



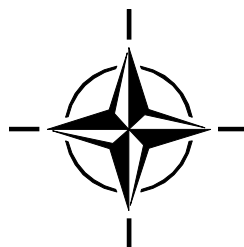
RTO TECHNICAL REPORT

TR-HFM-138

**Adaptability in Coalition Teamwork**  
*Leader and Team Adaptability in  
Multi-National Coalitions (LTAMC)*

(Adaptabilité dans le travail d'équipe en coalition  
*Adaptabilité des chefs et des équipes dans  
les coalitions multinationales*)

Findings of Task Group HFM-138.



Published November 2012





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# The Research and Technology Organisation (RTO) of NATO

RTO is the single focus in NATO for Defence Research and Technology activities. Its mission is to conduct and promote co-operative research and information exchange. The objective is to support the development and effective use of national defence research and technology and to meet the military needs of the Alliance, to maintain a technological lead, and to provide advice to NATO and national decision makers. The RTO performs its mission with the support of an extensive network of national experts. It also ensures effective co-ordination with other NATO bodies involved in R&T activities.

RTO reports both to the Military Committee of NATO and to the Conference of National Armament Directors. It comprises a Research and Technology Board (RTB) as the highest level of national representation and the Research and Technology Agency (RTA), a dedicated staff with its headquarters in Neuilly, near Paris, France. In order to facilitate contacts with the military users and other NATO activities, a small part of the RTA staff is located in NATO Headquarters in Brussels. The Brussels staff also co-ordinates RTO's co-operation with nations in Middle and Eastern Europe, to which RTO attaches particular importance especially as working together in the field of research is one of the more promising areas of co-operation.

The total spectrum of R&T activities is covered by the following 7 bodies:

- AVT Applied Vehicle Technology Panel
- HFM Human Factors and Medicine Panel
- IST Information Systems Technology Panel
- NMSG NATO Modelling and Simulation Group
- SAS System Analysis and Studies Panel
- SCI Systems Concepts and Integration Panel
- SET Sensors and Electronics Technology Panel

These bodies are made up of national representatives as well as generally recognised 'world class' scientists. They also provide a communication link to military users and other NATO bodies. RTO's scientific and technological work is carried out by Technical Teams, created for specific activities and with a specific duration. Such Technical Teams can organise workshops, symposia, field trials, lecture series and training courses. An important function of these Technical Teams is to ensure the continuity of the expert networks.

RTO builds upon earlier co-operation in defence research and technology as set-up under the Advisory Group for Aerospace Research and Development (AGARD) and the Defence Research Group (DRG). AGARD and the DRG share common roots in that they were both established at the initiative of Dr Theodore von Kármán, a leading aerospace scientist, who early on recognised the importance of scientific support for the Allied Armed Forces. RTO is capitalising on these common roots in order to provide the Alliance and the NATO nations with a strong scientific and technological basis that will guarantee a solid base for the future.

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## List of Acronyms

ACO	Allied Command Operations
ACT	Allied Command Transformation
AFRL	Air Force Research Laboratory
AGFI	Adjusted Goodness of Fit Index
ARI	Army Research Institute
ARL	Army Research Laboratory
AW04	Allied Warrior 04
AW05	Allied Warrior 05
BBN	BBN Technologies
C2	Command and Control
CCL	Culture and Cognition Laboratory
CD&E	Concept Development and Experimentation
CFEC	Canadian Forces Experimentation Centre
CJOC	Combined Joint Operations Centre
CJTF	Combined Joint Task Force
COTS	Commercial Off-The-Shelf
CPX	Command Post Exercise
CTA	Collaborative Technology Alliance
CTEF	Command Team Effectiveness
D/I	Direct/Indirect
DARI	Defence Advances Research Institute
DJTF	Deployable Joint Task Force
DMSO	Defence Modelling and Simulation Office
Dstl	Defence Science and Technology Laboratory
E/S	Egalitarian/Status
EBO	Effects Based Operations
FA	Factor Analysis
FFI	Norwegian Defence Research Establishment
FOI	Swedish Defence Research Agency
GFI	Goodness of Fit Index
HFM	Human Factors and Medicine
HRED	Human Research and Engineering Directorate
I/C	Individualism/Collectivism
I/I	Independence/Interdependence
ICCRTS	International Command and Control Research and Technology Symposium
IT	Information Technology
JET	Joint Education and Training
JFC (JFCOM)	Joint Force Command
JWC	Joint Warfare Centre
LISREL	Analysis of Linear Structural Relationships
LSA	Latent Semantic Analysis

LTAMC	Leader and Team Adaptability in Multinational Coalition
LTCR	Long-Term Capability Requirements
M/F	Masculinity/Femininity
MDS	Multi-Dimensional Scaling
MND	Multi-National Division
MNE	Multi-National Experiment
NATO	North Atlantic Treaty Organization
NAVAIR-ORL TSD	NAVAIR Orlando Training Systems Division
NEC	Network Enabled Capability
NES	Native English Speakers
NMSU	New Mexico State University
NNEC	NATO Network Enabled Capability
NNES	Non-Native English Speakers
NOR	Norwegian Defence Research Institute
NPC	Non-Player Characteristics
NRF	NATO Response Force
NST	NATO Staff Target
ONST	Outline NATO Staff Target
OSD	Office of the Secretary of Defense
PC	Personal Computer
Pd	Power distance
PfP	Partnership for Peace
POC	Point Of Contact
R/R	Risk/Restraint
RMR	Root Mean square Residual
RTG	Research Task Group
RTO	Research and Technology Organization
RYS	Research Symposium
SA	Situation Awareness
SABRE	Situational Authorable Behaviour Research Environment
SACT HQ	Supreme Allied Command Transformation Headquarters
SAP	Self-Assessment Profile
SAS	Studies Analysis and Simulation
SASO	Stability and Support Operations
SBIR	Small Business Innovative Research
Sfor Adapt	Simulations for Adaptability
SFOR HQ	Sustainment Force Headquarters
St/Lt	Short-term/Long-term
STANAG	Standardization Agreement
T/R	Task/Relationship
TACT	Training Adaptable Coalition Teamwork
TAP	Transition Assistance Programme
TOR	Terms Of Reference
Ua	Uncertainty avoidance
VSM	Hofstede Value Survey Module

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## Products

### **GLOBESMART<sup>®</sup> COMMANDER CULTURAL AWARENESS TRAINING TOOL**

The primary deliverable to NATO Allied Command Transformation was the *GlobeSmart<sup>®</sup> Commander* Cultural Awareness training tool. This computer based training was designed to provide operational-level military personnel with the necessary skills to adapt, as needed, to cultural influences on communication, coordination, support behaviour and other teamwork functions. *GlobeSmart<sup>®</sup> Commander* features learning modules that not only raise one's awareness of culturally-based cognitive differences in thought and behaviour, it also provides concrete, relevant scenario-based training on how one can proactively adapt their behaviour, as necessary, to improve team performance. The training will enable officers to navigate the challenges of culture during information exchange involving team tasks, goals and mission, response sequencing, time and position coordination, load balancing, matching resources to task requirements, adjusting activities in response to errors and omissions, and general activity monitoring.

This high-quality, low-tech training has been transitioned to multiple military entities and institutions, including ACT in the Fall 2007, where training and documentation was delivered to Brigadier General Ernst Otto Berk. Other transitions include the U.K. Ministry of Defence Human Systems Group, Bulgaria Defense Advanced Research Institute at the Rakovski Defense and Staff College, U.S. Military Transition Team Training Center, U.S. Army Knowledge On-line, U.S. Military Academy at West Point, U.S. Air War College for Strategy and Technology, U.S. Marine Academy, U.S. Naval Post Graduate School, and U.S. Naval Health Research Center. Future plans include demonstrating *GlobeSmart<sup>®</sup> Commander* at NATO headquarters in Brussels (Fall 2008) and the NATO School at Oberammergau, Germany (Fall 2008). See Chapter 5 for details.

### **NATO RTO HFM RSY 142 INTERNATIONAL RESEARCH SYMPOSIUM**

The primary deliverable to NATO Research and Technology Organization (RTO) Human Factors and Medicine (HFM) Panel was the HFM RSY 142 international research symposium, titled *Adaptability in Coalition Teamwork*. Details are summarized (and reported as a RTO publication) in the symposium's Technical Evaluator's Report (TER), submitted by Dr. Joseph Soeters, Professor of Organization and Social Studies, Netherlands Defence Academy, Tilburg University.

“In the HFM-142 symposium a total of 23 papers were given, in addition to four poster presentations, one featured speaker (Ms. Gail McGinn, U.S. Deputy Under Secretary of Defense for Plans) and two keynote addresses (Major General Ton van Loon, Chief of Staff, Allied Land Component Command HQ, Heidelberg, NLD) and Dr. Megan Thomspson (Defence Scientist, Canadian Defence Research and Development). The first speaker provided an overview of the policies of the Pentagon that were developed to improve the knowledge of relevant, strategic languages among U.S. military service personnel. Major General van Loon's address revolved around practical, operational experiences and the 'lessons learned' of a commander of the ISAF multinational coalition in Southern Afghanistan, whereas the Dr. Thompson's address related to academic insights with respect to differences in personality traits of individuals.

The papers were organized into two tracks, one on Culture (chaired by Dr. David Matsumoto, Professor at San Francisco State University USA; Director and CEO The Ekman Group Research

Division) and the other on Teams (chaired by Dr. Peter Essens, Chief Scientist Human in Command, TNO Defence, Security and Safety, NLD; HFM-142 Program Committee). Two internationally acclaimed scholars in the field of international management were present and participated in an expert's panel discussion at the end of the symposium. They were Dr. David Matsumoto (editor of the International Journal of Cross-Cultural Psychology;) and Dr. Mansour Javidan (co-author of the famous GLOBE study; Professor and Director The Garvin Center for Cultures & Languages of International Management, USA). Also participating on the expert's panel were Dr. Linda Pierce (Chief, Organizational Performance Unit, U.S. Army Research Institute), Dr. Winston Sieck (Principal Scientist, Applied Research Associates, USA) Ms. Anne Lise Bjornstad (Researcher, Norwegian Defence Research Institute, NOR), and Dr. Peter Essens.

The research symposium on 'Adaptability in Coalition Teamwork' in Copenhagen intended to study the theme as mentioned above. The main results of the more than 35 theoretical and research papers were as follows:

- Training tools (games, simulations) really work and seem to be effective in dealing with cultural diversity in coalition teamwork, at least to some extent;
- Tested in different national teams, different responses to stimuli emerged in terms of performance but also in terms of goal setting and problem solution;
- Confirming previous studies in the civilian sector, differences evolved between national groups and multinational groups; these differences relate to trust, flexibility and performance;
- Training with role playing seems to work really well in developing cultural skills among servicemen;
- Feedback information on team morale and performance during operations is an instrument that is highly valued by commanders in the field;
- Differences in language proficiency in English confound research output as much as they do in everyday operational life.

Overall, these results have underlined the importance of the theme and they have indicated a number of ways of dealing with the issues at stake. These results may lead to basic insights on how to deal with training and selecting military people in order to perform successfully in multinational teams. This work, however, cannot be considered to be complete or finished. A number of challenges ahead have been formulated that will induce more researchers from more member nations to participate in future studies in this area. These studies need to be conducted closer to the field of operations, and in closer connection with 'reflective', experienced commanders."

