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RTO TECHNICAL REPORT

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Human Environment Analysis Reasoning Tool (HEART)

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Human Environment Analysis Reasoning Tool (HEART)

Executive Summary

This paper provides an outline description and user guide for the Human Environment Analysis Reasoning Tool (HEART) which helps military staff and analysts understand the human and social environment, develop effective courses of action, and make use of appropriate analysis methods. HEART can be used to support early phases of operational planning, as a training resource and improve the representation of the human and social environment in exercise environments.

HEART provides an internet-based visual knowledge resource in four key areas:

- **Understanding the Human and Social Environment** provides guidance ranging from the individual to societal level, including specific elements on Economics and Governance. The content draws from a range of human and social science disciplines, including psychology, sociology, economics, and political science.
- **Achieving Behavioural Change** provides guidance on approaches to behaviour change for the same areas, aiming to support course of action development. It also includes advice on environmental screening of proposed actions.
- **Human and Social Analysis Resources** provides guidance on both quantitative and qualitative methods that can used to support analysis and monitoring of the human and social environment.
- **References and Data Resources** provides links to open source references and data sources, advice on use of Subject Matter Experts (SMEs) and a link to a partial fitness for purpose knowledge assessment.

An html view of the tool is available from: HEART [user name: 'visitor' and password: 'gateway'].

HEART is at a demonstrator stage, but is has already incorporated findings from national tests of earlier prototypes and is being used in its current form to support the training of operational analysts deploying to ISAF. Further exploitation is planned on a national basis. In addition, a short lecture series to socialise the tool is proposed. Hosting or advertising the tool on NATO web sites and further development via NATO ACT is also recommended.

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[1] **Note that there are no page numbers in this template since they will be added by the RTA at a later date**

Programme Committee

Please list the members of the Programme Committee here – note that this is not obligatory since the RTA can insert this information.

INCORPORATING HUMAN AND SOCIAL SCIENCES INTO NATO OPERATIONAL PLANNING AND ANALYSIS: HUMAN ENVIRONMENT ANALYSIS REASONING TOOL (HEART)

1.1 INTRODUCTION

NATO's approach to conducting operations currently and in the foreseeable theatres of asymmetrical/non-conventional conflict demands a comprehensive approach to achieve desired effects from the use of lethal and non-lethal means involving armed forces and other levers of coalition influence. This is exemplified, for example, in present command guidance that identifies the Afghan population, rather than the Taliban, as the centre of gravity for ISAF operations. Successful application of a comprehensive approach requires an evolution of military capability in concert with an improved understanding of the human and social dimension of conflict.

The NATO Research Task Group 074 within the Systems Analysis and Studies Panel (RTG SAS-074) has developed a demonstration visual reasoning tool, the Human Environment Analysis Reasoning Tool (HEART), to help military staff and analysts understand the human and social environment, develop effective courses of action, and make use of appropriate analysis methods. It directly addresses recommendations made by 5 previous NATO RTGs (MSG-024**,** MSG-028, SAS-027, SAS-044 and SAS-057).

An html view of the tool is available from: HEART [user name: 'visitor' and password: 'gateway']. Further ways to access the tool are described at section 1.5.

Potential uses of the tool include:

- Supporting early phases of operational planning.
- As a training resource.
- Improve the representation of the human and social environment in exercise environments.

HEART visually maps knowledge and provides links to related resources. It makes extensive use of Concept maps[2] which are graphical tools for organizing and representing knowledge. Figure 1 depicts a simplified view of the main components of the tool.

