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INTEGRATION OF PSYCHO-SOCIAL MODELS AND METHODS IN NATO'S APPROACH TO OPERATIONS; A REVIEW OF NATO RESEARCH AND TECHNOLOGY ORGANIZATION (RTO) SYSTEMS ANALYSIS STUDIES (SAS - 074)

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ABSTRACT

NATO's Research and Technology Organization (RTO) Systems, Analysis, Studies Task Force (SAS-074) is currently developing a process to increase the utilization of human and social-science based Theories, Models and Methods (TM&Ms) by planners and operational researchers in support of these operations. The paper outlines the approach the group is taking. A two-stage process has been developed which provides guidance to analysts and planners to help them: develop an overview of their operational problem from a range of Psycho-Social (P-S) perspectives; develop appropriate P-S objectives within the planning process; and, provide a knowledge base to promote the appropriate use of P-S TM&Ms throughout the Analysis - Planning – Execution – Assessment cycle. It also reviews the insights gained from other NATO RTO activities, including the recent SAS-071 workshop on Modeling and Simulation (M&S) in Irregular Warfare and highlights the development of a virtual community of interest.

1 INTRODUCTION

NATO is involved in a diverse range of contingency operations where achieving desired P-S effects are increasingly becoming an important and crucial part of a mission objective. Supporting analytical capabilities have traditionally focused on physical or 'kinetic' war-fighting capabilities, however, the particular interests of SAS-074 are P-S analytical approaches and how they may be applied to inform NATO decision-makers.(NATO 2009) The SAS panel conducts these operational studies to develop collaborative approaches for common analytical problems across the NATO alliance.

2 SAS-074 OUTLINE

NATO Research Task Group SAS-074 is developing guidance to enable operational analysts and planners make better use of P-S, which is defined broadly to include psychological, political, societal (sociological / anthropological), economic, political and military perspectives. TM&Ms, primarily in support of Irregular Warfare (IW) operations. The group is multi-disciplinary, drawing expertise from both human/social sciences, physical sciences and operational research communities Participants are from the US, Netherlands, Sweden, Finland, Canada and the UK. The task group commenced in April 08 and is due to conclude in 2011.

An objective of this activity is to enhance the operational analysis capabilities available to NATO and the nations. Current NATO operations increasingly require perception and anticipation of human, social, and cultural factors. SAS-074 addresses how to use human and social-science based TM&Ms and seeks to optimize these for desired P-S effects. However, effective analysis requires an coordinated set of tools and systems. (NATO 2002) Presenting a good model for P-S effects is not enough. It needs to be suitably integrated within an overall set of analysis methods and models. In short, models for P-S effects require system interoperability. (Tolk 2004) Current P-S efforts may be interesting and demanding, but operational relevance needs to be achieved by the SAS task force. [Not sure what the last sentence means)

Previous Research Technology Groups (RTGs) have acknowledged a need to evaluate and model social-science TM&Ms given a recent change to operational environments. These previous RTGs comprise NATO MSG-24 on M&S Support to Non-Article 5 Operations (TR-MSG-024, Jan 2008); MSG-028 Modelling and Simulation to Address NATO's New and Existing Military Requirements (RTO-MP-MSG-028, Oct 2004); NATO SAS-027 Analysis of Smaller-Scale Contin-

gency Operations in Long Term Defence Planning (TR-SAS-027, Feb 2005); SAS-044 Decision Support to Combined Joint Task Force and Component Commanders (RTO-TR-SAS-044, Feb 2004); and SAS-057 Information Operations – Analysis Support and Capability Requirements (TR-SAS-057, Oct 2006). All reports are available on NATO's website.

With this in mind, progress needs to be made on how to close the gap between P-S capabilities and current Modeling and Simulation (M&S) interoperability research and development efforts. RTG-074 perceives a need for this in order to meet analytic and interoperability challenges. A desired outcome of SAS-074 would be a process enabling operational analysts and planners to identify social-science TM&Ms and associate this knowledge with known P-S effects and provide a capability to share this information within in a specified operational context.

