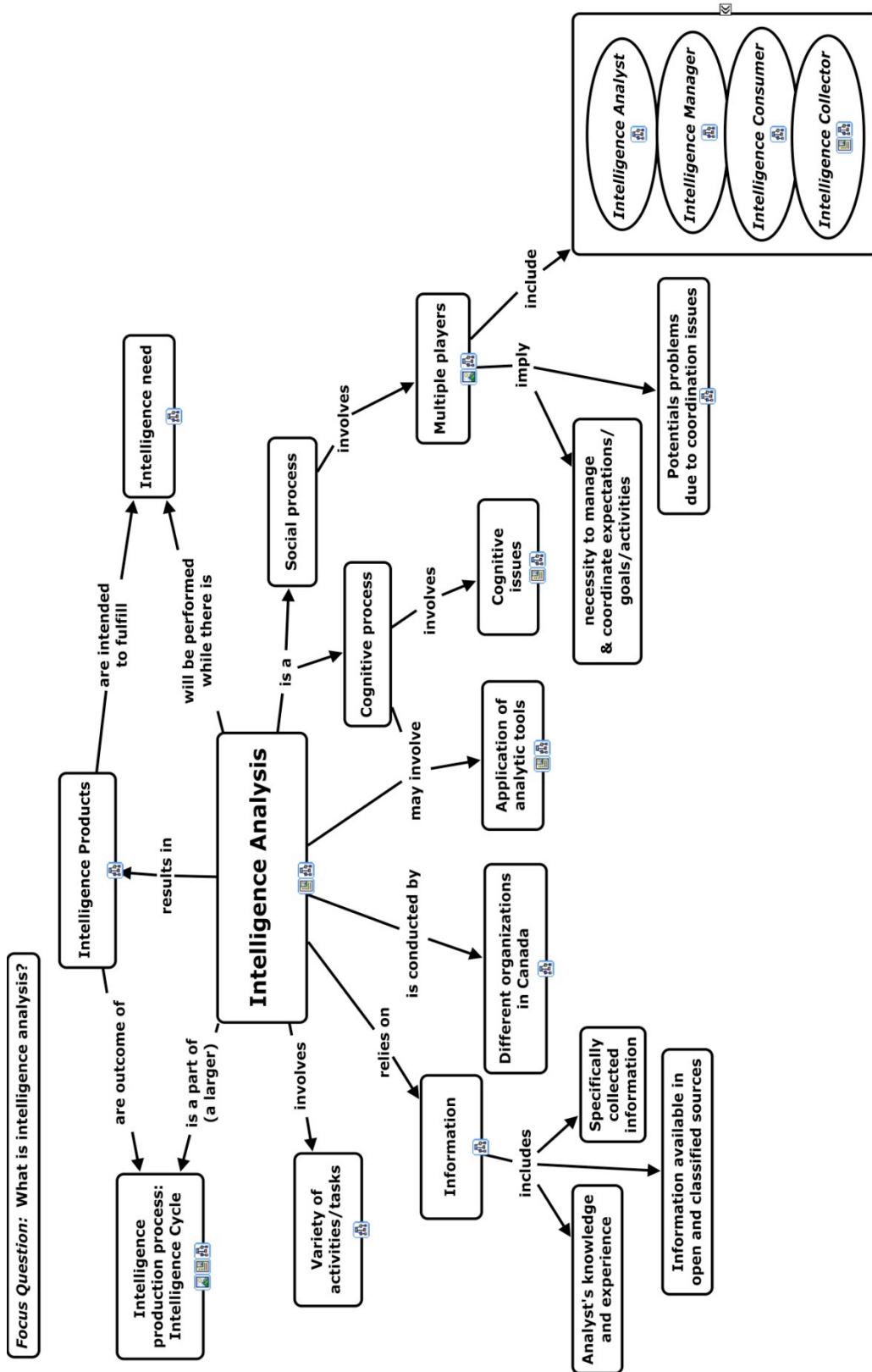


Figure 1: The top map of the Concept Map knowledge model of intelligence analysis.