[2] See http://cmap.ihmc.us/ for further detail,

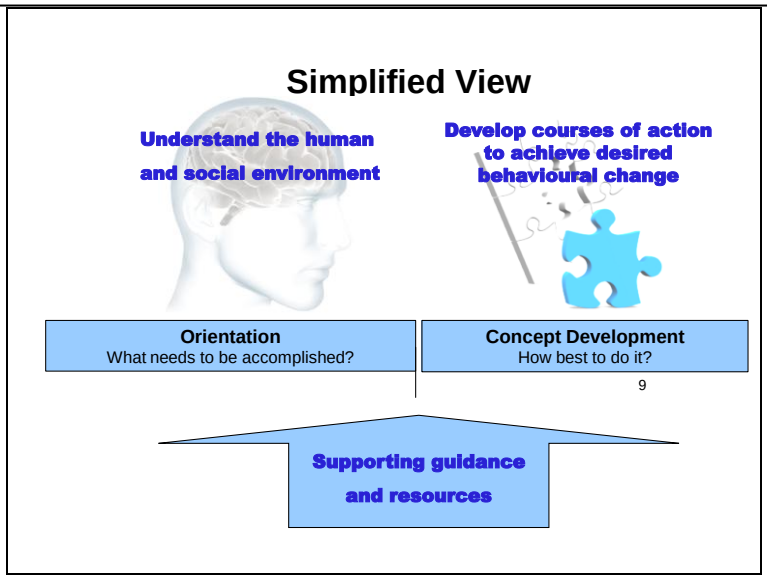

Figure 1: A simplified view of HEART

HEART encourages development of understanding human and social aspects of the operational environment. A key component of this process is the provision of *guiding questions* to help orient the user to the human and social dimension and help frame their ideas for desirable behavioural change at the individual, group, and/or societal levels. Such changes are, in essence, the desired effects to be achieved through a comprehensive, or integrated, approach to an invervention which draws on all levers of power including non-government organizations. It then provides concept maps that allow users to develop tailored courses of action (COA) by focusing on theoretically informed ways to induce desired behavioural change at all social levels. Both elements draw extensively from the human and social sciences. The tool also contains extensive guidance on associated reference material and analytical methods that can support both processes.

HEART can be used to support early phases of military planning processes, such as the *Orientation* and *Concept Development* phases of the NATO's Operational Planning Process (OPP) shown in Figure 2, or as a more general knowledge resource.

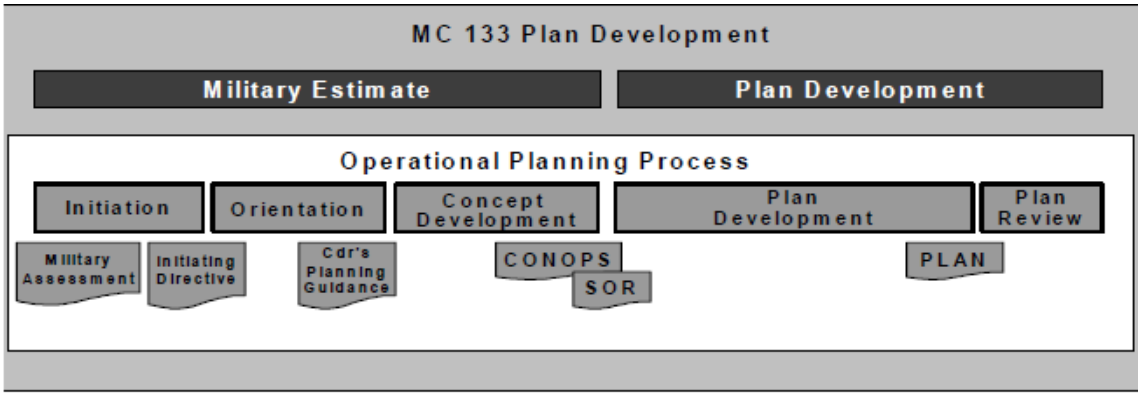

Figure 2: Overview of NATO's Operational Planning Process

1.2 OVERVIEW OF THE HEART TOOL

Concept maps are graphical tools for organizing and representing knowledge. They include concepts, herein enclosed in boxes, and relationships between concepts indicated by connecting lines. Linking phrases on the connecting lines specify the purpose of moving from one concept to another. The icons at the bottom-centre of many of the concepts can be clicked to open subsidiary concept maps and document resources. HEART is designed with a front 'Home' page (see Figure 3) that introduces and orients the user to its primary components.

HUMAN ENVIRONMENT ANALYSIS REASONING TOOL (HEART)