This is not without challenge as the nature of Human Social Cultural and Behavioral (HSCB) TM&M and diversity of P-S modeling efforts increase the difficulty of bounding a scope of the activity needed for effective operational support. An interim solution is to use a collaborative Concept Mapping (CMap) environment to begin a process of identifying the needed elements to support social-science TM&Ms and their associated P-S effects. (Cañas, Hill, Carff, Suri, Lott, Gómez, Eskridge, Arroyo and Carvajal 2004). Figure 1 shows the home CMap, which provides guidance in the form of a generic two phase process, and associated resources to develop an overview of the environment from a range of P-S perspectives in a specific operational context and inform selection / refinement of objectives and courses of action.

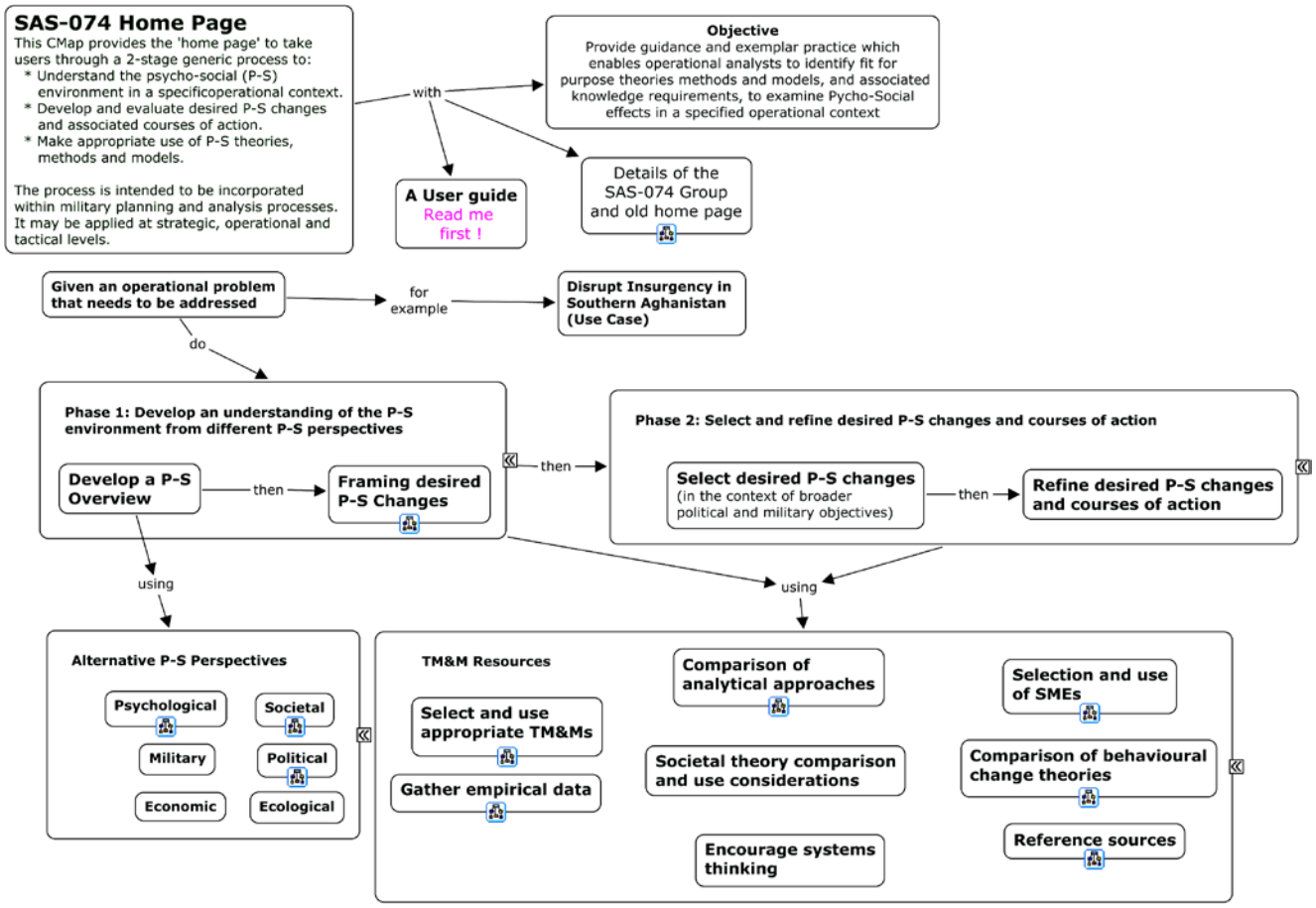

Figure 1: CMap Presentation from SAS-074 Home Page

3 IREGULAR WARFARE AND PSYCHO-SOCIAL COMMUNITY OF INTEREST (COI)

A procedure for modeling HSCB TM&M P-S effects in a Irregular Warfare (IW) environment using appropriate M&S tools requires an evaluation of current approaches. NATO's RTG SAS-071 contributed an evaluation of current state-of-the-art analytical tools regarding this subject matter. (Bexfield 2008) The group observed that conventional warfare analysis ap-

proaches are proven inadequate when addressing the multi-faceted nature of IW. (Tolk 2009) SAS-071 conducted workshops and participants presented their programs, M&S tools as related to IW and recommendations for improving analytic tool support. The following are recommendations made by the SAS-071 working group for NATO RTO action.

- Collect data from NATO and national operations in Afghanistan and make the data available to member nations to support tool building and analysis
- Provide joint support and training to analysts deploying to Afghanistan
- Sponsor a social-science COI that compares social science TM&M and data
- Sponsor an IW M&S COI to encourage the sharing of IW M&S techniques, data and lessons learned
- Sponsor a joint research team to develop an IW framework that could be used to assess M&S and establish requirements
- Sponsor a joint research team to develop a Code of Best Practices for IW M&S and data Validation and Verification (V&V)
- Recommend that Allied working groups sponsor a joint technical team to create a lexicon for IW-related activities for use by all the member countries.

3.1 Irregular Warfare (IW) Operations and P-S Models