As the knowledge model was developed, it became evident to us that input from members of the Canadian intelligence community would be beneficial in order to better understand how such a model might be used by intelligence personnel and, more generally, what uses Concept Mapping might have for the intelligence community. For instance, we saw potential in the model not only as a means of knowledge capture, but also as a medium within which to promote dialogue among members of the intelligence community on key issues germane to the practice and organization of intelligence, much as the Global Futures Forum website does (GFF, 2010), with its reference, forums, and blogs sections. Thus, the expansion of the model, and our realization of its potential uses beyond simply capturing our technical reports' main points, provided the impetus for organizing the recent workshop.

Workshop organization

We solicited participation in the workshop by contacting members of the Canadian intelligence community with whom we had an established relationship. Of the 12 individuals invited, nine participated, and, in one case, invited another participant. Thus, we had a 75 percent positive response rate with ten intelligence experts from both civilian and military intelligence organizations participating in the workshop. Most of the workshop participants had over ten years of experience in the intelligence domain and were mostly senior members of the intelligence community, occupying mainly roles as directors and educators.

A number of organizations were represented at the workshop, including Campbell Intel Services, Canada Border Services Agency, Canadian Forces School of Military Intelligence, Chief of Defence Intelligence, the International Assessment Staff of Canada's Privy Council Office, and the Library of Parliament.

None of the participants had prior exposure to Novakian Concept Mapping as a potential

tool in support of intelligence, although some would certainly have seen various forms of visual-textual diagrams before (e.g., Mind Maps). The half-day workshop began with introductory remarks (by DRM) and an introduction to Concept Mapping and a demonstration of the scope and usability of our Concept Map knowledge model of intelligence analysis (by ND). Most of the workshop time was reserved for two small-group discussion sessions, for which workshop participants were divided into three groups. Each of the discussion sessions was followed by reports in plenary sessions by rapporteurs from the three groups.

The first session had two objectives: First, to identify and prioritize potential uses of the Concept Map knowledge model and Concept Mapping, more generally, within the intelligence community. The second objective was to identify anticipated benefits and drawbacks of using Concept Mapping for the identified purposes. The second session involved a collaborative exercise in which participants were asked to construct a Concept Map that answered the focus question “What is analytic integrity?” For that activity, we provided participants with IHMC’s Concept Map “Steps in building a Concept Map” (Crandall, Klein, & Hoffman, 2006; IHMC, 2010)

Workshop Results

We report our observations and participants’ insights and comments during the workshop in the following sub-sections. We begin by summarizing identified perceived applications of Concept Mapping within the intelligence community, followed by a discussion of anticipated benefits and drawbacks of Concept Mapping. We conclude this section with the report on the collaborative Concept Map construction exercise in which our participants engaged during the second part of the workshop.

Perceived Applications

To minimize leading participants towards proving certain answers that might cast the utility of Concept Mapping in a positive light, the workshop organizers did not share with participants their own vision of how Concept Mapping or the knowledge model could be applied within the intelligence community. Each of the three discussion groups identified a number of potential applications of Concept Mapping within the intelligence community. These were grouped into six categories listed below. All three groups noted the first four of the uses in the list below, while the last two functions were discussed by two of the three groups:

- (a) tool for system analysis and management , i.e., to analyze and manage a topic or an issue that is comprised of various interrelated components;
- (b) tool to conduct analysis;
- (c) tool to assist with validation of analytic judgments and quality control;
- (d) collaboration tool to develop shared understanding;
- (e) training and knowledge transfer tool; and
- (f) communication tool.

The identified potential applications are distinct, yet interdependent, and arise from specific properties of Concept Mapping as a process and Concept Maps as products. We discuss these properties in the context of each of the applications below.

System Analysis and Management Tool. Participants noticed that a Concept Map may be a useful tool to analyze a system of interdependent issues by decomposing the system into its components and showing their interrelationships. Participants in all three groups noted that Concept Mapping may be a more appropriate method for intelligence collection planning than the existing methods, such as spreadsheets and lists. Intelligence analysts greatly rely on

information and need to be able to identify what information needs to be collected to advance their analysis (Bruce, 2008; Treverton, 2001). In collection planning, the analyst surveys the known information about the problem at hand, and identifies what currently remains unknown. A Concept Map was seen as a model that has the capability of structuring the “system of information” relevant to a problem. One of the groups also offered another example of potential system analysis application of Concept Mapping; namely, the analysis and management of military force development. In addition, some participants proposed that any analytic issue needs to be treated as a part of a system (i.e., in the context of other relevant and interdependent issues), and that Concept Mapping could thus be used for analyzing intelligence problems from a systems perspective.

