Opportunities for Scientific and Technical Support to Structured Analytic Techniques

Notes on the after-action review session at CFSMI's Strategic Defence Analysis Course

Natalia Derbentseva
Peter Kwantes
DRDC – Toronto Research Centre

Defence Research and Development Canada

Reference Document
DRDC-RDDC-2016-D026
July 2016

IMPORTANT INFORMATIVE STATEMENTS

This work was conducted under the JICAC project of the Joint Force Development Portfolio.

Abstract

In December 2014, two DRDC – Toronto Research Centre scientists were invited to attend the after-action review of the Strategic Defence Intelligence Course (SDIAC) run out of the Canadian Forces School of Military Intelligence (CFSMI) at Canadian Forces Base (CFB) Kingston. At the review, the scientists were asked to lead discussions around what the students learned in the course. Discussions revolved around two general topics: improving analysis tools through automation and visualization, and support for analysis done in collaborative teams. This short report documents the proceedings of those discussions with the purpose of informing tool development under the Joint Intelligence Collection & Analysis Capability (JICAC) project within DRDC's Joint Force Development portfolio.

Significance to defence and security

Not all analytic techniques are easy to conduct, and some might benefit from enablers that allow for collaboration among analysts. To the extent that DRDC can develop tools to support analysis, either individually or in teams, we will be able to improve analysts' ability to make sense of the information being examined. This report documents some of the requirements for tool development elicited from analysts.

Résumé

En décembre 2014, deux scientifiques du Centre de recherches de RDDC Toronto ont été conviés à participer à l'analyse après action du Cours d'analyse stratégique du renseignement de défense (CASRD) offert par l'École du renseignement militaire des Forces canadiennes (ERMFC), à la Base des Forces canadiennes (BFC) Kingston. Au cours de l'analyse, les scientifiques ont été appelés à diriger des discussions portant sur ce que les stagiaires avaient appris pendant le cours. Deux sujets principaux ont été relevés : l'amélioration des outils d'analyse à l'aide de l'automatisation et de la visualisation, et le soutien aux analyses réalisées par des équipes en collaboration. Ce bref rapport décrit le déroulement de ces discussions et vise à informer sur l'élaboration d'outils dans le cadre du projet sur la capacité interarmées de recherche et d'analyse du renseignement (JICAC), qui correspond au portefeuille Développement de la Force interarmées de RDDC.

Importance pour la défense et la sécurité

Les techniques d'analyse ne sont pas toutes faciles à réaliser. Pour ce qui est de certaines, il serait bénéfique que les analystes disposent d'outils leur permettant de collaborer entre eux. Dans la mesure où RDDC peut élaborer des outils favorisant l'analyse, aussi bien individuelle qu'en équipe, nous serons en mesure d'améliorer la capacité des analystes à interpréter les renseignements qu'ils examinent. Ce rapport présente quelques-unes des exigences que les analystes ont mentionnées pour l'élaboration d'outils.

Table of contents

List of tables

Acknowledgements

We are grateful to WO Craig Carney, Lt(N) Eric Pout and Capt. Chris Johnson for extending the invitation to attend the SDIAC's after-action review session. We would like to thank all of the Fall 2014 SDIAC students for their participation in the discussion and for sharing their thoughts with us.

This page intentionally left blank.

1 Introduction

The Canadian Forces School of Military Intelligence (CFSMI) at Canadian Forces Base (CFB) Kingston offers the Strategic Defence Intelligence Analysis Course (SDIAC). The SDIAC is designed for students with considerable analytic experience at operational and tactical levels. One of the goals of the course is to introduce students to various structured analytic technics (SAT) that could be applied in strategic and operational intelligence analysis. Defence Research and Development Canada (DRDC) scientists were invited to attend the after-action review at the end of the Fall 2014 course. The visit became an opportunity to discuss different aspects of what they took away from the course. The two scientists who attended held a two-hour focus group with the SDIAC students. The discussion had two objectives:

1. Solicit requirements for analytic tools and identify SAT that could benefit from automation, visualization, and tool support; and
2. Solicit requirements for collaborative spaces where analysts could do sense-making in teams.

This report summarises these discussions.

2 Discussion summary

2.1 SAT evaluation and analytic tool requirements

During the fall 2014 offering of the SDIAC, the students learned over 20 SATs and were required to apply at least four of them in a final course paper. With some exceptions, the vast majority of these techniques do not have automated or semi-automated tool support and have to be executed manually. Of the approximately 20 techniques, 14 were identified as ones for which automation or visualization could somehow be applied.

To identify the most suitable candidate SATs for automation and visualization, we reasoned that the most likely ones would be those that are highly valuable but relatively difficult to conduct. We therefore asked the students to consider the SATs two dimensions:

- The ease with which the technique can be applied. Students were asked to classify SATs as being relatively easy to apply or relatively difficult; and
- The potential value of applying the SAT to an analytic problem. Students were asked to classify SATs as being of high or lower value.

The classifications across the two dimensions resulted in four groups of SAT:

- Easy to apply and Low value;
- Easy to apply and High value;
- Difficult to apply and Low value;
- Difficult to apply and High value.