Understanding TM&Ms that produce desired HSCB P-S effects in an IW operational environment could result in their use as preventive actions that may ultimately help avert conflict. Identifying the desired P-S effects have shown value in crisis response and humanitarian areas where such intervention has succeeded under certain conditions. (Brown and Rosecrance)

The question arises if there is a need for P-S models in IW operations. The answer may be that there is more to "Winning Hearts and Minds" of a population involved in a conflict, or crisis, than decision-makers, using traditional methods, have accounted for. As we are currently seeing in Pakistan, destabilized states allow unprotected environments in which terrorists gain sanctuary, recruit new members, and eventually gain financial and moral support from the population. These conditions may also lead sectarian and ethnic discord which terrorist easily exploit. An alternative approach might be to directly identify proven TM&Ms and associate P-S effects known to reduce the initial conditions that make these societies vulnerable.

Regarding IW, P-S factors that contribute to weakened states and ultimately political instability, could be initial areas for observing important P-S factors that affect change. This is further supported by (Lund and Schirch 2009) who offer insight into actions that might deter development of these environments and conditions. These actions are briefly listed below.

- Prevent terrorism and insurgencies from emerging in the first place by mitigating their proximate causes
- It is more cost effective to prevent state failure or conflicts than having to intervene into conflict once this has occurred
- Promote preventive actions that strengthen fragile states to avert conflict. Certain preventative actions have been tried and have succeeded under certain conditions
- Available programs, analytical and decision-making tools need to be brought together and applied more consistently and robustly where and when threats are emerging, using coherent strategies.

To this end, the SAS-074 working group is testing usability of concept mapping HSCB TM&Ms by applying the a "use case" of disrupting an insurgency in Southern Afghanistan to a psychological overview using CMap. This idea supports the notion that preventive action can be done through P-S programs that pre-empt or diffuse the ability of extremist groups from being able to mobilize support from the population.