The symposium was delivered 21-23 April 2008 in Copenhagen Denmark, chaired by Dr. Janet Sutton (U.S. Air Force Research Laboratory). See Chapter 6 for details.

## **ORGANIZATIONAL QUESTIONNAIRE**

Significant contributions were made to the enhancement of a questionnaire being developed at the Norwegian Defence Research Establishment (FFI) to assess organizational and group processes, information sharing, decision making, language, group goals/process, social identify, and culture was enhanced. Recognized by exercise planners as one of the best survey instruments available for assessing factors that could contribute to organizational effectiveness in military operations, this questionnaire was implemented in the five-nation Multinational Experiment series (e.g., MNE4 and MNE5). See Chapter 3 for details.

## **CULTURAL ADAPTABILITY MODEL**

A relational model of Cultural Adaptability, based on an examination of specific traits, characteristics, and cognitive styles that may be exhibited in individuals who adapt easily in multicultural environments, was empirically developed and validated. This model was the first step toward developing a predictive model of Cultural Adaptability that can be used to inform personnel selection, training requirements, and collaborative system design. Significant follow-on research was initiated by the Swedish Defence Research Agency (FOI), funded by the U.S. Air Force Office of Scientific Research European Office of Research and Development, to experimentally determine causality for a subset of model variables. See Chapter 4 for details.

## **MULTICULTURAL, DISTRIBUTED TEAM EXPERIMENT**

A seminal research study, titled 'Leader and Team Adaptability in Multinational Coalitions (LTAMC)' established a baseline from which the international research community can explore mediating effects of culture on team process and outcomes. This study was the first large-scale (56 four-person teams of military officers, 224 participants total), five-nation distributed team experiment, using gaming technology to investigate information sharing, situation awareness, and team performance on culturally homogeneous and culturally heterogeneous military teams. See Chapter 2 for details.

## **PRESENTATIONS AND PUBLICATIONS (AS OF SEPTEMBER 2008)**

The following publications were generated as a product of the combined NATO ACT CD&E – RTO HFM RTG 138 program of research as of September 2008:

1. Bjornstad, A. L. (2005). *Part I: Allied Warrior 2004 – Pilot study and analysis of cross-cultural organizational issues*. FFI/RAPPORT-2005/01709.
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The views, opinions, and/or findings contained in the final report are those of the authors and should not be construed as an official NATO Research Technology Organization or Allied Command Transformation position, policy, or decision, unless so designated by other official documentation. Nor should the views, opinions, and/or findings contained in the report be construed as an official position, policy, or decision of the participating Nations.

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# Adaptability in Coalition Teamwork

## (RTO-TR-HFM-138)

### Executive Summary

NATO Research and Technology Organization (RTO) Human Factors and Medicine (HFM) Panel partnered with NATO Allied Command Transformation (ACT) Futures and Engagement Concept Development and Experimentation (CD&E) to conduct research aimed at improving the ability of officers to understand and adapt to culturally-based behavioural differences that impact multicultural teamwork at the operational level. The combined effort was reported as a project titled Leader and Team Adaptability in Multinational Coalitions (LTAMC) for ACT and titled Adaptability in Coalition Teamwork for RTO, first as HFM ET/049 and then as HFM RTG/138 (2005 – 2008). Participating on this project were national defence laboratories and research institutions representing (in alphabetical order) Bulgaria, Canada, Netherlands, Norway, Sweden, and the United States (Chair), with the UK participating as an observer. Collaborative national laboratory experiments were conducted using a role-play game specifically designed for the project. Questionnaires, interviews, and observations were conducted at NATO Command Post Exercises, Joint Task Force and Joint Force HQs, and at Allied Command Transformation HQ.

The highly productive Task Group significantly contributed to the body of knowledge in the domain of multicultural teamwork, as follows: First, a seminal research study of 56 four-person teams across five nations established a baseline from which the international research community can explore mediating effects of culture on team process and outcomes (Chapter 2). Second, substantial contributions were made to the enhancement of a questionnaire being developed at the Norwegian Defence Research Establishment (FFI) to assess organizational and group processes, information sharing, decision making, language, group goals/process, social identity, and culture (Chapter 3). Third, a relational model of Cultural Adaptability was empirically developed and validated (Chapter 4). This model was the first step toward developing a predictive model of Cultural Adaptability that can be used to inform personnel selection, training requirements, and collaborative system design. Fourth, research findings significantly contributed to content development of a computer-based cultural adaptability training tool, GlobeSmart® Commander, designed to enable military personnel to navigate the challenges of culture during information exchange involving team tasks, goals and mission, response sequencing, time and position coordination, load balancing, matching resources to task requirements, adjusting activities in response to errors and omissions, and general activity monitoring (Chapter 5). Fifth, a research symposium HFM RSY/142 was held 21-23 April 2008 in Copenhagen, Denmark, where internationally recognized scholars, scientists, and business managers participated in two themed tracks, Culture and Teams, that identified key findings of theoretical and research papers, guest speakers, and panel lists (see Chapter 6). Finally, Task Group members had produced 11 papers when the project completed in 2008.

Insights from the HFM RTG/138 Adaptability in Coalition Teamwork effort must be leveraged to help guide increased organizational effectiveness in multinational military HQs. Professor Joseph Soeters, Technical Evaluator of HFM RSY/142, advised “These studies need to be conducted closer to the field of operations, and in closer connection with ‘reflective’, experienced commanders”. To that end, a transition plan was implemented with the establishment of HFM ET/049, titled “Improving Organizational Effectiveness in Coalition Operations”, chaired by Capt. (BUL-N) Dr. Yantsislav Yanakiev.

# Adaptabilité dans le travail d'équipe en coalition

## (RTO-TR-HFM-138)

### Synthèse

La Commission sur les facteurs humains et la médecine (HFM) de l'Organisation pour la recherche et la technologie (RTO) de l'OTAN s'est associée au Commandement allié Transformation (ACT) de l'OTAN, branche Futurs et engagement, élaboration et expérimentation de concepts (CDE), pour mener des recherches visant à améliorer la capacité des officiers à comprendre et s'adapter aux différences culturelles de comportement qui rejaillissent sur le travail d'équipe multiculturel au niveau opérationnel. Les travaux combinés ont été relatés en tant que projet intitulé *Leader and Team Adaptability in Multinational Coalitions (LTAMC)* (Adaptabilité des chefs et des équipes dans les coalitions multinationales) pour l'ACT et intitulé *Adaptability in Coalition Teamwork* (Adaptabilité dans le travail d'équipe en coalition) pour la RTO, tout d'abord sous la référence HFM ET/049, puis sous la référence HFM RTG/138 (2005 – 2008). Ont participé à ce projet des laboratoires nationaux de la défense et des établissements de recherche représentant, par ordre alphabétique, la Bulgarie, le Canada, les États-Unis (président), la Norvège, les Pays-Bas et la Suède, le Royaume-Uni participant en tant qu'observateur. Les laboratoires nationaux ont mené des expérimentations en collaboration à l'aide d'un jeu de rôle spécifiquement conçu pour le projet. Les questionnaires, entretiens et observations ont été remplis et menés dans les quartiers généraux du groupe de forces interarmées et des forces interarmées, et au cours des exercices de Postes de commandement de l'OTAN, ainsi qu'au quartier général du Commandement allié pour la Transformation.

Très productif, le groupe de travail a contribué de manière significative au corpus de connaissances dans le domaine du travail en équipe multiculturelle, comme indiqué ci-dessous. Premièrement, l'étude fondamentale de 56 équipes de quatre personnes dans cinq pays a établi une base de référence à partir de laquelle la communauté internationale des chercheurs peut étudier les effets médiateurs de la culture sur le processus et les résultats des équipes (chapitre 2). Deuxièmement, des contributions importantes ont participé à l'amélioration d'un questionnaire élaboré par l'Institut norvégien de recherche sur la défense (FFI), qui vise à évaluer les processus de groupe et d'organisation, le partage des informations, la prise de décision, la langue, les objectifs / le processus du groupe, l'identité sociale et la culture (chapitre 3). Troisièmement, un modèle relationnel d'adaptabilité culturelle a été développé empiriquement et validé (chapitre 4). Ce modèle était la première étape vers le développement d'un modèle prédictif d'adaptabilité culturelle pouvant apporter des informations pour la sélection du personnel, les besoins de formation et la conception du système collaboratif. Quatrièmement, les résultats des recherches ont contribué grandement à l'élaboration d'un outil informatique de formation à l'adaptabilité culturelle, *GlobeSmart® Commander*, conçu pour permettre au personnel militaire d'explorer les défis de la culture pendant l'échange d'informations, notamment les tâches de groupe, les objectifs et la mission, le séquençement de la réponse, la coordination du temps et de la position, l'équilibrage des charges, l'adaptation des ressources aux besoins de la tâche, l'ajustement des activités en réaction aux erreurs et omissions et la surveillance générale de l'activité (chapitre 5). Cinquièmement, un colloque de recherche HFM RSY/142 a eu lieu du 21 au 23 avril 2008 à Copenhague, au Danemark, auquel des universitaires, scientifiques et chefs d'entreprise de renommée internationale ont participé à deux réflexions thématiques, sur la Culture et les Equipes, et qui a permis d'identifier les points essentiels issus des travaux théoriques et de recherche, des intervenants invités et des membres de la commission (voir chapitre 6). Enfin, les membres du groupe de travail avaient rédigé onze articles à la fin du projet, en 2008.

Les éclairages des travaux du HFM RTG/138 *Adaptability in Coalition Teamwork* doivent être exploités pour favoriser le renforcement de l'efficacité organisationnelle dans les quartiers généraux multinationaux.

Le professeur Joseph Soeters, évaluateur technique du HFM RSY/142, a indiqué : « Ces études doivent être menées plus près des opérations sur le terrain et en liaison plus étroite avec des commandants expérimentés et réfléchis ». Dans ce but, un plan de transition a été mis en œuvre, avec l'établissement du HFM ET/049, intitulé « *Improving Organizational Effectiveness in Coalition Operations* (Amélioration de l'efficacité organisationnelle dans les opérations de coalition) », présidé par le capitaine (BUL-N) Yantsislav Yanakiev.





## Chapter 1 – INTRODUCTION

### 1.1 ORIGIN OF ACTIVITY

The United States Army Research Laboratory Human Research and Engineering Directorate proposed a program of research to NATO Allied Command Transformation (ACT) Futures and Engagement Concept Development and Experimentation (CD&E) aimed at improving the ability of NATO officers to understand – and behaviourally adapt to - culturally based behavioural differences that impact multicultural teamwork. The concept was approved as an ACT CD&E project in December 2003 with the title “*Leader and Team Adaptability in Multinational Coalitions (LTAMC)*.” Shortly thereafter, the NATO Research and Technology Organization (RTO) Human Factors and Medicine (HFM) Panel approved an exploratory team, HFM ET 049 titled “*Adaptability in Coalition Teamwork*,” to support the CD&E effort. In September 2005, HFM ET 049 transitioned to a fully functional Research Task Group (RTG), HFM RTG 138.” Since its inception, the combined ACT CD&E LTAMC – RTO HFM RTG 138 project has been chaired by Dr. Janet Sutton, (2006 – present, U.S. Air Force Research Laboratory; 2002-2006, U.S. Army Research Laboratory).