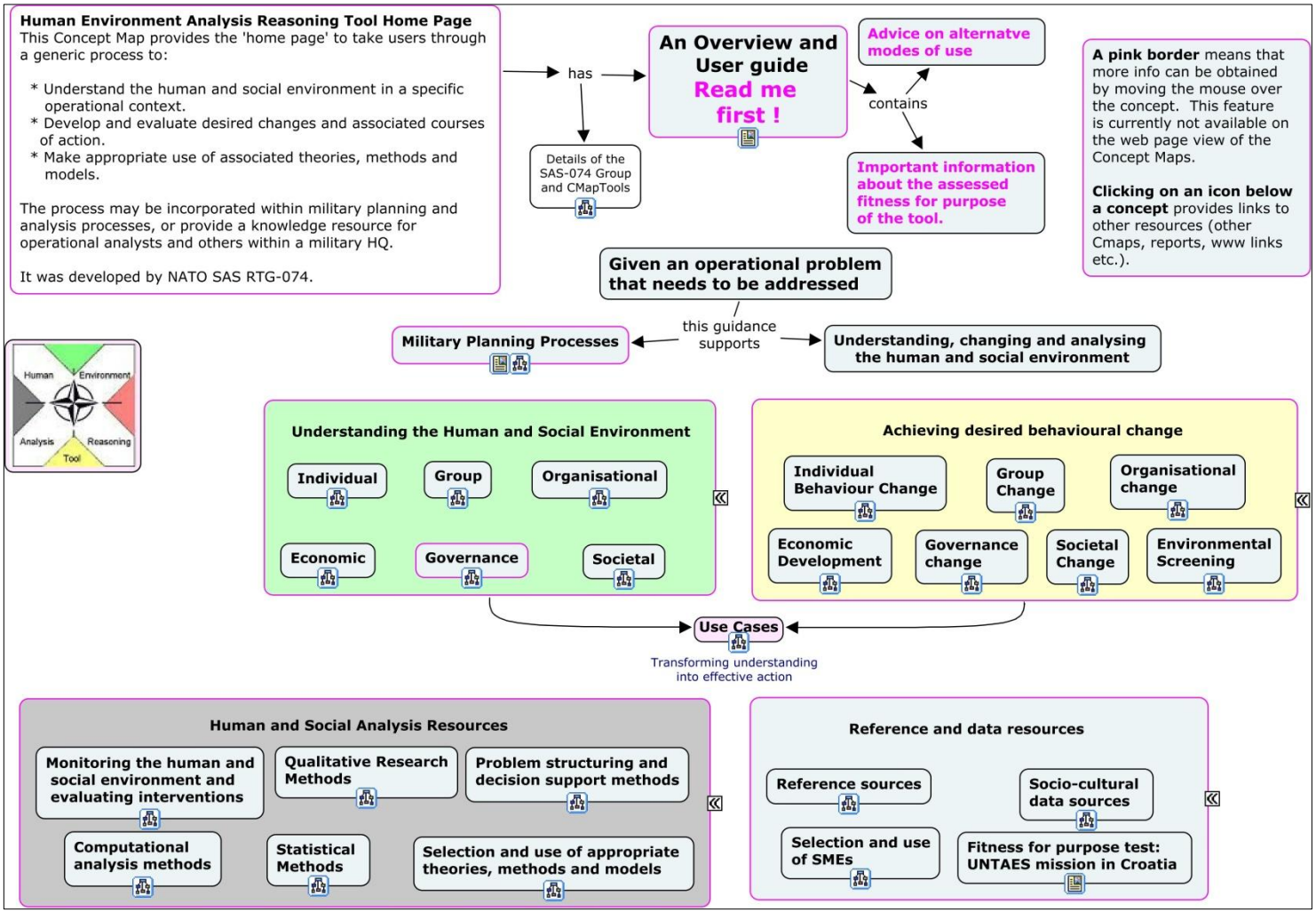

Figure 3: View of the SAS-074 Cmap home page

A description of HEART is found at the top of the home page with links to information about the group, concept mapping, this overview report, and a familiarisation presentation.

The main body of the tool is contained in 4 boxes. The top two focus on human and social knowledge, and the bottom two on supporting analytical and reference resources:

- *Understanding the Human and Social Environment* [Green] provides guidance ranging from the individual to societal level, including specific elements on Economics and Governance. The content draws from a range of human and social science disciplines, including psychology, sociology, economics, and political science.
- *Achieving Behavioural Change* [Yellow] provides guidance on approaches to behaviour change for the same areas, aiming to support COA development. It also includes advice on environmental screening of proposed actions.
- *Human and Social Analysis Resources* [Grey] provides guidance on both quantitative and qualitative methods that can used to support analysis and monitoring of the human and social environment.
- *Reference and Data Resources* [Blue] provides links to open source references and data sources, advice on use of Subject Matter Experts (SMEs) and a link to a partial fitness for purpose knowledge assessment.

Finally, a number of use cases have been developed [Pink] to illustrate the use of the tool.

1.3 SPECIFIC FEATURES

1.3.1 Key Characteristics and Guiding Questions

Figure 4 shows the *Organisational* concept map to illustrate the approach taken to all the concept maps in the *Understanding the Human and Social Environment* section. It contains three elements: a statement of purpose, a concept map showing characteristics that should be considered, and a set of 'Guiding Questions' to help the user examine these characteristics as broadly as possible.