The students placed each of the 14 SATs in one of these four cells, and the resulting 2 x 2 matrix is shown in Table 1.

Most of the SATs, eight out of 14 considered, were placed into the "high value and easy to apply" cell. Only two SATs were perceived as having low value—Hypotheses Generation and Counterfactual Reasoning. It is not worth the effort to develop tools to support lower value SATs. As well, the high value SATs that are easy to apply will have limited benefit from automation or visualization. Newly developed tools should facilitate the application of difficult-to-apply SATs of high value. The students identified four such SATs:

- Analysis of Competing Hypotheses;
- Indicator validator;
- Indicators of change; and
- Decision tree.

Table 1: Classification of SATs based on their perceived value and the ease of use.

	Low Value	High Value
Difficult to apply	• Hypotheses generation • Counterfactual reasoning	• Analysis of Competing Hypotheses • Indicator validator • Indicators of change • Decision tree
Easy to apply		• Reframe the question • Bow tie • Quad crunching • Cone of plausibility • Structured brainstorming • Environmental scanning • Force field analysis • Nominal group technique

2.2 Future tool enhancements

We asked the students to elaborate on requirements for future analytic tools. Key points from this discussion are summarized below.

Visualisation of the SATs outputs

Capability to push out a nice graphic from any of the SATs to use in reports is desirable. For example, the ability to visualise different hypothesis's probabilities from the Indicator Validator SAT or the output of the Quadrant Crunching technique.

Voice recognition capability

Ability to freely dictate to the tool using keywords as triggers for certain tool constructs. For example, using the word "indicator" as a keyword for the program to recognize what follows as an indicator-type variable. The program then transforms the spoken narrative into technique's constructs in electronic form for further manipulation. The goal of this capability is to allow for a free flow of the thought process, uninterrupted by the necessity to stop for typing.

Interoperability between SATs

Automation of the input and output between different SATs is highly desirable, it will save time. For example, if the output from Environmental Scanning could be automatically imported into the tool for Indicator validator SAT.

Dealing with the volume of available information

Before the techniques can be applied, an analyst needs to find relevant information that will serve as input. Dealing with the volume of available information is a challenge. Analysts need better/smarter search capability. Smart pre-scanning and automated pre-selection of traffic for analysts would be helpful.

Big Data

Big data is an extremely important and growing context for analysis. Tools to help in the analysis of large data sets will be increasingly important going forward.

2.3 Collaborative space requirements

Some students commented that analysts currently do not work in teams. Rather, analysts from different departments working on the same problem form informal peer groups, despite the fact that collaboration is not encouraged among the departments. The current lack of analytic teams within DND is due to the shortage of staff, and addressing the problem requires a human resource plan. Therefore, techniques that require group work, such as Structured Brainstorming and Nominal Group Technique, are not particularly relevant. However, the participants pointed out that using SATs in a group setting is a "group multiplier", which also explains why the two group-dependent SATs are placed in the high value category in Table 1.

We asked the students to imagine what an ideal analytic collaborative space would look like, and the key points from this discussion are summarised below.

Rank-free environment

The students pointed out that the collaborative space for analytic work should be rank-free, that is the space where it is possible to hide ranks of the collaborators. According to the participants, such an environment will be more productive; it will be more efficient, because the collaborators will not need to worry about going against higher ranks and how to voice their disagreements properly.

Seamless tool

The collaborative space has to be seamless with respect to the analytic workflow; otherwise it will not be adopted.

Temporal aspect

The environment needs to support the temporal aspect of the work. It would be helpful if it were possible to see the evolution of the work over time, graph changes using shared visualization to see everybody's input.

Critical mass of users

Adoption and use of the collaborative analytic environment will greatly depend on acquiring a critical mass of users for its adoption. Its use needs to go beyond a single country to be adopted by the community.

Confidence and trust issues

Analysts often do not want to share their work-in-progress because they fear that they might be wrong and that the work is not complete. Also, analysts are cautious in sharing their work until they build an actual relationship with the other person and they trust them.

Need to externalise and interact

Different analysts have different ways of approaching the problem, and some have difficulty explaining their view of the problem such that it relates to how others see it. When analysts externalise their view of the problem, for example through Mind Maps or Concept Maps, they are doing it for someone else's benefit. A certain degree of back and forth is needed in order to clarify the meaning.

3 Recommendations

Based on the feedback from the students, the future analytic tool development efforts need to include the following four SATs:

- Analysis of Competing Hypotheses;
- Indicator validator;
- Indicators of change; and
- Decision tree.

Although, simple individual SAT tools would be helpful, interoperability among the tools is highly desirable.

Any new tools developed to support the analytic work need to be mindful of the workflow. Therefore, we recommend undertaking a cognitive task analysis of the intelligence analysis function and soliciting further specific requirements from desk officers.

List of symbols/abbreviations/acronyms/initialisms

DND	Department of National Defence
DRDC	Defence Research and Development Canada
CFB	Canadian Forces Base
CFSMI	Canadian Forces School of Military Intelligence
SDIAC	Strategic Defence Intelligence Analysis Course
SAT	Structured Analytic Technique(s)

This page intentionally left blank.