The combined effort followed the CD&E process and was reported as a project for both the ACT and RTO. The project was unique in that, in addition to delivering a cultural awareness training tool as a CD&E product and an international research symposium as a RTO product, team members conducted national and multinational field and laboratory experiments to advance science in the domains of adaptability and teamwork by providing evidentiary data on the impact of culture on operational-level teamwork. The impact of culture on teamwork was the primary focus. The program of research included developing a conceptual model of cultural adaptability for military operations, developing methods for experimentation (e.g. experimental design, reference scenarios, and process and outcome measures), establishing national and international testbeds, all with the intent to improve leader and team cultural adaptability in multicultural environments.

### 1.2 RATIONALE

The need to improve leader and team adaptability is expressed within a number of NATO documents and initiatives: The NATO Alliance Strategic Concept [1], Combined Joint Task Force (CJTF) Concept [2], Defence Capabilities Initiative [3], and the Prague Summit Declaration [4], where the creation of a NATO Response Force (NRF) consisting of a technologically advanced, flexible, deployable, interoperable and sustainable force was announced. The CJTF, NRF, and standing NATO headquarters (such as HQ Supreme Allied Command Transformation (HQ SACT)) challenge commanders to optimize the effect of cultural diversity on teamwork.

### 1.3 PROGRAM OF RESEARCH

Culture is the acquired knowledge used to form values, create attitudes, interpret experience, and influence behaviour. Individuals can have significantly different culturally based biases that influence their behaviour. In concert with the biases of others, resulting behaviours will either enhance or hinder team performance. Those who recognize cultural biases and understand the impact of culture on teamwork are better prepared to adapt, as needed, to ensure mission success. Other factors impacting multicultural teamwork may include, but are not limited to, the presence of a military culture that transcends national cultural boundaries, organizational issues that arise from distributed teams and collaborative information technology, and individual differences such as personality or cognitive style. Experimentation is needed to define training requirements, organizational design, and information system requirements for adaptable performance of coalition headquarters personnel.

## INTRODUCTION

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Coalitions are the norm in today's global theatre of operations with future operations regularly consisting of multiple branches of military service, government and non-government agencies, and nations. Needed are models, methods, and tools that support rapid development of effective multicultural teams comprised of individuals that (a) understand their own culturally based biases and predisposition to action, (b) recognize the need to adapt to cultural diversity, (c) understand how to adapt, and, importantly, (d) choose to adapt. Additionally, the ability to predict adaptable performance in leaders and teams and the promise of improving adaptability through training can provide an opportunity for NATO to optimize the CJTF and NRF concepts and improve effectiveness in multinational headquarters, in general.

The principle findings of the combined ACT CD&E / RTO HFM 138 research task group serve as a basis for developing a common understanding of cultural implications for teamwork. The international research community who provide support to military leadership must leverage what is known about individual differences, national/organizational/military cultures, teams, **teamwork**, and training in order to provide a model of coalition teamwork that can be used to guide doctrine, training, personnel, and organization.

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## INTRODUCTION

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There were seven working meetings, held in Brussels, Canada, Sweden, and the United States over the course of the project. The Internet, including web-conferencing, was also used to support the research effort.

## 1.5 RESEARCH VENUES

### 1.5.1 NATO Response Force Exercises

In accordance with the overall NATO Response Force Military Concept [5] joint NRF Command and Control (C2), embedded in Strategic Command HQ, Joint Force Command HQ, and Command Control HQs must provide a high degree of interoperability and the capability to rapidly plan and prepare for deployment during an emerging crisis, as well as the capability to operate as a stand-alone initial entry force for up to 30 days. Exercises are conducted to demonstrate the readiness of headquarters, component commands, and selected units to integrate, activate, prepare and deploy within NRF Operational Readiness Timelines [6]. The ACT CD&E / HFM RTG 138 project focused primarily on operational level teamwork on two NRF Deployable Joint Task Forces.

Allied Warrior 04 (AW04) was the first time experimentation was sanctioned by Strategic Allied Command Europe to be integrated as part of a major NATO Command Post Exercise (CPX). It was an exercise designed to certify the NATO Response Force 4 (NRF 4), the force capability for the six-month period starting January 2005. Data collection was conducted at two different times and two different sites. First, surveys were administered to the NRF 4 Deployable Joint Task Force (DJTF) at Joint Force Command Naples several weeks prior to exercise start. All participants were located in one room and completed the survey at one time, taking 1-1.5 hours to complete. Second, observation and interview data was collected at the DJTF headquarters located near Verona, Italy during the actual exercise. Observation of the command post was unobtrusive and occurred several times a day and some evenings. Interviews were conducted in a room designated for the project and lasted approximately 1 hour. The room contained two desks, with a divider placed between the desks, two unclassified computers, and several chairs. Privacy was ensured by closing the door. Some individuals were unable to find the time for an interview and were given the opportunity to write their responses to interview questions on a form provided by the researchers. Feedback was provided to all participants on results of survey data previously collected in Naples. Additionally, all participants had the opportunity to look at a web-based cultural awareness training tool, GlobeSmart<sup>®</sup>, designed for industry use and were asked to assess the merit of cultural awareness training for the DJTF.

Allied Warrior 05 (AW05) was as SHAPE/Allied Command Operations (ACO) Computer Assisted Exercise designed to certify the NATO Response Force VI (NRF-6) capability, under the command of Joint Force Command Lisbon (JFC Lisbon), for the six month period starting January 2006. Data collection was conducted at two different times and two different sites. The process was to be the same as that used for AW04. Specifically, surveys were to be administered to headquarters staff at Joint Force Command Lisbon who were scheduled to participate at the DJTF for AW05. However, a natural disaster in Pakistan resulted in deployment for many DJTF officers. And at the time, it was unknown how many and who might be relieved of disaster deployment to participate in the exercise. Even in the face of the emergency situation, JFC-Lisbon was very responsive to the research needs and objectives. Command was able to provide sufficient officers for

data collection at HQ. Surveys were administered over multiple sessions of approximately 1-1.5 hours each. Second, observation and interview data was collected at the DJTF headquarters in Montijo, Portugal during the AW05 exercise. The command post was established in an air craft hanger with dividers separating work groups and teams as designated by the commander. Experimentation was conducted in an eight foot by four foot area enclosed on three sides by dividers. Privacy was not an option. The area contained two tables, two unclassified computers, and several chairs. Observation of the command post was unobtrusive and occurred constantly throughout the days and some evenings. Interviews were conducted in a designated work area and lasted between 15 minutes and one hour, depending on the availability of the participants. Survey feedback was available to all participants who completed the surveys at Joint Force Command Lisbon, but not all persons who completed the surveys were members of the DJTF and not all members of the DJTF had completed the surveys. Researchers were unable to demonstrate the GlobeSmart® Commander cultural awareness training prototype due to limited availability of unclassified bandwidth.

Experimentation at AW04 and AW05 contributed to the following research thrusts: Assessment of Organizational and Interpersonal Factors in a Simulated Mission and an Operational Environment (Chapter 3); Modelling Cultural Adaptability (Chapter 4); and Training Cultural Adaptability (Chapter 5).

There were two critical ‘lessons learned’ with regard to participating in NATO exercises. First, there must be buy-in at the highest levels of the Deployable Joint Task Force (DJTF) command for the experiment to succeed. Experimenters must be afforded the opportunity to brief the Commander and his staff prior to the final planning stages. For example, upon being briefed on the experiment planned for Allied Warrior 04, Major General Rick Lynch, DJTF Commander at AW04, fully and enthusiastically supported the scientists’ data collection efforts at JFC-Naples and during the exercise. It cannot be stated strongly enough: the commander’s was the key to successfully achieving research objectives. The second, and equally important, ‘lesson learned’ was that the lead scientist must be invited to, and participate in, all of the planning conferences for that given exercise. Said lead experimenter must have a forum to discuss experimental design and resources needed, in addition to being kept apprised of changes to personnel, schedules, locations, and exercise plans in general. This objective was met for the AW05 exercise.

### **1.5.2 HQ Supreme Allied Command Transformation: Norfolk, VA USA**

On several occasions, HQ SACT personnel participated in the research by completing questionnaires, answering interview questions, and testing prototype training content and delivery mechanisms. Participation was strictly on a volunteer basis. Individuals were solicited by CD&E personnel assisting the ACT CD&E / RTO HFM 138 project. Without exception, the volunteers were polite and professional in demeanour, and they usually showed genuine interest in the research. Since the target audience for the GlobeSmart® Commander product is individuals who will work, or are working, in a multicultural collaborative headquarters environment, the contribution of the HQ SACT volunteers was invaluable.

### **1.5.3 National Facilities**

In addition to field data collection at NATO sites, Bulgaria, Canada, The Netherlands, Norway, Sweden, and the United States provided research facilities at either military laboratories or universities to complete an extensive laboratory experiment on multicultural distributed teams. These nations significantly contributed to the Leader and Team Adaptability in Multinational Coalitions (LTAMC) distributed team experiment investigating relationships among national culture, information sharing, team situations awareness, and team performance (Chapter 2).



## **Chapter 2 – RELATIONSHIP BETWEEN CULTURE, INFORMATION SHARING, SITUATION AWARENESS, AND TEAM PERFORMANCE**

### **2.1 BACKGROUND**

A five-nation, distributed team laboratory experiment was conducted in Bulgaria, The Netherlands, Norway, Sweden, and The United States and was referenced at the “Leader and Team Adaptability in Multinational Coalitions (LTAMC)” experiment. The goal was to investigate whether team composition (single or multi-nation) has an impact on information sharing, situation awareness and team performance. Specifically, a single experimental design was executed to build a baseline of responses from nationally homogenous teams from the participating countries. Then, that design was executed with nationally heterogeneous teams comprised of participants from the different participating countries. Team composition on culturally heterogeneous teams was randomized using a Latin Square design developed by Capt (BUL-N) Dr. Yantsislav Yanakiev. The experiment objective was to answer the following questions:

- What is the relationship among measures of team process and outcome in a distributed task environment where the members are not face-to-face and represent different nationalities?
- In a distributed task, are nationally homogeneous teams more effective at information sharing, developing situation awareness, and ultimately achieving better team performance outcomes than nationally heterogeneous teams?
- Can measures of cognitively-based cultural biases distinguish national teams from multi-national teams?

Team performance is, in part, the result of team members effectively performing their interdependent tasks. Information sharing and situation awareness (SA) are widely recognized to be important factors in achieving effective team performance outcomes. Effective information sharing has been linked to situation awareness which is a critical cognitive skill required for maintaining awareness, knowledge, and understanding of events in our immediate and future environment [7]. Teams that share task-related information are more likely to have better SA, make better decisions and have better overall performance outcomes than teams that do not exchange information ([8], [9], [10]). Likewise, we would expect effective information sharing and situation awareness to be especially important factors in a distributed team performance environment, but little research exists on this subject.