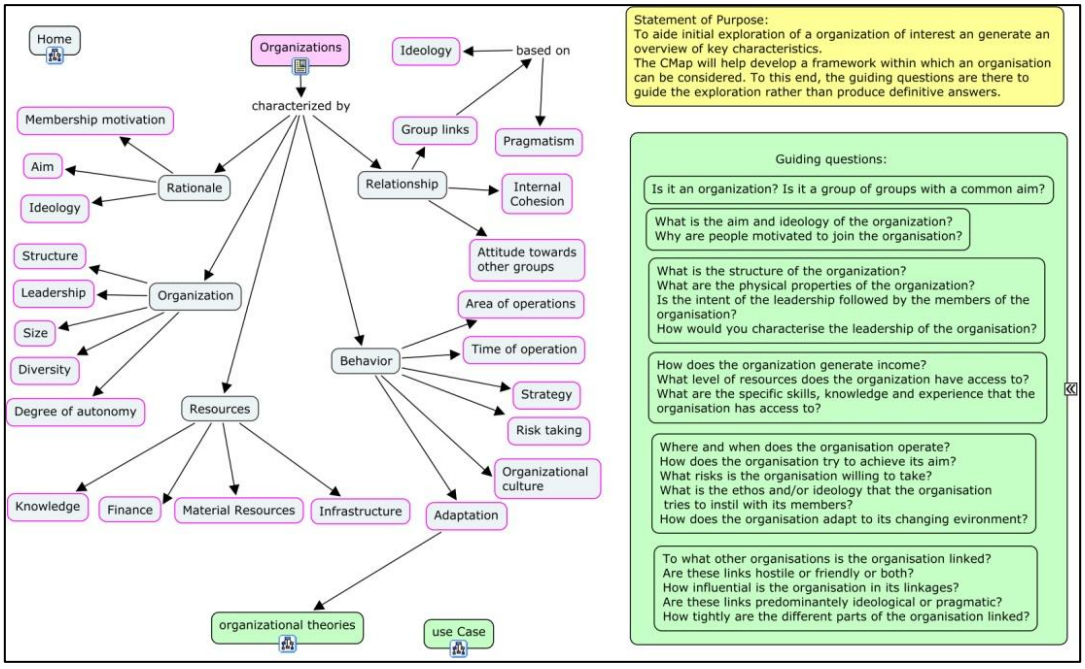

Figure 4: Illustration of the use of concept mapping and guiding questions.

1.3.2 Use Cases

A number of Use Cases have been developed to illustrate how the concept maps can be used to examine a specific operational objective. Figure 5 shows an excerpt from the *Societal* use case to demonstrate how guiding questions are answered to develop knowledge of the human and social environment. In practice, users would draw on SMEs, open source, and intelligence source information to address these questions. Note that answering the guiding questions is not intended to be a prescriptive process, as some questions may be more relevant than others in a specific context.