Analytic Tool. The group discussion focused mainly on the application of Concept Mapping as a structured analytic technique. All three groups recognized a potential of applying Concept Mapping during the process of analysis as an imagination-promoting structured analytic technique. Participants noted that constructing a Concept Map as a component of the analytic process could help structure an intelligence problem, organize and discipline analysts’ thinking processes, and help analysts detect links between concepts and identify gaps.

In line with participants’ observations, we believe that Novakian Concept Mapping has several properties both as a process and as a product that may be advantageous for analysis. As a process, Concept Mapping (a) requires analysts to externalize their thinking, (b) requires analysts to decompose a problem into its core conceptual elements, (c) requires analysts to establish relationships among those elements by forming propositions, and (d) promotes synthesis through the requirement that the entire map provide a comprehensive answer to the focus question. All of these properties have been recognized as requirements for rigorous analysis (Heuer, 1999; Heuer

& Pherson, 2010).

As a product, a Concept Map serves as a record of one's thinking process, and it provides a "transparent" representation that allows analysts to "smoke out" unwarranted assumptions, identify gaps in analysis and logic, and promote dialog with other analysts. In general, participants recognized these various benefits for promoting rigorous analysis.

As noted earlier, intelligence analysts deal with problems that are characterized by a great deal of uncertainty. The future that analysts endeavor to anticipate and describe is uncertain, as is the accuracy and completeness of information available to the analyst. The process of intelligence analysis has thus been characterized as the process of putting together a jigsaw puzzle with many missing pieces and an unknown final picture (Johnson, 2007). A Concept Map may be instrumental in structuring and providing a representation of the current state of such a "puzzle" in an analyst's mind. That representation, in turn, may serve as a basis for discussion with the analyst's manager and peers.

Validation Mechanism and Quality Control. Concept Maps have a proven record of application (and their widest use) in the educational setting to promote meaningful learning and capture changes in student's understanding of the subject (Cañas, et al., 2008; Novak, 1998; Novak & Musonda, 1991). Concept Maps capture the creator's understanding of a topic and represent it in an explicit form, which allows teachers to easily identify students' misconceptions and to evaluate the quality of their learning (Hay, 2007; Hay & Kinchin, 2008; Kinchin, 2000; Novak, 1998). Although it may be impossible in the intelligence domain to compare an analyst's Concept Map against a correct answer, except in hindsight, Concept Maps may help to reveal differences in current understanding of the topic among analysts. In addition, adult learners have reported that constructing a Concept Map allows them to identify gaps in their own

understanding and led to a much more thorough processing of information (Derbentseva & Safayeni, 2008). All three groups at our workshop noted the property of Concept Maps to make a map creator's understanding explicit and considered it to be valuable for intelligence analysis.

Participants outlined a number of advantages in having an explicit representation of an analyst's thinking. First, it would allow analysts to review their Concept Maps and identify gaps in their logic or information that might have been overlooked during the analytic process. Some participants commented that identifying gaps in logic from a Concept Map might be easier and more efficient than from a standard written intelligence assessment because, as one group member stated, "the gaps in logic will jump in your face." One group suggested using Concept Mapping at the end of the analytic process as a "sanity check," by which an analyst would transform his or her written report into a Concept Map to see whether everything that the analyst wanted to say actually got said and made sense.

Second a Concept Map might also be instrumental in the process of evaluating the quality of intelligence assessments since it provides a transparent record of an analyst's thinking and allows identifying gaps and assumptions. Third, one group discussed how a Concept Map could be used as a defensible record of an analyst's thinking in the audit process, if the product is challenged at a later date.