Fiore and colleagues [11] have proposed cognitive explanations for factors that would impact the effectiveness of distributed team members. When team members are co-located, they have the advantage of clear perceptual clues to help them discern meaning and intention from fellow team members’ paralinguistic cues during face-to-face meetings [11], [12]. When team members become distributed, the rich visual, auditory, and social array of cues is lost and they must rely on less reliable technical forms of communication to discern meaning and intention [11]. Moreover, when team members are physically close to each other, the frequency of communication is greater than for team members who are more physically distant [13]. Consequently, the ability for efficient information sharing and the development of good situation awareness is compromised. As a result, efficient and effective team decision-making and team performance outcomes are likely to be compromised. Nevertheless, we expect to see some positive relationships among the dependent variables in this experiment. Furthermore, however, we expect that nationally homogeneous military teams will perform better than multi-national teams in a distributed environment because they share similar training experiences and expectations.

### **2.1.1 National Culture**

Sutton et al. propose that culture can be construed as a cognitive framework within which personal experiences are interpreted, values are formed, and behaviour results, to include team behaviours [14], [15], [16]. The expectation is that cultural norms may determine what information can be shared up and down the chain of command or among peers, or how much information is needed to make a decision, among other things. Sutton and Pierce describe the construct of “cultural competence” as having a clear understanding of the dominant values and culturally based orientations (e.g., relationship orientation, time orientation) of other team members, and recognizing that the thoughts and behaviours of others are influenced by such cultural norms. Consequently, diversity in cultural competence, combined with the lack of natural environmental and social cues, may explain why the incidence of conflict within the team increases as teams become more distributed and multinational, (for review see [17]). Together, the increasing multinational and distributed nature of teams can significantly impair the ability of team members to perform well because they are less able to effectively engage in the communications necessary to enhance information sharing and situation awareness. Therefore, in this experiment we explored the degree of similarity in responses to the GlobeSmart® Commander cultural dimensions due to team composition (single nation vs. multi-nation).

### **2.1.2 Situation Awareness**

Effective decision-making is a vital component to the success of any organization [7]. However, within the human factors community, there is a general belief that effective decision-making is facilitated by good situation awareness (SA) [9]. Although the definition of SA varies in broad terms, broadly, SA is a cognitive construct that refers to our awareness, knowledge, and understanding of events in our immediate and future environment [7]. Since World War I, researchers and practitioners have come to view SA as critical for accurate decision-making and performance in a variety of work domains such as air traffic control [18], nuclear power plant management [18], aviation [21], medicine [21], and driving [22]. While most of this research has focused primarily on understanding and developing systems to support individual operator SA, in reality, teams of operators perform work; teams of operators run nuclear power plants; crews of pilots fly planes; and groups of medical personnel treat patients [26]. Indeed, SA has been identified as an important component of the success of team efforts [8], [9], [10], and researchers are now focussing more of their attention on the study of shared or team SA.

An interesting trend occurring with teams (both civilian and military) and organizations in general is that they are becoming more culturally diverse and geographically distributed. To date, there is a paucity of research designed to examine the relationship between culture and situation awareness. However, there have been numerous studies developed to examine the relationship between culture and decision-making. For example, researchers have demonstrated cultural differences in planning and decision-making effort [27], judgment and decision-making (for review see [28]), confidence in decision-making, decision-making styles, risk-taking [23], [24], [25], [26], [27], [28], [29], [30]. Interestingly, much of this research has focused primarily on describing national differences in various facets of decision-making with much less research aimed at examining the underlying mechanisms for these differences [28], [30]. Because SA is considered a vital component of decision-making, and little is known about the underlying mechanisms that explain cultural differences in decision-making, it seems possible that the observed cultural differences in decision-making might, at least in part, be due to cultural differences at the level of SA. Thus, a fruitful avenue for SA research specifically, and for decision-making in general, would be to examine the relationship between culture and SA.



As teams become more distributed [11], the ability to develop good SA becomes more difficult than for teams that are co-located. When teams are co-located, team members have the advantage of clear perceptual clues to help them discern meaning and intention from fellow team members' paralinguistic cues during face-to-face meetings [11],[12]. When teams become distributed, the rich visual, auditory, and social array of cues normally present in co-located teams is lost and team members must rely on less reliable technical forms of communication to discern meaning and intention [11],[13]. Moreover, when team members are physically close to each other, the frequency of communication is greater than for team members who are more physically distant [13]. In addition, as teams become more geographically distributed and multinational, the incidence of conflict within the team increases. Together, the increasing multinational and distributed nature of teams, as well as other characteristics (for further discussion see [13]), tax the ability of team members to engage in effective communication. Consequently, the ability for efficient information sharing and the development of good SA is compromised. As a result, efficient and effective team decision-making is likely to be compromised.

Both cultural diversity and distributed teams pose important challenges to the development of good team SA. This is a critically important issue to militaries around the world as these militaries increasingly perform within culturally diverse teams and become more geographically distributed. The challenge for researchers is to examine the extent to which these factors in particular and related factors (e.g., cognitive biases, trust), individually or in combination with each other, impact team decision-making. Armed with this knowledge, researchers can then assist in the development of new concept of operations and training programs to help alleviate the potential negative impacts that cultural diversity and distributed teamwork have on the development of good team SA and ultimately efficient team decision-making.

### 2.1.3 Team Performance

The understanding of a team performance perspective for developing effective organizations has been recognized in the research literature especially during the last two decades due to a number of reasons [31]. However, even if an interest for team performance exists in the research community and quite a large quantity of articles focus on team performance the understanding of team processes and especially the relation between team processes and outcome still leaves practitioners with a number of unanswered questions.

Team performance is a complex domain to study. Not only are there often many participants involved (compared to studies of individuals) but it can also be difficult to identify and measure relevant team performance processes or outcome. There is a need to integrate results and knowledge provided by different research domains within the team performance field. Models and important dimensions for team work need to be integrated with research about the mechanisms that can explain how the interaction between team members affects individuals and teams.

In order to understand team performance it is important to distinguish between team work and task work [32], [33], [34]. Task work refers to individual skills needed to accomplish the requirements of a specific job and team work refers to the processes and skills individuals develop to coordinate their activities. The distinction is important since the variations in outcome are, more or less, related to one of the two processes. Even both processes are extremely vital for team outcome; team work is of interest for the present purposes since task work is more related to individual skill acquisition.

The understanding of important dimensions for team work has been discussed to some extent in the research literature [35], [33], [36]. In their attempt to define the dimension that underlie effective team work (cf. [36]) researchers have taken different perspectives, such as team members personality or team work functions, as their point of departure.

The perspectives on team work dimensions often discussed is (a) the “Big Five” [37] focusing on the relation between team performance and personal traits (conscientiousness, agreeableness, openness to experience, emotional stability, and extraversion) and (b) the functional view of team performance focusing on dimensions such as decision-making, communication, and shared situational awareness (see [33] for details). Both perspectives discuss important traits or functions the teams need to have or accomplish in order to perform well.

However, even if we know that the team members need to be adaptive, share information and create a common ground [38], we also need to understand how a team can develop adaptability or become communicative in an effective way [39], [40]. In multinational coalitions, people from different countries will have to work together as a team and will be expected to perform well. These people may come from different cultures and have different values which may affect their individual behaviour and thereby the team’s performance. Thus there is a need to study team performance in multinational military settings. The question is how do we capture team performance?

There are a number of factors that affect team performance. Salas et al [41] have presented a model, team effectiveness model, which describes many of the factors that have been shown to affect team performance. This model assumes that team effectiveness is a function of inputs (such as individual, team and task characteristics), and processes, such as communication and coordination. Outcomes are measured in terms of products of the collaborative process (meeting objectives or mission success), and are typically measured by the quantity and quality of the products and the efficiency and effectiveness of the process involved in producing those products. Smith-Jentsch, Johnston, and Payne, [44] present a taxonomy of the measures of interest and their relation for obtaining valid results for team performance.

In order to get a better understanding of team performance and the factors that lead to good or bad team performance there is a need to study team performance in relevant settings. However, it is difficult to find relevant platforms to study team performance, i.e. platforms where all aspects of team performance (input, process and output) can be assessed and measured systematically. Therefore a research platform called SABRE (Situational Authorable Behaviour Research Environment) was developed. Through SABRE individual and team characteristics can be collected systematically. All team communication, coordination and decision making is recorded and the team outcome is measured through Goodwill points that the team can acquire in the game if they meet the mission objectives (see method section for details).

Hypothesis 1. Significant positive correlations will be found among information sharing, situation awareness and goodwill points.

Hypothesis 2: Compared to the multi-national teams, the single nation teams will 2a) share more information (forward more tips, initiate more shared utterances, and use a greater number of map marking tools), 2b) achieve higher scores on situation awareness, and 2c) achieve more goodwill points.

Hypothesis 3: Multi-national teams will have significantly greater variability in the measures of cognitively-based cultural biases (Globesmart Commander (GC) cultural dimensions) than single nation teams.

## **2.2 METHOD**

Following is a description of the LTAMC multicultural distributed team experiment as it was originally designed by for the ACT CD&E / HFM RTG 138 project. Deviations from the design,

though rare, did occur and are reflected in the results. Some of the material below was developed by testbed designers at BBN Technologies and documented in the SABRE NATO Experimenter's Guide. For more information about SABRE, log onto <http://seriousgames.bbn.com/SABRE>. This Web site contains additional information about SABRE and how it is being used for experimentation. For more information about the NATO LTAMC Experiment and SABRE, log onto <http://dsl-external.bbn.com/cultural-modeling/twiki/bin/view/NATO/WebHome>. The BBN material in any original and/or summarized form, is based upon work supported by the U.S. Defense Modelling and Simulation Office (DMSO) under U.S. Air Force Contract No. FA8650-04-C-6437. Any opinions, findings and conclusions or recommendations expressed in that material are those of the [BBN] author(s) and do not necessarily reflect the views of DMSO or its Contracting Agent, the Air Force Research Laboratory, Wright Patterson AFB. © 2005, 2006 BBN Technologies Corp.

### 2.2.1 Participants

Both culturally homogeneous and heterogeneous teams consisted of four equally ranked male officers, though different teams could have different ranks. For example, one team might consist of four Captains, whereas another team may consist of four Lieutenants. We recognize that gender can be a factor in some team interactions and perceptions of leadership. However, females played only supporting roles in the population to which findings are to be generalized. That population is the NRF DJTF. To include females in this particular study would require a significantly higher number of participants than requested or that might be available, and data from teams with female participants would, of necessity, have to be excluded from any analyses. Other requirements included an officer target age group of 18-35 with normal or corrected to normal vision, and a familiarity with computer use (e.g., mouse, keyboard). Participants must have completed undergraduate university or currently enrolled in university. Additionally, participants cannot have spent more than 6 months between the ages of 1-18 living outside of the United States and should have at least a level 3 understanding for reading, writing, and speaking English.

Eight four-person teams per nation (Bulgaria, The Netherlands, Norway, Sweden, and The United States) were required for data collection on culturally homogeneous teams for a minimum of 40 teams or 160 participants. Eight four-person teams were required for data collection on culturally heterogeneous teams for a minimum of eight teams or 32 participants. Participation in the study by any individual was limited to one session, which should occur on one day. Participant time commitment ranged from 3.5 – 5 hours, depending on the average computer skill level of the four-person team. The interactive team play of the game-based testbed meant that all four team members completed the experiment at the same time.

Participation was voluntary. All participants were given the opportunity to ask questions during the experiment. They were free to discontinue their participation at any time without penalty. All data collected was coded with subject identification numbers to protect the participant's identity. Participants' names are not linked to subject identification numbers.