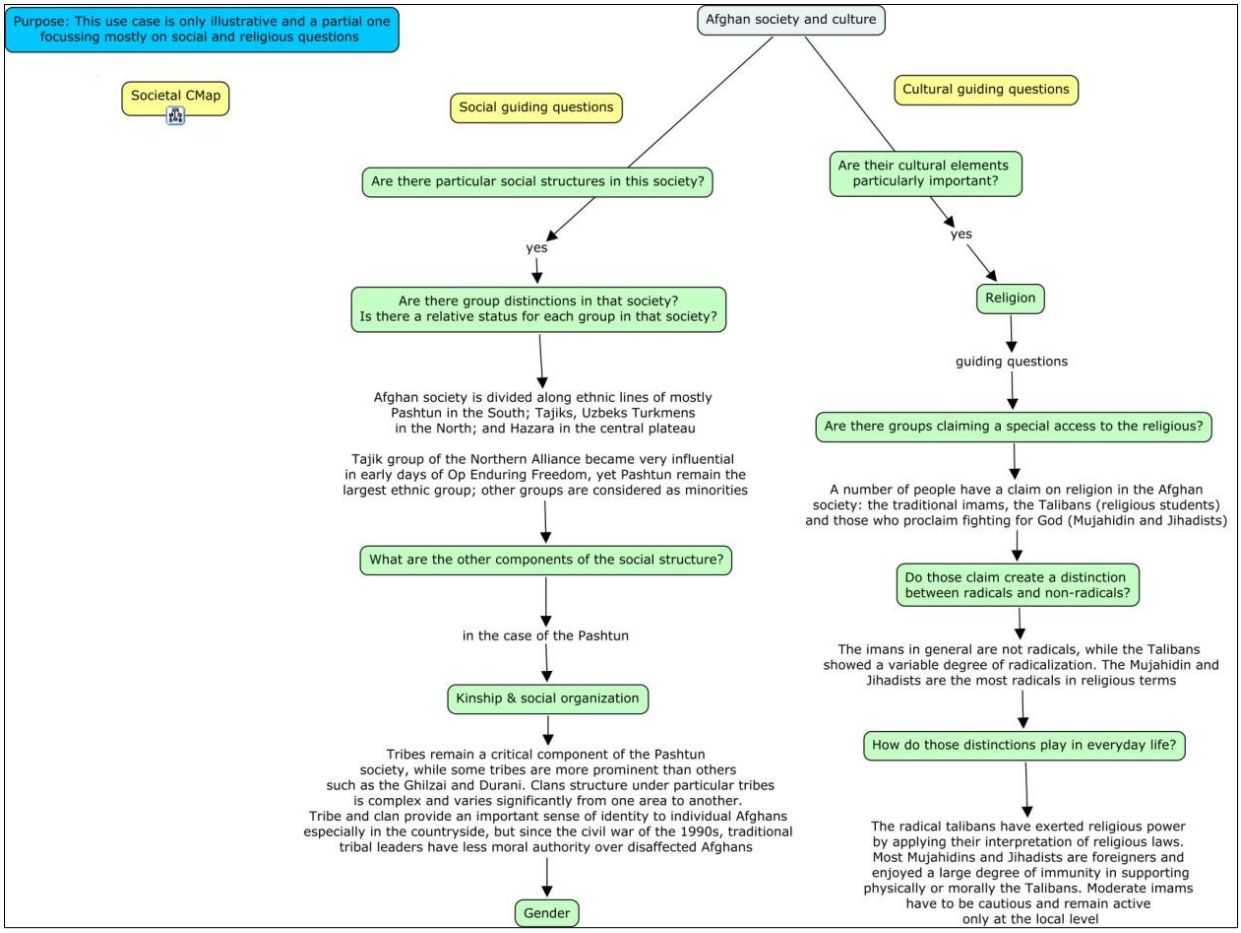

Figure 5: Example Use Case on Societal Perspectives

1.3.3 Analytical and Reference Resources

To answer the questions cited in the human and social knowledge boxes, the user will likely require analytical and reference sources. Figure 6 shows one of these concept maps, which highlights the computational analysis approaches for human and social analysis.