Fourth, and finally, a Concept Map might serve as a means of sharing an analyst's way of thinking about a problem with other analysts in order to promote a collaborative discussion. We focus more on this aspect in the following subsection.

Collaboration Tool To Develop Shared Understanding. Groups discussed two different aspects of collaboration that may be prompted through Concept Mapping in the intelligence context. First, as we noted earlier, participants regarded Concept Maps as having the capacity to

promote discussion in the context of the analysis process. Second, Concept Mapping was also seen as a collaborative tool to discuss general topics related to intelligence analysis within the entire community.

The first application may facilitate the process of analysis of a particular issue, while the second application may promote dialog within the community and may help developing shared understanding. However, it is the same property of Concept Maps – the explicit representation that they provide – that may lead to collaboration in the two contexts. A Concept Map presents a set of propositions that can be evaluated. Identifying logic gaps, finding missing cross-links, and finding divergent propositions could be beneficial in stimulating collaborative discussions. Such collaboration in the context of analyzing an intelligence issue may help to uncover hidden assumptions and verify an analyst's logical thinking.

In the broader context of discussion within the intelligence community about how to improve the practice and organization of intelligence, collaborative Concept Mapping could facilitate the development of common understanding and help the community arrive at consensus on key concepts and standards.

Training and knowledge transfer. Two groups discussed the potential utility of Concept Mapping for training and knowledge transfer, and their discussions revolved around slightly different ideas. One group proposed that Concept Mapping may be a good way of training intelligence analysts to avoid linear thinking patterns and to visualize more complex relationships among concepts. This group also suggested that implementing Concept Mapping in the training context might serve as a test bed for validating the utility of the tool.

The other group proposed that Concept Maps could be used to transfer knowledge from an experienced desk analyst to his or her replacement in order to accelerate the newcomer's

learning about important issues. Accordingly, an experienced desk analyst would develop and maintain a Concept Map knowledge model of the important issues in his or her area. The incoming analyst would then use that model to get up to speed when taking over the desk, and later, as he or she gains more knowledge, would be able to update and maintain the model. Although the group did not explicitly discuss technical requirements to support this activity, it seems that a Concept Map knowledge modeling environment, such as CmapTools, would be required to provide the necessary information management flexibility and support. One potential challenge with this application of Concept Mapping may be in the time and effort required to develop the initial model and its subsequent maintenance. The application of Concept Mapping to knowledge capture and transfer in the domain of intelligence analysis could, however, draw upon a growing body of literature on application of Concept Mapping to knowledge preservation and sharing in various areas (Coffey, Cañas, et al., 2003; Hoffman, 2008; Moon, Hoffman, & Ziebell, 2009). Moreover, the intelligence community could develop partnerships with the research and development community in order to capitalize on expertise and reduce the burden on intelligence personnel (Mandel, 2009).

Communicative Function. Two of the three groups discussed a possibility of using the Concept Map as an aid for communicating with intelligence consumers. Intelligence consumers often do not have time to read lengthy intelligence reports, and effective communication of intelligence judgments to consumers has been an important issue in the community (Hulnick, 2006). Some participants suggested that providing a Concept Map of alternative possibilities to intelligence consumers might allow them to expand their horizons by exposing them to novel representations of information. It was noted, however, that Concept Maps will appeal only to “visually inclined” individuals and may not be suitable for everybody, and that such Concept

Maps could not replace written reports. Yet, as Moon et al. (2008) demonstrated, Concept Maps hold more potential than PowerPoint for rapidly and accurately conveying complex information – an important finding given the vast amount of PowerPoint presentations that regularly circulate throughout the intelligence community.

Another challenge in the relationship between consumers and producers of intelligence is that consumers often have limited understanding of capabilities and processes involved in the intelligence production (Davis, 2006; Gardiner, 2009). Some participants recognized that a Concept Map knowledge model of intelligence analysis may be an appropriate tool to educate consumers about the issues involved in analysis and to demonstrate the breadth and complexity of various activities and issues involved. According to some of the workshop participants, this may help with the “sales” angle of intelligence to the consumers and could also help with securing resources for intelligence agencies.