DOCUMENT CONTROL DATA

(Security markings for the title, abstract and indexing annotation must be entered when the document is Classified or Designated)

1. ORIGINATOR (The name and address of the organization preparing the document. Organizations for whom the document was prepared, e.g., Centre sponsoring a contractor's report, or tasking agency, are entered in Section 8.)

DRDC – Toronto Research Centre
Defence Research and Development Canada
1133 Sheppard Avenue West
P.O. Box 2000
Toronto, Ontario M3M 3B9
Canada

2a. SECURITY MARKING (Overall security marking of the document including special supplemental markings if applicable.)

UNCLASSIFIED

2b. CONTROLLED GOODS

(NON-CONTROLLED GOODS)
DMC A
REVIEW: GCEC DECEMBER 2012

3. TITLE (The complete document title as indicated on the title page. Its classification should be indicated by the appropriate abbreviation (S, C or U) in parentheses after the title.)

Opportunities for Scientific and Technical Support to Structured Analytic Techniques : Notes on the after-action review session at CFSMI's Strategic Defence Analysis Course

4. AUTHORS (last name, followed by initials – ranks, titles, etc., not to be used)

Derbentseva, N.; Kwantes, P.

5. DATE OF PUBLICATION (Month and year of publication of document.)

July 2016

6a. NO. OF PAGES (Total containing information, including Annexes, Appendices, etc.)

18

6b. NO. OF REFS (Total cited in document.)

0

7. DESCRIPTIVE NOTES (The category of the document, e.g., technical report, technical note or memorandum. If appropriate, enter the type of report, e.g., interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.)

Reference Document

8. SPONSORING ACTIVITY (The name of the department project office or laboratory sponsoring the research and development – include address.)

DRDC – Toronto Research Centre
Defence Research and Development Canada
1133 Sheppard Avenue West
P.O. Box 2000
Toronto, Ontario M3M 3B9
Canada

9a. PROJECT OR GRANT NO. (If appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant.)

9b. CONTRACT NO. (If appropriate, the applicable number under which the document was written.)

10a. ORIGINATOR'S DOCUMENT NUMBER (The official document number by which the document is identified by the originating activity. This number must be unique to this document.)

DRDC-RDDC-2016-D026

10b. OTHER DOCUMENT NO(s). (Any other numbers which may be assigned this document either by the originator or by the sponsor.)

11. DOCUMENT AVAILABILITY (Any limitations on further dissemination of the document, other than those imposed by security classification.)

Unlimited

12. DOCUMENT ANNOUNCEMENT (Any limitation to the bibliographic announcement of this document. This will normally correspond to the Document Availability (11). However, where further distribution (beyond the audience specified in (11) is possible, a wider announcement audience may be selected.))

Unlimited

13. ABSTRACT (A brief and factual summary of the document. It may also appear elsewhere in the body of the document itself. It is highly desirable that the abstract of classified documents be unclassified. Each paragraph of the abstract shall begin with an indication of the security classification of the information in the paragraph (unless the document itself is unclassified) represented as (S), (C), (R), or (U). It is not necessary to include here abstracts in both official languages unless the text is bilingual.)

In December 2014, two DRDC – Toronto Research Centre scientists were invited to attend the after-action review of the Strategic Defence Intelligence Course (SDIAC) run out of the Canadian Forces School of Military Intelligence (CFSMI) at Canadian Forces Base (CFB) Kingston. At the review, the scientists were asked to lead discussions around what the students learned in the course. Discussions revolved around two general topics: improving analysis tools through automation and visualization, and support for analysis done in collaborative teams. This short report documents the proceedings of those discussions with the purpose of informing tool development under the Joint Intelligence Collection & Analysis Capability (JICAC) project within DRDC's Joint Force Development portfolio.

En décembre 2014, deux scientifiques du Centre de recherches de RDDC Toronto ont été conviés à participer à l'analyse après action du Cours d'analyse stratégique du renseignement de défense (CASRD) offert par l'École du renseignement militaire des Forces canadiennes (ERMFC), à la Base des Forces canadiennes (BFC) Kingston. Au cours de l'analyse, les scientifiques ont été appelés à diriger des discussions portant sur ce que les stagiaires avaient appris pendant le cours. Deux sujets principaux ont été relevés : l'amélioration des outils d'analyse à l'aide de l'automatisation et de la visualisation, et le soutien aux analyses réalisées par des équipes en collaboration. Ce bref rapport décrit le déroulement de ces discussions et vise à informer sur l'élaboration d'outils dans le cadre du projet sur la capacité interarmées de recherche et d'analyse du renseignement (JICAC), qui correspond au portefeuille Développement de la Force interarmées de RDDC.

14. KEYWORDS, DESCRIPTORS or IDENTIFIERS (Technically meaningful terms or short phrases that characterize a document and could be helpful in cataloguing the document. They should be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location may also be included. If possible keywords should be selected from a published thesaurus, e.g., Thesaurus of Engineering and Scientific Terms (TEST) and that thesaurus identified. If it is not possible to select indexing terms which are Unclassified, the classification of each should be indicated as with the title.)

structured analytic techniques, intelligence analysis, requirements