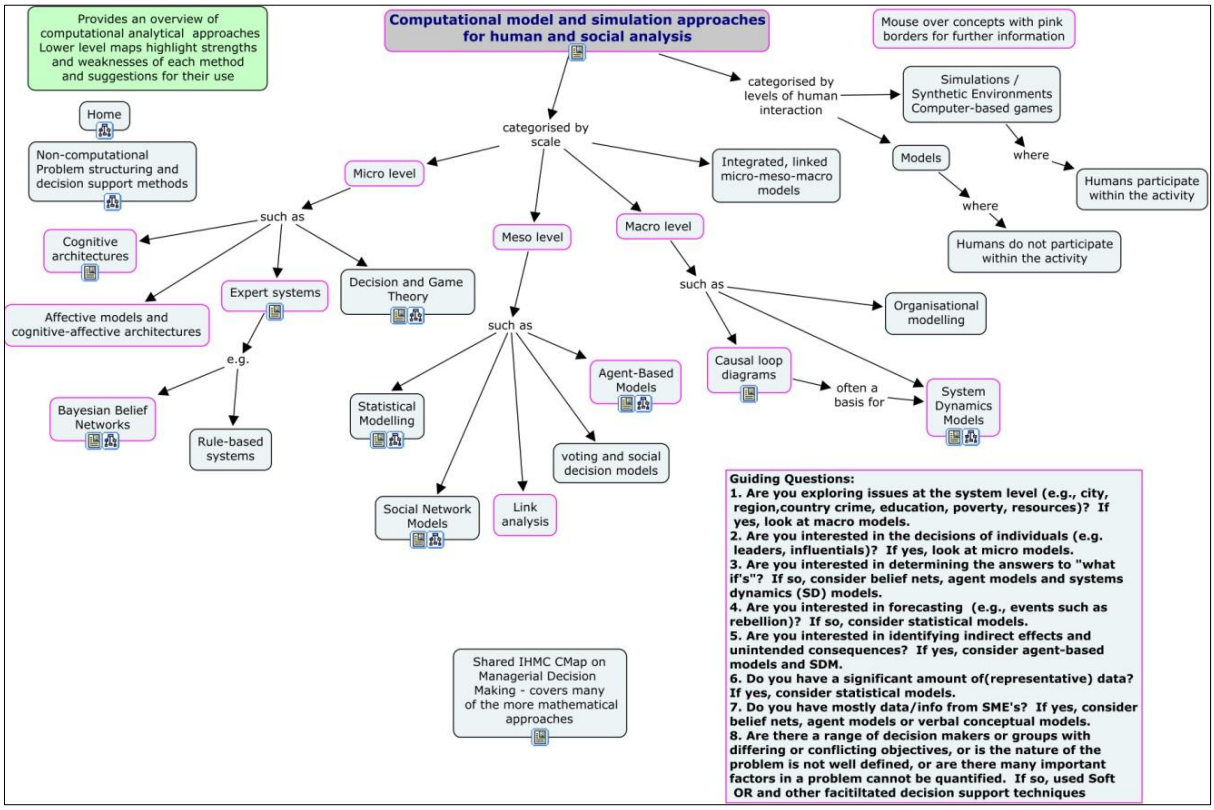

Figure 6: Example of one of the Human and Social Analysis Resource Concept Maps

1.4 UTILITY AND FITNESS FOR PURPOSE

HEART is a demonstration tool to promote and assist the integration of human and social sciences into planning and Operational Analysis (OA) processes. It can also be used as an independent resource to support training and exercise scenario development.

By design, it aims to provide the user with a 'tool for thinking' that offers basic familiarity of the human and social environment, and helps make appropriate use of that knowledge. The authors of the tool recognise that 'a little knowledge is a dangerous thing'. The tool will not make users instant experts or provide definitive 'answers' for a specific operational problem. Users should continue to make extensive use of SMEs to understand the specific operational context and to make effective use of the insights that social science and operational analysis can bring - indeed the tool can be utilized to maximize the benefit of such exchanges by helping users frame the right questions to ask such experts.

The content of the tool reflects the expertise of the participants of the NATO SAS-074 group. Hence, it contains omissions and areas that require further development. However, a partial test of fitness for purpose, conducted using a retrospective analysis of the UNTAES mission in Croatia in 1996, has demonstrated the tool's usefulness to understand the actions and behaviours that unfolded during the mission. However, more thorough evaluation is highly recommended.

Initial user testing has highlighted that familiarization training to help navigate around the tool and explain its purpose will be beneficial. In the absence of such training, a familiarisation presentation[3] is available from the *Overview and User guide* concept at the top of the home page.

[3] This link will take you to a handout version, with explanatory notes, in pdf format. You will be requested for a user name: visitor and password: gateway.

Users wishing to make operational use of the tool specific to their nation's requirements are encouraged to undertake their own test and validation activities, and to develop the tool further to meet their specific needs. Indeed, the tool is offered as a living construct that can only improve through the contribution of others. Users are encouraged to inform their national Points of Contact (see Table 1) of enhancements and lessons learned.

1.5 TOOL AVAILABILITY

The tool is currently available in two forms:

1.5.1 Concept Maps

- The tool can be viewed from an internet connected PC using the CMaptools program which is available for free from www.cmap.ihmc.us. General help and advice on using CMaptools is also available from this site.
- Once CMaptools is opened, HEART is held in 'Shared Cmaps in Places', in sub-folder *IHMC Public Cmaps (3) > Users (create your own folder) > SAS 074.*
- You will then be asked to supply a user name and password. Read-only access is available using user name 'visitor' and password 'gateway'.
- The HEART 'home page', illustrated in Figure 3, can be accessed by clicking on *00 SAS-074 Process View Shortcut*. Users are strongly encouraged to look at the familiarisation presentation available from the icon immediately under the *Overview and User Guide* before proceeding further.

1.5.2 HTML Pages

- The tool may also be viewed as Internet-based html pages using the url: http://cmapspublic3.ihmc.us/rid=1JSD3T7DL-1L24W8L-15BD/SAS-074%20Process%20View.cmap
- You will be requested for a user name and password: 'visitor' and 'gateway'.
- The main disadvantage of viewing the pages in this manner, as opposed to using CMaptools, is that the 'mouse over' feature to gain more information about individual concepts does not work. The SAS 074 Concept Maps make extensive use of this feature: concepts that have extra 'mouse over' information are identified using a pink border. CMaptools also has bespoke search capabilities.
- A pdf handout version of the familiarisation presentation with notes pages can be directly accessed.