To summarize, workshop participants perceived the greatest value of Concept Mapping in:

- providing an external, visual, and transparent representation of the thinking process;
- exposing gaps in logic and information;
- supporting and encouraging collaboration;
- allowing representing complex problems and thinking about broader ideas; and
- prompting thinking about relationships.

Our workshop participants independently arrived at conclusions regarding utility of Concept Mapping in the intelligence context that are similar to applications envisioned and discussed by IHMC’s researchers (Hoffman, 2010). Our study thus provides an independent confirmation of the perceived utility of Concept Mapping in the intelligence domain and ensures face validity of

the findings given that the applications were envisioned by the intelligence professionals themselves.

Advantages and Drawbacks of Concept Mapping

Some of the Concept Map's properties that are advantageous in one situation may be a hindrance in another situation. For instance, the ability to produce a visual and non-linear representation of the thinking process with a Concept Map was identified as one of the tool's main advantages. However, participants also noted that such a representation may be unsuitable for non-visual individuals or those who are more comfortable with a linear representation.

Also, the fact that Concept Maps allow representing complex problems and thinking about broader ideas was seen as an advantage, which may broaden one's view and be a useful way to explain a subject matter to someone. However, participants commented that a Concept Map does not seem to provide a single, specific answer or "bottom line" to the focus question, which may be necessary in some situations. Thus, some participants viewed it as an inappropriate means to represent answers to some intelligence questions, such as required in tactical intelligence. Tactical intelligence is short-term and deals with specific questions that are of interest to a commander. Some participants commented that presentation methods that follow a more linear thread, such as standard textual summaries, may be more appropriate for tactical intelligence briefs.

Some participants said that Concept Maps may be more appropriate to answer focus questions such as "What is..." or to describe "things that are," whereas they might be less useful for describing the world of "might be"--in other words, to represent forecasts of future events and their potential impact. It is an interesting observation that Concept Maps may be more appropriate for some questions and less so for other questions, and one that could be tested

empirically. For example, there is an empirical evidence that (unguided) Concept Mapping tends to facilitate representation of static relationships and that such Concept Maps tend to answer “what is...” type of questions (Safayeni, Derbentseva, & Cañas, 2005), which is in concurrence with our participants’ observation. Nevertheless, research also suggests that it is possible to increase expressive variety in Concept Maps through strategies, such as adjusting map’s structure and posing explicit focus questions (Derbentseva, Safayeni, & Cañas, 2007). At least in principle, Concept Mapping morphology and semantics do not preclude the expression of probabilistic or hypothetical propositions. Thus, Concept Mapping ought to be able to support the construction of diagrams that explore hypothetical or even counterfactual events.

Developments in this area are currently underway at IHMC (Hoffman, 2010)

The representation of probabilistic relationships in Concept Maps would have to rely on verbal expressions of uncertainty, which are inherently vague, but this is no different than current practices involving written reports. Moreover, just as reports *could* be supplemented with numeric probabilities, so too could Concept Maps. In a related vein, some Workshop participants noted that it would be useful to be able to show the importance or centrality of propositions in a map, such as one might do in some influence diagrams of varying degrees of computability (Fischhoff, 2009) or social network models (Bavelas, 1950; Knoke & Yang, 2008), respectively.

Two of the groups expressed a concern regarding the lack of existing mechanisms to determine whether the application of Concept Mapping or any other tool would yield a better outcome than status quo practices. Participants noted that it would be helpful if Concept Mapping were validated with respect to specific requirements of the intelligence domain to identify the most appropriate and beneficial areas of application and to assess whether the benefits associated with implementing the tool would outweigh the costs. Participants, however,

also recognized that validation of analytic techniques, although desirable, is not yet a common practice in the intelligence community. In general, there is a lack of a scientific base of research concerning the validity and usability of structured analytical techniques, with some exceptions (e.g., see Cheikes, Brown, Lehner, & Adelman, 2004; Folker, 2000; Pirolli, 2006). Application of analytic techniques greatly relies on the intuitions and preferences of experienced analysts (Heuer & Pherson, 2010).