How could models used in IW environments influence P-S change to one of a desired behavior? The first challenge in answering this question is to make sure that a common lexicon is adapted for HSCB TM&Ms. When defining a P-S problem set, each of the disciplines involved must demonstrate interoperability. Given a "use case" example of disrupting an insurgency in Southern Afghanistan, the group must arrive at an agreement on a common tool set for analysis and experimentation. This is why M&S architectures contribute to this community with their work in framing a common environment, development of meta-models and mappings for HSCB experimentation. (Zeigler *et al.* 2000) SAS-071 has also concluded that progress must be made on common lexicon for IW. NATO's RTOs are in a good position for coordinating this approach for both joint analysts and field support. Needed are collaborative and accessible databases with common HSCB data definitions that yield themselves to P-S experimentation.

Another challenge for influencing P-S changes is one of a qualitative nature due to the diversity of theory and semantics associated with HSCB. Within the many disciplines associated with HSCB, field concepts and terminology vary widely, pre-

senting a problem for common consensus. However, if the problem set is presented for P-S behavior then perhaps a known set of outcomes may be presented, allowing each discipline expert to contribute to a prioritized list of common experimental objects. Again, M&S meta-models may be used to translate these diverse TM&Ms into common objects for experimental use.

3.2 Target Community of Interest (COI)

Reliable expert input and references are needed for the "use case" presented by SAS-074. This may be found with a target COI needed specifically for TM&Ms associated with P-S effects. This COI could also be used by SAS-074 members to help construct an HSCB meta-model for the IW specific scenario. These needs are also addressed as part of a larger body of knowledge associated with identifying HSCB gaps. (National Defense University 2008)

Addressing similar requirements, the *Catalyst Project* sponsored by the U.S. Joint Forces Command was created to identify current HSCB/PMESII experts, projects and M&S tools used in supporting related programs or projects. (Catalyst Project 2009) The project also assesses overlaps in project/tool functionality and in observed gaps for M&S capabilities as identified by the contributing COI experts. The project provides a virtual workspace for participating SMEs to share program and project information. It also provides a baseline of PMESII related projects, programs, and tools. This helps analyst identify perceived gaps within community efforts. By identifying these gaps, efforts may focus on development of both PMESII/HSCB and M&S capabilities that result in coordinated planning for crisis response or relevant COI participation in mutual experimentation.

3.3 Contributions using COI and Forecasting of P-S effects

Forecasting P-S events in an IW environment requires a thorough review of TM&Ms and their application to a P-S event meta-model. Particular ideas for using a COI include:

- Aligning theory and practice (Using the COI to map social-science theory to practical application of P-S events)
- Meeting community interest (Extending the *Catalyst Project* and using experts for participation in a virtual exercise)
- Analyzing HSCB gap with theory and practice (Identifying and validating these gaps and ensuring there are appropriate TM&Ms supporting this validation)
- Analyzing gap for behavioral variables and IW objectives (Linking behavioral models and methods to similar IW objectives)
- Analyzing Analyzes gap between HSCB and M&S tool sets (Identifying common elements within HSCB disciplines, based on a common problem set, and matching them to a usable meta-model for M&S support).

Using the virtual workspace provided by the *Catalyst Project*, HSCB/PMESII professionals are able to network, collaborate and share program information.. (https://primus.casos.cs.cmu.edu/catweb) This COI forum may be used to address the above concerns and to help identify related M&S tool sets. Knowing that each discipline varies widely in methods used to analyze problems associated with HSCB events, the *Catalyst* COI could provide reliable referents for developing common semantics to particular HSCB "use cases" associated with pre-defined problem sets.. Translating TM&Ms into common objects for experimental use and comparing these with similar objects presented in the *Catalyst* COI also prove useful in developing a common meta-model. These efforts, given participation and cooperation among the community, could provide acute HSCB observations resulting in a shared environment for use in experimentation. Inputs contributed by domain experts would provide reliable referents adding to a productive scientific approach to planned actions and focused efforts toward conflict and crisis prevention.

This virtual enterprise of networked practitioners provides a COI consisting of HSCB experts, their organizations and projects, as well as the supporting M&S tools. Significant contributions have been made to this PMESII domain through member awareness, idea exchange and identification colleagues who share similar interest and are working on related projects. This successful sharing of information among members found in academia, industry, government, and in the private sector can be leveraged for use by SAS-074 and applied to the initial uses case and subsequent experiment..