1.5.3 Deployment onto Different Servers and PCs

HEART is currently on a publicly accessible server, though it is password protected. However, it can be placed on other servers by making use of the CMapServer software – also freely available from www.cmap.ihmc.us.

Local copies of the tool can also be made to individual PCs. The most robust approach for doing so with an Internet connected PC is to:

- Open CMaptools.
- Click on *Shared CMaps in Places* to open the *My Places* window . Find the SAS 074 folder in IHMC Public Cmaps (3) > Users (create your own folder).
- Click on *CMaps in My Computer* to open the *My CMaps* window.
- Drag and drop the SAS 074 folder from the *My Places* window to the *My Cmaps* window.

- Once the folder has been downloaded, it is desirable to use *Tools>Validate and fix links* on the local version.

To transfer to stand-alone PCs the following procedure is required, making use of an external hard drive, USB stick or equivalent.

1. Connect the hard drive to an internet connected PC.
2. Create a root folder for the CMaps on the external disk drive using Windows Explorer.
3. Open CMaptools.
4. Click on *Edit>Preferences*. Note the current default location for the *My CMaps* root folder, then change it to the CMaps folder on the external disk drive. Click OK.
5. Go through the procedure for the internet- connected PC shown above.
6. Change the default location back to the original.
7. Connect the hard drive to the stand-alone PC.
8. Create a folder for the CMaps on the stand-alone PC using Windows Explorer.
9. Open CMaptools.
10. Click on *Edit>Preferences*. Change the default location to the CMap root folder on the external hard disk. Click OK.
11. Open *My CMaps*.
12. Drag and drop the SAS 074 folder into the CMap folder in Window Explorer.
13. Change the default root folder location to the one you're using on the stand-alone PC using *Edit>Preferences*.

1.5.4 Reliance on the Internet

The *Understanding the Human and Social Environment* and *Achieving Behavioural Change* sections are not dependent on the internet for use. Thus, the two most important elements of the tool may be used 'stand-alone'. However, the *Human and Social Analysis Resources* and *Reference and Data Resources* draw heavily on Internet links. Development of a stand alone html pages (e.g. by use of a wiki) would enable stand-alone use. This has been demonstrated through TNO's ADAPT tool (see section 1.6).

1.6 NATIONAL TESTS, USE AND DEVELOPMENTS

The following points are a synthesis of national experiences (with the exception of the Netherlands, which is discussed separately below) with the tool at various stages during its development.

- There was general consensus among potential external users that a better understanding of psycho-social issues would improve military planning and that it is very much needed, but at the appropriate planning level.
- Given that most deployed HQ organizations are under-staffed and the tempo is very fast, the usefulness of HEART at the tactical level was deemed to be limited. However, use of HEART in a training environment to familiarize Staff Officers with the knowledge it contains was perceived to be beneficial. This was borne out by the NLD's evaluation of ADAPT and HEART, using simulated Brigade planning staffs.
- At the Operational planning level, where there is more time and specialized, use of HEART is likely to be more productive. However, it will not replace requirements to draw on SMEs who have a detailed knowledge of the operational context, social sciences and Operational Analysis. Indeed, one of the uses of HEART would be to help operational users know what questions they ought to ask of SMEs.
- The tool is seen as potentially providing best value at the strategic analysis and planning level where time is less of a constraint, and analysts and planners have the capacity to reach back to SMEs to get the additional expertise that they require.
- In its current form, the tool can be used most effectively for knowledge access to trainers (e.g. exercise developers) and trainees within training and education environments. It is already being

used in the UK as the foundation for providing a social science appreciation for operational analysts deploying on operations.
- Future enhancements should include a procedure (via search/query algorithms) to help planners discover what they do not know beyond intuitive exploration.

The Netherlands has made very good use of the SAS074 process and results within the NLD-MoD research program on Enhancing Information Operations through Multiple Perspectives. This beneficial interaction has had the following consequences. The SAS074 group has made available a research network/platform that helped generate new lines of thought and "solutions" for understanding the complexity of the "non" kinetic operational environment. Not only the discourse but also the actual results in the form of hyperlinked concept maps and associated documents were a good starting point for the development of the Dutch prototype tool "Awareness Development Across Perspectives" (ADAPT) which has taken this graphical representation of knowledge further; it also includes a textual representation (Wiki-like) of knowledge and can produce tailored semantic maps of topics of interest to the user[4].