A more general concern was raised regarding the fact that intelligence analysts operate under a significant “pressure to get their products out the door.” Thus, some participants believed that analysts simply would not have the time to apply any analytic tools, even the simplest and quickest ones. Also, such issues as analysts’ learning and reasoning styles play a role in acceptance of analytic tools, as some analysts may prefer not use any tools at all.

Some participants also thought that analysts could get too bogged down with structured analytic tool use, and that it remained an empirical question as to whether a particular tool would yield the anticipated benefits. As one participant noted, overemphasis on tools could have the deleterious effect of having analysts lose their focus on solving the pertinent analytic problem. We suggest that the prospect for this type of unwanted outcome would be more likely early on in the tool use phase, as analysts acquire their tool use skill. As that skill is developed, however, less and less cognitive resources would need to be applied to using the tool itself. Thus, the cost-benefit ratio would be expected to become more favorable over time.

To complement participants’ understanding of Concept Mapping and enrich it with practical experience, the second session of the workshop was devoted to hands-on Concept Mapping, the results of which are discussed in the next section.

Collaborative Map Construction

The second session of the workshop was devoted to a collaborative Concept Map construction exercise. Workshop participants spent 40 minutes in their groups constructing a Concept Map to answer the focus question “What is analytic integrity?” Although the available time was insufficient for groups to fully complete their Concept Maps, the groups nevertheless had an opportunity to immerse themselves in the Concept Map construction process and acquire some first-hand experience with Concept Mapping. Figures 2A, 2B, and 2C show the “in progress” Concept Maps produced by the three groups at the end of the session.

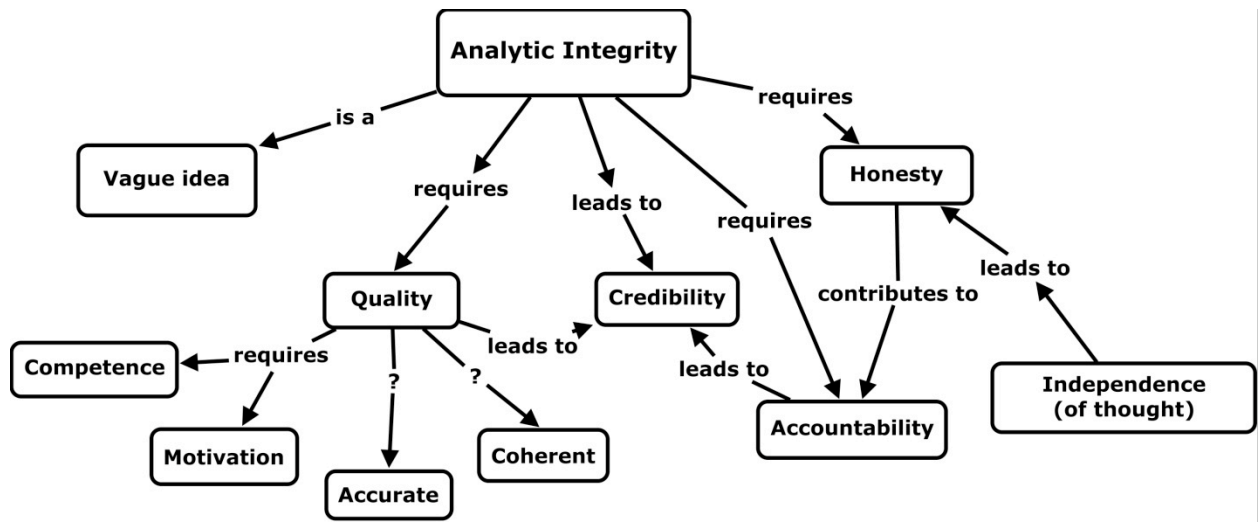


Figure 2A: Group 1.