4 MAPPING IRREGULAR WARFARE (IW) AND P-S EFFECTS

As presented earlier, it is important to map P-S effects to a meta-model to help define common semantics for a specific problem set. If this is not accomplished, there is the possibility of non-interoperability among models or disagreement on related concepts. In the area of IW, this becomes important to SAS-074 regarding the experimental use case of thwarting the creation of an insurgency prone environment. Obviously, objects and elements of the use case need to be defined, created, and supported by applicable TM&Ms. One of the first steps is to show relevance within an operational setting for P-S effects.

This means that HSCB TM&Ms must either have proof or show a potential to affect P-S change for a vulnerable insurgency state.

Mapping potential P-S change objects to observable events also implies the possibility of using these objects to model desired behavior that may result in favorable societal outcomes. Ideally, model actualization of this mapping, using P-S variables, would lead to experiments that forecast probabilities of positive change to IW operational outcomes. SAS-074 has started an initial attempt at this process using CMap. The idea is to provide an orderly account of behavioral change and a theory comparison. Usability will be assessed by applying the use case of disrupting an insurgency in Southern Afghanistan to the psychological CMap overview and comparing this with supporting TM&Ms.

A top level hierarchy and event outline are needed to help map and model the event. As part of TM&M identification and evaluation, experts must be validated as germane to the observed discipline or field of study. Also, CMap results will need to be interpreted for ultimate use as representative software objects. This will allow for both developing a method for concept transformation into usable objects and for further development and linkages with M&S tools or systems.

4.1 Defining the IW Test Population

The IW problem set of disrupting an insurgency in Southern Afghanistan requires a definition of the population and associated P-S variables {X,Y, …}. There are other factors to consider such as cultural, governance, PMESII, and emotional states. (Silverman *et al.* 2006) Also, one must select the related disciplines (e.g., anthropology, sociology, psychology, linguistics, etc.) for inclusion in the experiment. Appropriate experts specific to the given problem must be identified and an agreed upon set of variables must be established that accurately represent P-S behavioral change. More so, when representing this scenario in a M&S environment, the scenario must accurately represent the test case. When defining the IW population, it would also be advantageous to note any P-S "triggers" that could assist in the observations. In short, this is not an easy task.

4.2 Mapping to a M&S Tool Set

Selecting M&S tools for mapping HSCB attributes to an experimental framework requires an assessment and examination of models whose attributes provide a "best fit" for the application. Again, a given problem set helps guide selection of the appropriate model. In the case of SAS-074, M&S Tool Sets considered for experimentation should associate applications that link desired P-S change to realistic, observable, and measurable HSCB scenario outputs.

The *Catalyst Project* recognized this need for mapping and took the first step by constructing a visualization tool for the PMESII COI. A system of systems approach was considered. (This closely aligns with a cognitive mapping approach and is very similar to the approach considered by SAS-074) Cognitive processes for seeking systems projects, organizations, and locations were used as a benchmark for developing the model. These considerations were used to identify the model objects and create a data infrastructure to support the visualization software. The result was the creation of a visualization management tool called "The Brain". (The Brain Visualization Management Tool 2009) Mapping mental processes to objects with their associated meta-data for the PMESII COI project allowed for software object creation and development of the COI virtual interactive environment.

5 EXPERIMENTATING FOR PSYCHO-SOCIAL DESIRED EFFECTS

SAS-074 selected an IW problem set and has identified initial parameters associated with this pre-defined event. This problem set has been chosen to explore the desired P-S effects associated with a vulnerable population related with instances of insurgent influence. Regarding experimentation, a goal is to present a behavioral change model and to experiment seeking these desired effects.

5.1 HSCB Referents

An important factor to consider for the experimental use case presented by SAS-074 includes identification of supporting proofs and theories for the desired P-S behavioral change. TM&Ms referenced for behavior change must be relevant to the use case and confirmed by demonstrated experts. Also, P-S variables associated with behaviors that are considered significant to the this change must be identified. It is also noted that, in the case of an IW event, these variables may affect more than one P-S objective.