### 2.2.2 Sample of Laboratory Layouts

Three national laboratory venues used for the LTAMC are described here (listed alphabetically by nation) to provide examples of facilities and process implemented by participating nations.

#### 2.2.2.1 Norway

In Norway, there was employed a mobile laboratory of 5 laptop computers for the national experiments, four client machines and one server set up in a local network. We (the experimenters) controlled the server. In the experimental set-up, the 4 subjects in each group were randomly assigned to a computer. The players were sitting with their backs to each other in a large square room. Figure 1 shows the technical set-up.

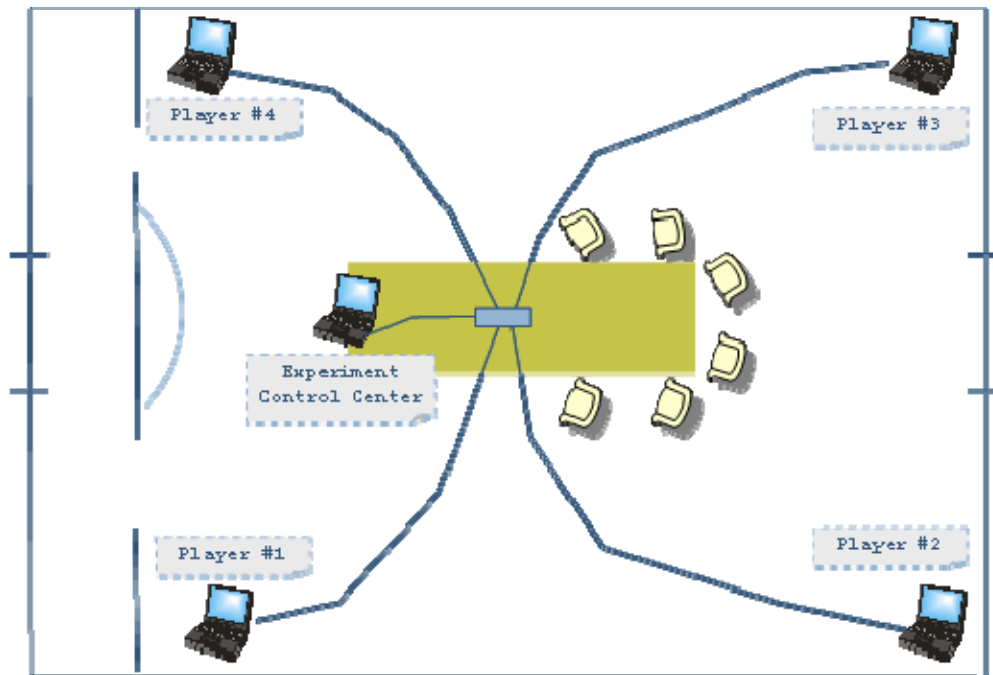


Figure 1: Technical set-up of the experiment.

There were conducted a total of 16 Norwegian national experiments; the first series of 8 experiments were conducted in a class-room at a higher Norwegian military educational institution (master level) and the second series of 8 experiments were conducted in a class-room at a lower Norwegian military educational institution (bachelor level). The first series of national experiments were conducted on 8 days between 24.04 and 15.05 2006 and the second between 12.10 and 10.11 2006.

The international experiments were conducted on a regular stationary computer located in an office at the Norwegian Defense Research Establishment (FFI). Norway participated in 6 of these, executed between 06.03 and 28.03.07. Subjects were recruited from a lower Norwegian military educational institution (bachelor level).

#### 2.2.2.2 Sweden

Swedish data was collected at five sites in Sweden to facilitate volunteer participation:

**Army Combat School Kvarn, Linköping.** The school instructs, develops and trains individuals, units and systems in ground combat. The school has an advanced training facility to train Military Operations in Urban Terrain. Researchers provided NeverWinter™ Nights and SABRE, using computers, network equipment, monitors, keyboards and headsets provided by the school. Experimental sessions were conducted in the school's combat technique laboratory over the course of two days.

**Army Combat School, Skövde.** The school instructs, develops and trains individuals, units and systems in ground combat. The school has unique education systems where simulators, adapted technology increase realism and training effectiveness. The school has an advanced Crew Training Facility for tank personnel and a Command Training Facility for commanders and their staffs. For the experiment researchers provided laptop

computers, network equipment and headsets, using monitors and keyboards provided by the school. Experimental sessions were conducted in a classroom over the course of two days.

**Swedish Armed Forces Development Centre, Enköping.** At this facility the Swedish Armed Forces conduct experiments, studies and tests. It is an important facility for CD&E and MNE related studies. It is a large facility where different technologies and methodologies are implemented and tested. For the experiment researchers provided Never Winter Nights and SABRE, using computers, network equipment, monitors, keyboards and headsets provided by the facility. Experimental sessions were conducted during one day.

**Norrbottn Wing, Luleå.** This regiment creates Task Forces; Squadrons, Battalions, fighter control battalions and signal and communication units. The regiment also takes part in surveillance of Swedish air territory. For the experiment researchers provided laptop computers, network equipment and headsets, using monitors and keyboards provided by the regiment. Experimental sessions were conducted during one day.

**Swedish Defence Research Agency (FOI), Stockholm.** FOI, the Division of Command and Control Systems, was the sponsoring organization in Sweden for the data collection effort. Research in this division of FOI covers areas such as Command and Control Systems, electronic warfare, IT security and communications. The aim of this division is to design systems which make full use of human cognitive potential. The division of Command and Control Systems is located in Linköping. Due to practical reasons the data was collected at FOI in Stockholm. FOI in both Stockholm and Linköping have laboratories for advanced simulations and data collection. The experiment was set up with equipment from FOI and data was collected.

### 2.2.2.3 The United States

U.S. data were collected at the U.S. Air Force Research Laboratory, Human Effectiveness Directorate, Warfighter Interface Division, Cognitive Systems Branch Culture and Cognition Laboratory (CCL), Wright-Patterson Air Force Base, Dayton Ohio USA. The lab contained five desktop computers: four of which were client computers located in one room and one server computer located in an adjoining room. For data collection on culturally homogeneous teams, the effect of distributed teamwork was achieved by placing physical barriers (portable walls) between participants. This arrangement meant that participants could not see each other nor see each other's computer screens. To further create the feeling of being on a distributed team, all participants wore headsets during the experiment session. With culturally heterogeneous teams, participants were truly distributed with only one person from any given nation sitting at the client computer. Assisting the Principle Investigator, were two lab assistants currently enrolled in the Psychology graduate program at Wright State University and two computer technicians.

### 2.2.3 SABRE Game-Based Testbed

Participants played a non-violent interactive computer video game modified by BBN Technologies from Bioware's Neverwinter Nights using the game's provided toolset [43]. This game-based testbed, titled "Situation Authorable Behaviour Research Environment (SABRE)," required participants to make responses using the keyboard and mouse while working in a team composed of four people. The primary goal of the specific SABRE game modification used for the NATO experiment was to search for hidden supplies of weapons in a virtual city and, in the process, earn or lose the goodwill of the non-player characters (NPC) (i.e., townspeople). Participants communicated by typing messages in a chat box and were not in visual line-of-sight with their teammates. They wore headsets to prevent distraction from the experimental task.

#### **2.2.4 Phases of Game-Play**

The NATO experiment scenario required exactly four participants, with one participant randomly selected to be the team leader at the beginning of each experimental session. The team was given the mission of searching for hidden weapons caches inside and outside of buildings in a virtual city. As a result of the searches, a team Goodwill score was generated. The Commander's Intent, delivered by a non-player character in the game, was for the team to maximize their Goodwill score as they searched the virtual city for weapons caches. Each team began game play with the same number of Goodwill points.

After completing four computer-administered, pre-game surveys, participants were signed on to the *Training Phase* of the game by the experimenter. During the training (familiarization) phase of the experiment, participants go through a series of virtual areas (e.g., rooms, hallways), each designed to teach participants individually about different aspects of the game. After showing proficiency on individual tasks, participants are brought together by the game and taught team skills. The training phase is not time constrained. Typically, participants required 1 to 2 hours to complete the training phase.

After completing the team skills section of the Training Phase, participants were signed on to the *Planning Phase* by the experimenter. The Planning Phase occurred at the start of the game, before the team executed the mission. The Planning Phase began the actual experiment. In this phase, participants were first asked to discuss, using text chat, the distribution of five responsibilities among the team. Each responsibility could have been taken by no one person, one person, or more-than-one person. The responsibilities consisted of: Coordinating the search plan; Monitoring the Goodwill score; Monitoring the time elapsed and remaining; Tracking the number of weapons caches located; and Managing information. Next, the team is required to distribute equipment that will aid in finding weapons caches. The team equipment included: two high-fidelity sensors, one lock pick, one Goodwill monitor, one time monitor, one re-planning trigger, and one explosives/IED detector. Also occurring during the Planning Phase, each participant was provided with a map marking tool and a journal management tool. Participants were each given two distinct tips about where to search for caches. At this point, and at any point in the game, team members could share or assign their tips to their teammates by using the tip management tool. Then, within the game, they were shown a map of the town and asked to formulate a search plan and a communications plan. A "spokesperson" (not necessarily the randomly selected leader) was selected by the team to summarize each of the two plans for the Commander. The experiment will not progress until both plans are documented. Finally, each participant's journal is automatically updated with the group plans, their own responsibilities, and the overall equipment distribution. The planning phase is not time constrained. Typically, participants will require approximately 30 minutes for completion.

Upon completion of the Planning Phase, participants immediately began the *Execution Phase* of the mission, where the team enters the virtual town and begins the task of locating and acquiring caches of weapons. The exchange of information among team members could be either structured or unstructured. Team members could communicate with each other through the structured formats of their map-marking tool and journal-management tool. They could also communicate by typing text messages (unstructured). When participants used the chat *Talk* mode, they sent a broadcast message to all nearby teammates. When participants used the chat *Tell* mode, they sent targeted, long-distance messages to a specific teammate.

Three times during game-play, at 20-minute intervals, participants were presented within-game situation awareness probes. All participants had to independently enter their responses to the probes before game play could continue. The Execution Phase of the experiment was timed, giving participants one hour to complete the task at which time the game stopped automatically.

## **2.2.5 Dependent Variables**

### **2.2.5.1 Information Sharing**

The amount of information sharing for a team was measured by the sum of three sub-measures: the number of typed utterances initiated, total number of information tips forwarded, and total number of map marker uses. Map markers were used by team members to indicate that a building or area had been searched.

### **2.2.5.2 Situation Awareness**

The team's situation awareness score was the aggregate scores over three situation-awareness probes delivered to each participant during the experiment. There were a total of six automatically scored questions on each situation awareness probe. Because there were four team members, and the probe occurred three times during the experiment, the maximum team score was 72 correct answers.