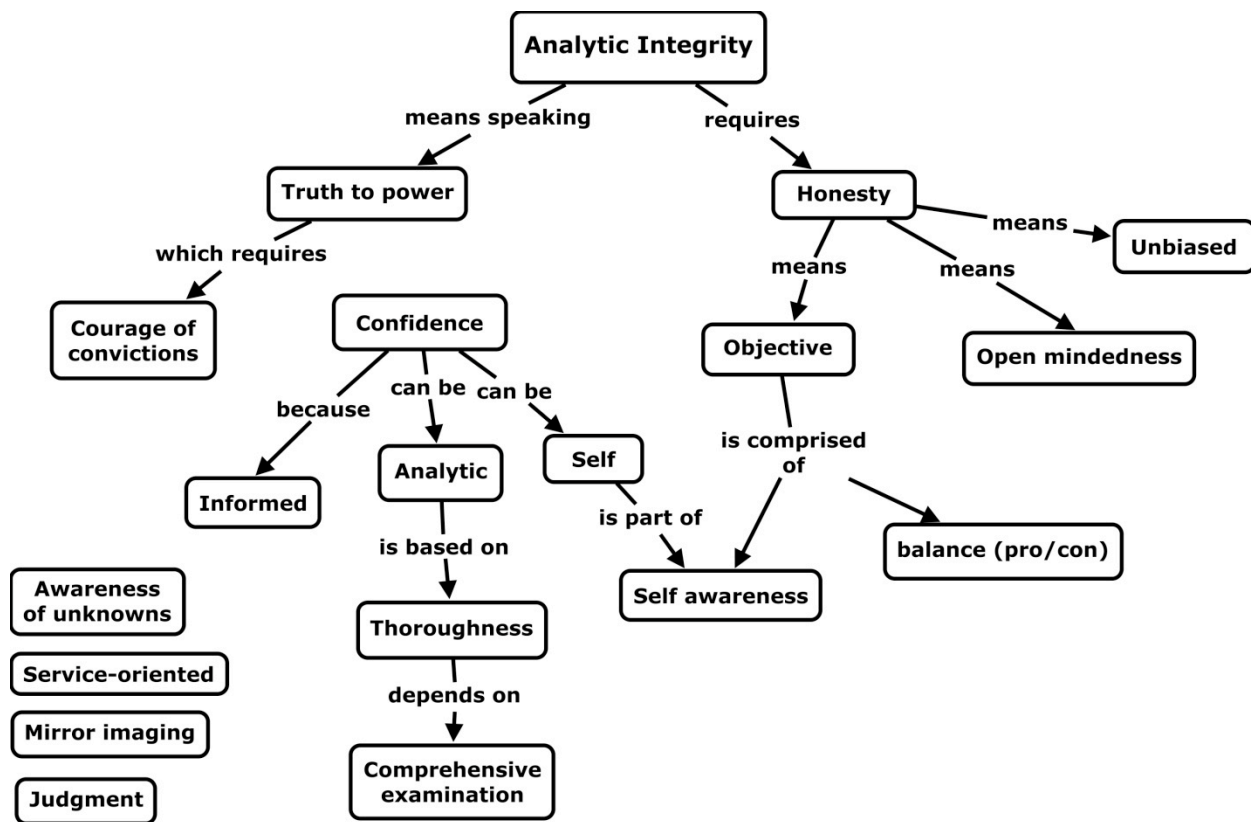


Figure 2B: Group 2.

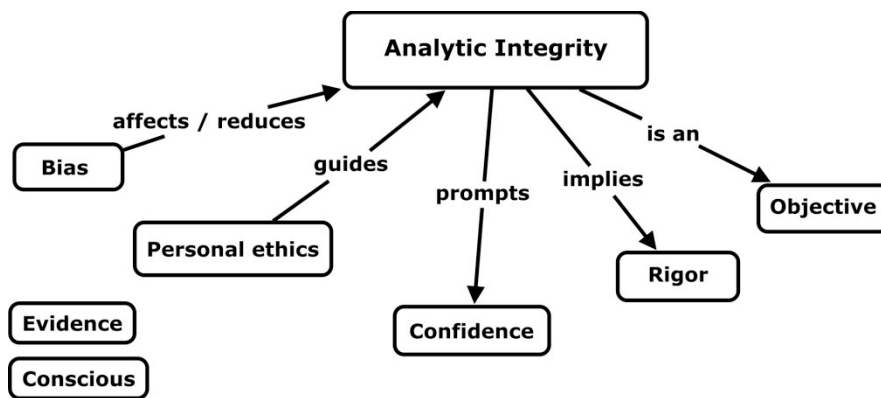


Figure 2C: Group 3.