This fruitful collaboration has stimulated and facilitated the realization of the NLD ADAPT prototype which has been applied in a simulated Brigade Staff environment within a Concept Development and Evaluation process to test the proof of principle. This being an enhanced sense making capability of brigade level staff officers, in other words a broadening of perspectives on a complex operational environment. The positive evaluation of the principle can be seen as a "partial validation" of the SAS074 enterprise and effort.

1.7 FUTURE DEVELOPMENTS

In its current form, the RTG recommends that HEART should be socialised by means of a NATO lecture series. The target audience would be at OF-5 (Colonel) level, which suggests that the NATO Defense College Rome and the US National Defense University NATO Staff Officers Orientation Course as appropriate venues. A lead for this potential follow-on activity has been identified[5]. On a national basis, RTG members are also recommended to undertake similar activities with their respective national defence colleges.

The group recommends that HEART should be hosted on, or advertised from, the NATO Research and Technology Organisation (RTO) and Allied Command Transformation (ACT) web sites.

The Netherlands ADAPT tool suggests a number of enhancements that could be made to HEART to improve its functionality. In summary these include: development of a back-end wiki to reduce reliance on links to the Internet and provide a text interface; better search/ query mechanisms; development of topic-centred semantic maps; more thorough Use Case development and further user evaluation[6]. The group considers that such enhancements would be better achieved through a focused full-time activity, rather than by extension of this RTG activity. It is recommended that NATO ACT or ACO, potentially supported by the NATO Command Control and Communications Agency (NC3A), be tasked to undertake such work. An RTG could be created to provide oversight of such developments.

Specific proposals for further national developments include:

- Further enhancement of the ADAPT and HEART tool by TNO (NLD).

[4] Where factors relating to a chosen topic of interest are 'mind-mapped'.

[5] Laurie Fenstermacher, US Air Force Research Laboratory

[6] Wikis provides an alternative textual representation of knowledge, which is preferred by some, and allows development of semantic networks. The latter also enable topic-centred concept or mind maps to be created.

- The Swedish Defence Research Agency (FOI) has made a project proposal to the Swedish Armed Forces, to develop a Swedish prototype based on the results from the SAS074 study. The aim is to test the tool and concept to gain more user experience, but also adapt the tool to Swedish conditions using FOI analyst and subject matter experts. The project will include an experiment where the prototype will be tested in a planning situation in a staff environment. Based on the results the final report will recommend possible future implementation in the Swedish Armed Forces.
- Dstl is making HEART available across MoD UK's Wide Area Network so that it can be used for training and education and by the operational community. It will also actively seek exploitation and national customisation for use in both domains.
- The Canadian team will seek 'champions' who can develop the tool further for operational analysis and planning. Maximum benefit can be realized by gaining the support of other national government departments and international partners in concurrence with a comprehensive approach.

RTG MEMBERSHIP AND POINTS OF CONTACT

Further information on the tool is available from the points of contact shown in Table 1.

Table 1: SAS RTG 074 Membership

	Country	Email
Primary Points of Contact		
Philip Jones (SAS RTG-074 Lead)	UK and other nations	prjones@dstl.gov.uk
Peter Tikuisis	Canada	Peter.Tikuisis@drdc-rddc.gc.ca
Tony van Vliet	Netherlands	tony.vanvliet@tno.nl
Nina Hellum	Norway	nina.hellum@ffi.no
Anders Tavemark	Sweden	anders.tavemark@foi.se
Laurie Fenstermacher	USA	Laurie.Fenstermacher@wpafb.af.mil
Other RTG Members and Points of Contact		
Dr Eric Ouellet	Canada	ouellet@cfc.dnd.ca
Luminata Stemate	Canada	Luminita.Stemate@international.gc.ca
Sofi Blazeski	Canada	Sofi.Blazeski@drdc-rddc.gc.ca
Mikael Lundin	Sweden	mikael.lundin@foi.se
Gemma Warren	UK	Gemma.Warren100@mod.uk
Abigail Davison-Jenkins	UK	Abigail.Davison-Jenkins303@mod.uk
Albert 'Bull' Mitchum	USA	Albert.Mitchum@langley.af.mil

Final Note:

Should you require further assistance in using RTO Templates, or have any questions, comments or suggestions or any other matter relation to the formatting of your report, please contact the RTA Information Management and Systems Branch directly at author_support@rta.nato.int or visit our Author Support Page on the RTO Website at http://www.rta.nato.int/download.htm