### **2.2.5.3 Team Performance**

The team's performance was measured by difference in Goodwill points that they started out with and their final Goodwill score (i.e., the Delta). Outdoor caches were worth 100 Goodwill points and indoor caches were worth 300 Goodwill points. The main costs to Goodwill points were associated with entering private buildings to search for caches. Because the team was provided with the tools to screen locations for weapons prior to taking action, it cost 50 points if a private building was entered and no weapon cache was found (whether there was none to be found, or they failed to find it). Participants were penalized 100 points if they opened a container that did not contain a cache. They were also penalized 250 points if they set off one of the two IEDs in the game (by opening a rigged crate). Only interior (i.e., inside a building) crates had IEDs. If a participant opens a rigged crate, a small yellow light appeared around the crate then disappeared from the screen after a few seconds. The player character, or avatar, was not physically harmed by the explosion and does not even jump when the soundless "explosion" occurred. The team was provided with information, equipment, monitors, and tools to assist with searches and help maintain team situation awareness. There were no individual Goodwill scores. All participants were informed each time any individual team member gained or lost Goodwill points for the team.

The maximum number of weapons that the team could find in the town was 20. That included 4 outdoor, 12 indoor, and 4 indoor that existed only for a limited time before "disappearing." (Tips were provided in-game regarding the caches that had a limited life-span.) This scoring could gain the team 300 Goodwill points for each indoor weapons cache, and 100 for each outdoor cache, for a maximum gain of 5800 Goodwill points. The team could also gain a up to 530 Goodwill points if they completed a variety of sub-quests, thus earning extra goodwill from the non-player character townspeople. Although the theoretical maximum performance for a team would be to gain 6330 Goodwill points, it is unlikely that a team could manage to do this. Similarly, because there are approximately 40 houses, 10 empty crates, and 2 trapped crates, a team could theoretically lose 3500 Goodwill points. It is unlikely that a team would do that either.

## **2.2.6 Survey Instruments**

Several in-game surveys were administered. They include a background and a debrief questionnaire developed by the research team, the NEO-FFI Personality Inventory [44], [45]; Hofstede Value Survey Model 1994 Culture Survey [46]; Organizational and Interpersonal Factors questionnaire developed by project team member Ms. Anne Lisa Bjornstad (Norwegian Defence Research Establishment, FFI); and the GlobeSmart® Commander Culture Survey (Copyright: [47], [48]).

**2.3 PRIMARY RESULTS**

**2.3.1 Hypothesis 1. Significant positive correlations will be found among information sharing, situation awareness and goodwill points.**

Table 1 presents the correlation matrix for the dependent variables: Information (Info)-Sharing: Briefing Phase and Residential Search Phase, three self-reports of situation awareness (SA1, SA2, and SA3), and the Net Goodwill Balance. Hypothesis 1 was partially supported. As expected, team members' information sharing in the briefing phase was strongly related to information sharing in the residential search phase, and had a weak, but significant relationship later in the search phase with situation awareness (SA 3) and goodwill points. Information sharing in the residential search phase had a weak significant relationship with situation awareness (SA 1, SA 2, and SA 3) throughout that phase. In contrast, no relationship was found between goodwill points and information sharing in the residential search phase or with goodwill points and situation awareness.

**Table 1: Pearson correlation matrix for the dependent variables (Information-Sharing: Briefing and Residential Phases, SA, and Net Goodwill Balance).**

	Info Sharing Briefing	Info Sharing Residential	SA1	SA2	SA 3
Info Sharing: Residential	.576**				
SA 1	.115.	.178**			
SA 2	.123.	.179**	.519**		
SA 3	.130*	.136*	.433**	.448**	
Net Goodwill Balance	.129*	.056	.079	.111	.066

*N* = 224, \* *p* < .05, \* *p* < .01

**2.3.2 Hypothesis 2: Compared to the multi-national teams, the single nation teams will 2a) share more information (forward more tips, initiate more shared utterances, and use a greater number of map marking tools), 2b) achieve higher scores on situation awareness, and 2c) achieve more goodwill points.**

Table 2 shows the mean and standard deviation for each dependent variable by national and multi-national teams: Information (Info)-Sharing: Briefing and Residential Phases, three reports of situation awareness (SA), and the Net Goodwill Balance. The total number (*N*) of participants is listed next to each nation. For all of the analyses conducted in this section, the partial eta squared ( $\eta^2$ ) statistic is included for significant effects. All post hoc analyses used the Tukey Honestly Significant Difference for Unequal *N* statistic.



### 2.3.2.1 Information-Sharing: Briefing Phase

The Information-Sharing: Briefing Phase data was analyzed within a 1-way ANOVA with nations as the independent variable. The analysis revealed hypothesis 2a was partially supported. A significant effect of nations was found,  $F(5, 218) = 15.07$ ,  $Mse = 533.74$ ,  $p < .001$ , and  $\eta^2 = .26$ . Figure 2 shows the national and multi-national total scores for information shared during the SABRE Task Briefing Phase. The post hoc analysis showed that, statistically, the Norwegian and Bulgarian teams did not differ in the amount of information shared during the briefing phase within their teams and demonstrated the least amount of sharing. In contrast, the Dutch and American teams had the highest scores for information sharing in the briefing phase, followed by the Swedish and multi-national teams, who did not differ statistically in the amount of information shared within their teams.

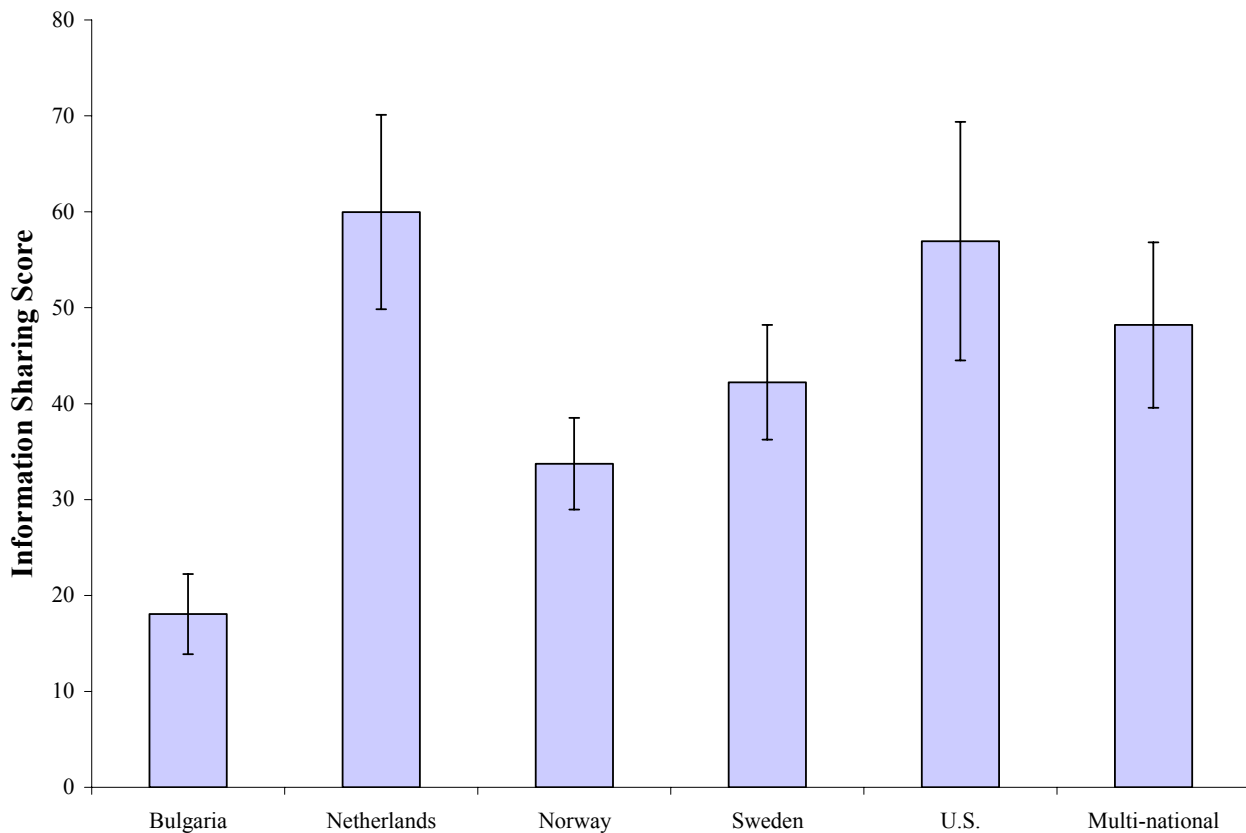
**Table 2: Mean and standard deviation for each dependent variable by national and multi-national teams: Information-sharing: briefing and residential search phases, three reports of Situation Awareness, and Net Goodwill Balance.**

Nations ( <i>N</i> )	Info-Sharing: Briefing Phase (std err)	Info-Sharing: Residential Phase (std err)	SA Report 1 (std err)	SA Report 2 (std err)	SA Report 3 (std err)	Net Goodwill Balance (std err)
Bulgaria (32)	18.06 (2.13)	15.63 (1.69)	4.50 (.27)	4.53 (.23)	4.37 (.19)	186.56 (78.78)
Netherlands (32)	59.97 (5.17)	62.75 (5.16)	4.63 (.23)	4.53 (.23)	4.18 (.19)	250.31 (80.89)
Norway (64)	33.73 (2.44)	49.36 (3.49)	4.66 (.12)	4.56 (.12)	4.17 (.14)	142.50 (31.40)
Sweden (36)	42.22 (3.05)	56.16 (3.09)	4.67 (.22)	4.69 (.24)	4.44 (.21)	190.00 (61.75)
U.S. (28)	56.93 (6.35)	55.64 (6.03)	3.75 (.24)	4.07 (.29)	4.14 (.23)	308.93 (113.53)
Multi-National (32)	48.19 4.41	43.03 (3.68)	4.46 (.23)	4.34 (.21)	4.34 (.23)	265.31 (78.31)

### 2.3.2.2 Information-Sharing: Residential Search Phase

The Information-Sharing: Residential Search Phase data was analyzed within a 1-way ANOVA with nations as the independent variable. The analysis revealed hypothesis 2a was partially supported. A significant effect of nations was found,  $F(5, 218) = 15.07$ ,  $Mse = 602.39$ ,  $p < .01$ , and  $\eta^2 = .26$ . Figure 2 shows the National and Multi-national total scores for information shared during the SABRE Task Residential Search Phase. The post hoc analysis showed that during the search phase, the Bulgarian teams demonstrated the lowest amount of information sharing with team members, whereas the Dutch, Swedish, and American teams showed the greatest amount of information sharing. The Norwegian teams had the second lowest amount of information

sharing in the search phase and the multi-national teams did not differ significantly from the Norwegian, Swedish, and U.S. teams in their amount of information sharing. Since the experiment was conducted in English and involved a complex computer game, we would expect these factors to affect the pattern of results. A covariate analysis, which also included age since age negatively correlates with game experience, indicated that these three factors together accounted for 40% of the variance in performance scores (Warren, 2008). When the effects of these confounding factors were removed, all nations had comparable median performance and the mixed-nation teams as a whole had the best performance.