Figure 2: Concept Maps constructed by the three groups to answer the focus question “What is analytic integrity?”

As one might expect, the groups experienced some difficulty in constructing their Concept Maps. This was certainly due, at least in part, to the fact that the Concept Mapping process was unfamiliar to participants. However, it was also partly due to the fact that the answer to the question posed was more elusive than participants had initially thought it would be. Group 1 expressed this idea in their map with a proposition “Analytic integrity is a vague idea” (see Figure 2A). The variability in ideas associated with the concept of analytic integrity is also represented in the range of concepts that different groups generated for their Concept Maps. Only one concept—namely, *honesty*—was used by two groups (see Figures 2A and 2B). In other words, the remaining concepts were unique in each group.

All three groups concluded that Concept Mapping was a difficult process that required much thinking and clarity in the terms used. Participants experienced their greatest difficulty with defining linking terms, which was not surprising as it is a common challenge in Concept Map construction (Derbentseva & Safayeni, 2008; Novak & Cañas, 2008). Participants observed that the collaborative map construction process allowed them to uncover differences in individuals’ understanding of various concepts. These differences became evident during the process of linking concepts and defining the relationships. Also, participants pointed out that Concept Map construction allowed them to reach conclusions, which would not have been possible with conventional presentation means, such as a written definition or a bulleted list. In particular, while constructing relationships in their Concept Map, Group 1 reached a conclusion that *quality* is a central concept in defining *analytic integrity* and that the two concepts have very similar meaning in this context.

Participants generally enjoyed the hands-on Concept Mapping activity, which clearly demonstrated to them some of the benefits of Concept Mapping that they anticipated. It is also

worth noting that some workshop participants who were skeptical towards Concept Mapping at the beginning became much more favorable to the method after acquiring first-hand experience with the Concept Mapping process.

Future Directions

Our workshop generated considerable interest in Concept Mapping from the intelligence professionals who took part. As a result, Concept Mapping is finding its way into Canadian intelligence analyst training. For instance, the authors received a request to develop a “one-pager” on Concept Mapping as an “imagination” structured analytic technique for the Canadian “Aide Memoire on Intelligence Analysis Tradecraft,” which is used in training intelligence analysts in the Canadian Forces (Thompson, 2009). Currently, the Memoire contains 29 structured analytic techniques recommended for intelligence analysis. We expect that a description of Concept Mapping will complement this collection in the near future.

The authors were also requested to develop a Concept Map knowledge model of one of the sections in the Aide Memoire that discusses analytic rigor for potential application in intelligence analyst training. The development of the Concept Map model of analytic rigor contributed to further development of the concept of rigor by identifying areas that required expansion.

In upcoming intelligence analysis courses, we will be working in conjunction with the Canadian Forces School of Military Intelligence to pilot a collaborative Concept Mapping approach to solving analytic problems. Using Concept Mapping in the analyst training environment will expose cohorts of analyst trainees to the tool and will allow us to assess the effectiveness of the tool in an analytic environment where any potential detrimental

consequences would not have an impact on real intelligence products. Exposure to Concept Mapping during training may also contribute to its future application in actual analytical activities and reporting.

Plans are also underway for one of us (ND) to facilitate a workshop session on Concept Mapping as part of an upcoming Global Futures Forum's Community of Interest on the Practice and Organization of Intelligence (COI POI) roundtable. COI POI is an international community of intelligence professionals interested in multi-disciplinary collaboration on various intelligence issues. The idea is to use Concept Mapping as a medium to launch an experiment on virtual international collaboration.

In summary, our interactions with Canadian intelligence experts demonstrated that Concept Mapping has a potential to contribute to the community in various ways, realizing of course that no tool is a panacea. In implementing structured analytic techniques, care should be taken to match the capabilities of the tool or technique with the task requirements. Our nascent research program on Concept Mapping is aimed at validating the use of this technique with respect to specific requirements of the intelligence domain and we will continue to provide support to the Canadian intelligence community and its allies in further Concept Map research and development.

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