To help locate these referents, the previously mentioned C*atalyst Project* proves helpful as it maintains a virtual catalog of people, organizations, and projects related to the PMESII field. This source may be used to identify experts, programs and theories to support the experiment. Also, in partnership with the Army Research Laboratory (ARL) and Carnegie Mellon University, an effort is underway to develop a "Facebook-like" capability linking those doing work in the PMESII/HSCB

community with shared or similar work within their organizations. These efforts are viewed as preliminary ground work for observing M&S gaps associated with HSCB. These sources may also allow for an alignment of PMESII variables associated with IW objectives. Furthermore, these reference sources might provide information that helps align the gap between IW objectives and P-S variables for behavioral change. It is also possible to use the diversity of both social-science disciplines and SMEs to align TM&Ms relationships (best fit) and to present a collaborative set of semantic relationships needed for the experiment.

5.2 The Virtual Experiment

The platform to be used for experimentation is still unresolved regarding the SAS-074 case. Currently being discussed are plans to test this problem set within a virtual collaborative environment. However, there are many challenges associated with this. (Wainfan L. and Paul 2004) These challenges include issues associated with the quality of work performed in the environment. One example of this is the frequent occurrence of software developers representing a subject matter vice its legitimate representation by experts. There are other complications associated with event operation. An example of this is when a virtual working group settles for reduced quality or performance when the process of sustaining a virtual environment overrides the importance of the group agenda. For an effective virtual experiment, these must be guarded against to ensure that an involvement or fascination with the environment does not become more important than the subject matter at hand.

To help nurture this culture for HSCB/PMESII participants, Second Life (SL) is being tested as a possible decision support platform for iterative workshops and as a possible trial experimental medium. (http://www. secondlife.com) SL is a promising technology and exciting platform for multi-user visual simulation and decision support.

Conducting an experiment in this virtual collaborative environment requires active member participation. Current iterative workshops are using SAS-074 members to test the environment for optimum performance. The idea is to provide an environment that lends itself to promoting and sustaining group membership. Also, current recommendations from members attending these workshops are used to mutually agree on the experimental approach. These workshops also confront the challenges previously identified with collaborative experiments. Ultimately, what is needed is a collaborative group of proven experts successfully operating in this environment who are dedicated to solving a given HSCB/PMESII problem set.

Currently JFCOM is working with University of Edinburgh in a SL environment testing how PMESII analysis tools, M&S or decision-making systems may present their information in some useful way into this 3D space to be shared by the COI. Some initial collaborative workshops use SL avatars for this coordination. If it is shown that systems can be effectively used in this manner and mutually shared within the VWCE, then SL or another virtual web 2.0 environment may be considered as a platform for the initial experiment.. Figure 2 shows an initial iterative collaborative workshop using SL and screen shot of a CMap presentation.

Figure 2**:** CMap Presentation to SAS-074 Members using a Virtual Collaborative Environment

Figure 2 is an actual iterative workshop with each avatar representing an expert who is virtually attending from differing geographic locations.. These experts are collaborating and reviewing a CMap presentation for SAS-074 integration of P-S models. Initial findings from the workshops show strengths associated in the area of user observation of multiple feeds, or views, that can be used in shared decision-making or problem solving. An example is where avatars are able to view multiple presentations in near real time, as presented by invited members/experts, and relate these to the group deliberation at hand. It is envisioned the HSCB community can be stressed with a critical IW problem set using this environment in a carefully controlled setting.

6 CONCLUSION

In order to better support current NATO operations, an increased utilization of human and social-science based TM&Ms is needed for decision-makers. To accomplish this task, observations using TM&M in Irregular Warfare (IW) settings and identification of appropriate M&S tools have been presented that directly support a related experimental problem set. These evaluations may be used to map current P-S theories. A P-S approach to IW scenarios using an experimental objective also presents interoperability demands that require COI expert intervention. Expected results include a process that will help the armed forces and analysts better understand how and when to use P-S TM&Ms for crisis planning and emergency response.

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