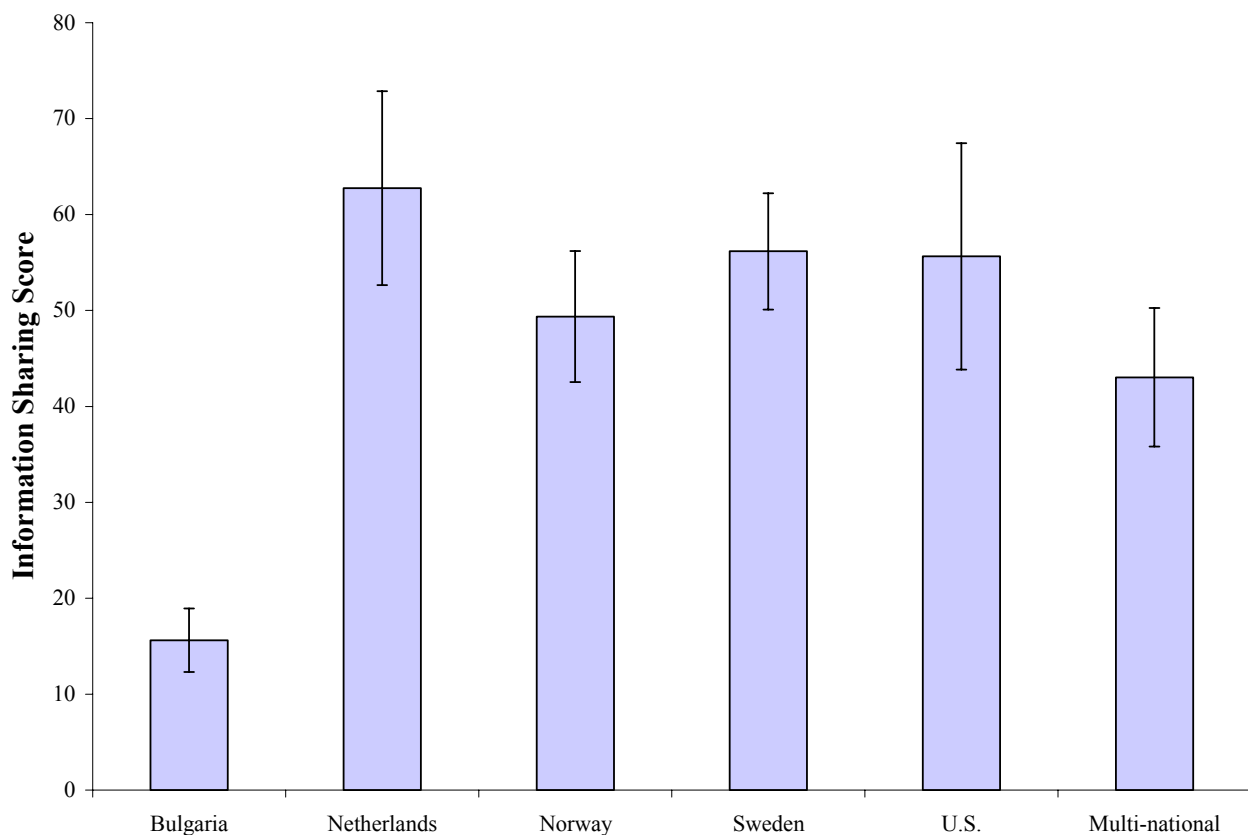
**Figure 2: National and multi-national total scores for information shared during the SABRE Task Briefing Phase.**

### 2.3.2.3 Situation Awareness

Hypothesis 2b was not supported. The SA data was analyzed within a 6 (nations) x 3 (SA reports) repeated measures analysis of variance (ANOVA) with repeated measures on the last variable. The analysis revealed null effects of nations ( $F(1, 218) = 1.38, ns$ ) and SA (Wilk's  $\lambda = .98, F(2, 217) = 2.44, ns$ ), as well as a non-significant interaction between nations and SA (Wilk's  $\lambda = .95, F(10, 434) = 1.09, ns$ ).

### 2.3.2.4 Net Goodwill Balance

Hypothesis 2c was not supported. The Net Goodwill Balance data was analyzed within a 1-way ANOVA with nations as the independent variable. Similar to the SA analysis, there was a null effect of nations on the Goodwill scores ( $F < 1$ ).



**Figure 3: National and Multi-national total scores for information shared during the SABRE Task Residential Search Phase.**

**2.3.3 Hypothesis 3: Multi-national teams will have significantly greater variability in the measures of cognitively-based cultural biases (GlobeSmart® Commander cultural dimensions) than single nation teams.**

An inter-rater agreement statistic was calculated (i.e., the average deviation index, or AD) to examine the degree of agreement among team members within the same team with respect to their responses to each GlobeSmart® Commander cultural dimension. We computed the AD index and its associated test of statistical significance for each team's responses to each dimension. We then calculated, for each team, the proportion of items on each dimension for which the team members had non-chance (i.e., statistically significant) levels of agreement. Hypothesis 3 was supported. Across all dimensions, the multi-nation teams consistently had the lowest level of agreement on each dimension compared to the single nation teams. Single nation teams were uniformly agreeable on all but the egalitarian dimension, having significant levels of agreement (i.e., average deviation statistic with a  $p < .05$ ) on approximately 80% of the items for any one dimension. For example, on the ST-LT dimension, Norwegians were most close in their agreement on the scale items (83.50%) while the multi-nation teams had the lowest agreement (54.25%). Only the egalitarian/status dimension resulted in less agreement within individual nations. For the NEO-FFI dimensions, internal consistency reliabilities as indicated by Cronbach's Alpha ranged from .66 - .83, which is roughly consistent with previous research (Costa & McCrae, 1990).

The effect of these findings may be reflected in the poor internal consistency reliability estimates calculated for each of the GlobeSmart® Commander dimensions. Cronbach's Alpha was calculated using the entire group of participants in the experiment ( $N=223$ ). The estimates were found to be lower than is considered reasonable for self-report individual difference measures [49]. Internal consistency reliabilities for the original scales ranged from .09 - .53. After removing problematic items with the lowest corrected item-total correlations, reliabilities ranged from .35 - .63. Only the GlobeSmart® Commander Short Term-Long Term (ST-LT) culture dimension had the highest corrected Cronbach's Alpha of .63. The low internal consistency of each scale may be due to mixing the single nation and multi-nation data together. Further item analyses on the GlobeSmart® Commander culture scales are available upon request.

## **2.4 SECONDARY RESULTS**

### **2.4.1 Descriptive Statistics for All Study Variables**

All of the individual difference measures were reasonably distributed with some skewness and some kurtosis. On the performance variables, most of the interval level data was negatively skewed (i.e., a high frequency of low numbers around zero). For the 3 SA reports, the distribution was slightly positively skewed. Box plots and frequency distributions are available upon request.

Significant correlations among each personality dimension, and each GlobeSmart® Commander dimension, and the SABRE performance outcomes are described below. Correlations reported are significant at the  $p < .05$  level. The full matrix is available upon request.

Neuroticism:

- + Independent: individuals who are higher on neuroticism also tended to be more independent.
- + Risk: individuals who are higher on neuroticism also tended to be more willing to take risks.
- - Direct: individuals who are higher on neuroticism also tended to be less direct.
- - Short: individuals who are higher on neuroticism also tended to think short term.

- - Information sharing – briefing: individuals who are higher on neuroticism also tended to share less information.

### Extraversion:

- - Risk: individuals higher on extraversion tended to be less likely to take risks.
- + Direct: individuals higher on extraversion tended to have a more direct communication style.
- + Forwarded tip count: individuals higher on extraversion tended to forward more tips to others.

### Openness:

- - Risk: individuals higher on openness tended to be less likely to take risks.
- + Short: individuals higher on openness tended to think more short-term.
- + Information sharing: individuals higher on openness tended to share more information with others.

### Agreeableness:

- - Independent: more agreeable people also tended to be less independent.
- + Short: more agreeable people also tended to think more short-term.
- + Age: more agreeable people also tended to be older.

### Conscientiousness:

- - Risk: more conscientious people also tended to be less likely to take risks.
- + Short: more conscientious people also tended to think more short term.

Independent-Interdependent: No significant correlations observed.

### Egalitarianism-Status:

- + Exterior cache finds: more egalitarian people also tended to find more exterior caches.
- - Chat count: more egalitarian people also tended to chat less with other team members.
- + Map marking tool count: more egalitarian people also tended to use the map marking tool more.

Risk-restraint: no significant correlations observed, though a marginal correlation with the SA score report 1 ( $p < .10$ ) was noted – this effect disappeared by SA report #3.

### Task-Relationship:

- + Exterior cache finds: more task oriented people also tended to find more exterior caches.
- + Interior cache finds: more task oriented people also tended to find more interior caches.
- + Net good-will balance: more task oriented people also tended to have higher good will balances.

### Direct-Indirect:

- + Forwarded tip count: more direct people also tended to forward more tips to others.
- - Map marking tool count: more direct people were less likely to use the map- marking tool.

- + Utterance count: more direct people also tended to have more utterances.

Short-term-Long-term:

- + Information sharing – briefing phase: those with more short-term orientation were also more likely to share information.

#### **2.4.2 Team Homogeneity Analyses**

We calculated inter-rater agreement statistics (i.e., the average deviation index, or AD) to examine the degree of correspondence among team members within the same team with respect to their responses on individual GlobeSmart® Commander items. We computed the AD index and its associated test of statistical significance for each team's responses to each item on the GlobeSmart® Commander dimensions. We then calculated, for each team, the proportion of items on each dimension for which the team members had non-chance (i.e., statistically significant) levels of agreement.

For all dimensions except for the egalitarianism dimension, teams were uniformly homogenous on the GlobeSmart® Commander dimensions, having significant levels of agreement (i.e., average deviation statistic with a  $p < .05$ ) on approximately 80% of the items for any one dimension.

For the egalitarianism dimension, there were differences among teams with respect to their homogeneity. Norwegian teams were most homogenous (i.e., 86% of items had significant agreement), and mixed teams (i.e., 54% of items had significant agreement) were least homogenous.

#### **2.4.3 Comparison of Observed GlobeSmart® Commander Scores to National Norms Reported on GlobeSmart® Website**

We further calculated team means for each item on each dimension, as well as 95% confidence intervals around these means. We then examined the norms for each nationality reported on the GlobeSmart® website, and used the dimension means as benchmarks against which to compare our observed team means. For each item, if the team's confidence interval included the benchmark value for that team's nationality, the item was considered a 'hit', if the benchmark value was not included in the confidence interval it was considered a 'miss'. We then calculated, for each team, the proportion of items for each dimension that were hits.

Teams differed consistently on their proportion of hits as a function of their nationality.

- Independence: Americans were highest and Bulgarians were lowest.
- Egalitarianism: Swedes were the highest and Bulgarians were the lowest.
- Risk: Americans were the highest and Swedes were lowest.
- Task: Americans were highest and Bulgarians were lowest.
- Direct: Dutch were highest and Bulgarians were lowest.
- Short term: Americans were highest and Swedes were lowest.

#### **2.4.4 Item Response Theory Analyses**

The GlobeSmart® Commander items, like many self-report measures of individual differences (i.e., designed to assess values, attitudes, or personality), can be considered examples of ideal-point, or Thurstonian items. With ideal-point items, the probability of a positive response to the item depends on the difference between the individual's trait level and the position of the item on the trait continuum (traditionally considered the

“difficulty” level of the item):  $\theta - \delta$ , and is maximized when the individual and the item are on the same point on the trait continuum. Thus, the probability of a positive response increases non-monotonically (i.e., like the normal curve) with the respondent’s actual trait level. Often, Thurstonian items consist of statements with which an individual can disagree for two reasons: 1) the individual’s trait level is below that targeted by the item, or 2) the individual’s trait level is above that targeted by the item. For example, consider the item “I tend to take on extra work tasks if I know my supervisor will hear about it” designed to measure work motivation. Individuals too low on the trait would disagree because they never take on extra work tasks, whereas those too high on the trait would disagree because they take on extra tasks even if their supervisor might not hear about it. Because the item targets a moderate level of the trait, individuals with moderate levels of the trait would have the highest probability of response.

Ideal-point items can be contrasted with cognitive ability items, in which the probability of a correct answer increases monotonically with higher levels of the underlying ability. For example, someone with high math ability will have a high probability of a correct response to a moderately difficult math item no matter how much higher their trait level vis-à-vis the trait level demanded by the item. In other words, one can never have “too much” of the trait.

Responses to ideal-point items are best modelled using unfolding item response theory (IRT) models. IRT models are a family of psychometric models that allow one to estimate the probability of a positive response to an item as a function of the where the person and the item are located on the latent trait continuum. Unfolding IRT models take into account the marked folding in the item characteristic curves that occurs for moderate items (i.e., the respondent can disagree from above or below). It is important to note that unfolding models will yield similar results as cumulative IRT models (i.e., IRT models used traditionally for ability-type items) for extreme items (e.g., “Finding time to organize your belongings is your top priority”).

The primary benefit of ideal-point items and unfolding IRT models is that they ensure increased measurement precision across all levels of the trait continuum. It is difficult to estimate trait levels using cumulative, monotonic IRT models for individuals who are in the middle of the trait continuum. Unfolding IRT models alleviate this problem by capturing the folding that appears in the extremes of the trait continuum, in which case cumulative models would lead to underestimation of trait levels for individuals with the most extreme values of the latent trait. Thus, unfolding models ensure the benefits associated with IRT (e.g., person-invariant item parameters, item-invariant trait estimates, high measurement precision) but provide a better fit to the data for neutral/moderate items, ensuring accurate trait estimation across levels of the trait continuum.

We used the Generalized Graded Unfolding Model (i.e., “GGUM”; Roberts, 2002) to estimate item parameters for each of the GlobeSmart<sup>®</sup> Commander dimensions and to estimate individuals’ latent trait levels along each of the dimensions. The original response scale, with eight graded response options, was transformed to a new scale with four response options. Adjacent categories were combined (i.e., original 1 and 2 = 1, 3 and 4 = 2, 5 and 6 = 3, 7 and 8 = 4). The fully specified GGUM was found to fit the data adequately for each dimension.

We estimated the following item parameters for each item:

- Item difficulty – where the item stand on the latent trait continuum.
- Discrimination – the slope of the item characteristic curves and the ability of each item to discriminate between individuals high and low on the respective dimension.

- Response category threshold position – the point on the latent trait continuum at which the probability of responding in the next highest category (e.g., transitioning from agree to strongly agree) becomes higher than the probability of responding in the current category.
- Response category threshold distance – the distance between response category thresholds.

Models estimated for each dimension were found to fit the data adequately. Item fit and person fit statistics were found to be adequate for each scale. Estimated trait levels take into account item parameters and vary along a - 4 to + 4 scale, as is the standard for IRT analyses. Item characteristic curves are available upon request.

### **2.4.5 Regression Analyses**

We performed a set of multiple regression analyses to examine 1) the direct influence of the set of cultural dimensions on multiple aspects of performance (using the IRT trait estimates for each GlobeSmart<sup>®</sup> Commander dimension), and the incremental validity of 2) team nationality, and 3) personality, as measured by the NEO-FFI. These analyses address the extent to which team nationality can be used as a proxy for team culture as measured by the GlobeSmart<sup>®</sup> Commander. By independently assessing nationality, culture, and personality, we can address their independent effects and potential causal orderings among these variables. Results are described by SABRE performance variable.

#### **2.4.5.1 Cache Finds**

- Interior cache finds: the set of GlobeSmart<sup>®</sup> Commander dimensions as a whole accounts for approximately 10% of the variance in interior cache finds. Adding team nationality into the model does not account for significantly incremental variance in interior cache finds.
- Exterior cache finds: the same pattern was observed as with internal cache finds, except that the variables accounted for 7% of the variance.
- Although there were no significant differences on exterior cache finds, American and Mixed teams had the highest mean numbers of cache finds.
- Personality accounts for an additional 4% of the variance above and beyond the effects of the GlobeSmart<sup>®</sup> Commander dimensions for interior but not exterior cache finds. Agreeableness and Conscientiousness appear to be the best predictors.

#### **2.4.5.2 Chat Count**

- Team nationality predicts chat count, but the effects of nationality are not transmitted through national differences in culture.
- Swedish and Dutch have highest number of chat counts.
- Bulgarian and Mixed groups have the lowest number of chat counts.
- Personality does not predict above and beyond the effects of team nationality.

#### **2.4.5.3 Tip Count**

- The set of cultural dimensions as a whole did not predict tip count, but the direct-indirect dimension was a significant predictor of tip count. Those who are more direct tend to forward more tips.
- The incremental validity of team nationality is marginally significant at  $p = .07$ .
- Swedish and American teams had the highest number of Tip counts.



- Bulgarian and Norwegian have the lowest number of Tip counts.
- Personality accounts for an additional 5% of the variance above and beyond team nationality. In particular, extraversion and conscientiousness are the best predictors. Higher extraversion and lower conscientiousness are associated with higher numbers of tip counts.

### 2.4.5.4 Information Sharing

- For the briefing phase, neither the set of cultural dimensions nor team nationality predicted information sharing.
- In the search phase, the cultural dimensions did not predict, but nationality did predict information sharing. Dutch, Swedish, and Americans had the highest scores and Bulgarian and Mixed had the lowest.
- Personality did not add significant prediction above and beyond nationality

### 2.4.5.5 Map Tool Markings

- The set of cultural dimensions accounts for a significant amount (10%) of the variance in scores for map tool markings.
- The addition of team nationality into the model does not increase prediction.
- Even though team nationality did not offer incremental prediction above and beyond the effects of the set of cultural dimensions, there was a significant difference in map tool markings by team nationality. Dutch and Bulgarian were the highest and Norwegian and Swedish were the lowest.
- Personality did not predict map tool markings above and beyond the effects of culture.

### 2.4.5.6 Utterances

- Among the cultural dimensions, direct-indirect was the only significant predictor of the number of utterances, and team nationality predicted utterances above and beyond the effects of the direct-indirect dimension. This implies a partial mediation effect in which the influence of team nationality on number of utterances is partially transmitted through scores on the direct-indirect dimension.
- Test of the partial mediation model: Differences in directness-indirectness associated with team nationality affected the number of utterances.
  - Teams with high scores on the dimension (i.e., most direct), Swedish, had highest numbers of utterance counts.
  - Teams with lowest scores on the dimension, Bulgarian, had lowest numbers of utterance counts.
  - Personality does not predict above and beyond the effects of culture.

### 2.4.5.7 Goodwill Points

- For net-goodwill balance, the task-relationship dimension was the only one that emerged as a significant predictor.
- No reliable differences were associated with team nationality.
- Personality did not predict above and beyond the effects of culture.

### 2.4.5.8 Situational Awareness

- No reliable predictors of situational awareness were observed for any of the three reports.

- Lower levels of agreeableness associated with higher levels of SA for report 1 only.

## **2.5 DISCUSSION**

Each of the hypotheses we addressed in this chapter were supported, but with some important exceptions. Weak relationships were found among measures of team process and outcome. More information sharing in the briefing phase weakly predicted greater situation awareness and higher goodwill points. In contrast more information sharing in the residential phase was only weakly related to greater situation awareness and situation awareness was not related to goodwill points.

The finding that only information sharing varied across nationality suggests that a more complex relationship may be moderating or mediating relationships among the dependent variables. The GlobeSmart® Commander cultural dimensions may be influencing relationships, as the results suggest that perceptions about the dimensions are stronger within single nation teams than in multi-national teams. Further analyses should be conducted to determine whether more complex relationships may exist.

Further, subsequent analysis has revealed a strong mediating affect of language competency and age on the impact of culture on teamwork. Specifically, when age and language are used as covariates in the data analyses, performance differences between nations disappear.

## **2.6 CONCLUSIONS**

This experiment represents a highly significant accomplishment that has never been done before. It has established a baseline comparing team performance data from 56 teams representing five separate nations and multi-national teams comprised of members from these same nations. The findings bear out the general principle that information sharing in teams is related to situation awareness, and that the process of information sharing predicts team performance outcomes. Nationality influences information sharing, but not situation awareness or team outcomes, and it is not yet clear what the nation specific factor might be. Further exploration of cognitive cultural biases using the GlobeSmart® Commander culture dimensions measure is needed to understand the effect of nationality on the psychometric properties of the measure. Such analyses are needed before it can be used to identify mediating or moderating effects of culture on team processes and outcomes.

## **Chapter 3 – ASSESSMENT OF ORGANIZATIONAL AND INTERPERSONAL FACTORS IN A SIMULATED MISSION AND IN AN OPERATIONAL ENVIRONMENT**

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### **3.1 ASSESSMENT #1: ORGANIZATIONAL AND GROUP PROCESSES, INFORMATION SHARING, DECISION MAKING, LANGUAGE, GROUP GOALS/PROCESSES, SOCIAL IDENTITY, AND CULTURE IN AN OPERATIONAL ENVIRONMENT**

#### **ABSTRACT**

This chapter presents the analysis of the organizational processes in a NATO Headquarter (HQ), based on the data collected at the NATO exercise Allied Warrior 2004 (AW04). Data was mainly collected through questionnaires and interviews.

Topics covered in the analysis are: information-sharing, decision-making, language, organization, group roles and processes, social identity, and culture. There are analyses of both quantitative and qualitative data included. The results of the analysis provide some preliminary insights into the organizational processes linked to the cooperation in a multinational headquarter as well as some preliminary insights into the cultural influence on organizational processes linked to cooperation in a multinational headquarter.

#### Sum of results:

There had been a reorganization of the Deployable Joint Task Force (DJTF), aiming to achieve a more Effects Based Operations (EBO)-type structure. In line with this, 87% of the responding personnel reported that they found the organization to be changed in this exercise. A majority also found their tasks and responsibilities to be different from usual. Those who were given increased responsibilities in this exercise were found to like it better as well as rate the organization as better.

In terms of organization, most personnel perceived the organization to be flatter, but also more centralized than what they were used to. This could indicate a higher work-load on the top leadership, which may not be optimal for the efficiency of the organizational processes. It was found that perceived flexibility was connected to perceived decentralization, in line with the expectations of NATO Network Enabled Capabilities (NNEC). Results indicated that respondents from cultures scoring low on Hofstede's Power distance (Pd) dimension<sup>1</sup>, tended to rate the organization more positively if they perceived it to be decentralized. This is in line with the finding that organizations in low Pd cultures tend towards flatter and more decentralized structures.

English language competency turned out to be an important factor to include in order to understand the organization processes and the influence of culture. Almost all respondents reported that native English speakers (NES) dominated the cooperation in the organization, and there were indications that three out of four non-native English speakers (NNES) had a handicap in the organization due to language.

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<sup>1</sup> Indicating someone who feel there is little difference between people in a hierarchy, in terms of power and worth.

Contrary to expectations, language and culture were seen as greater obstacles by the NES than the NNES; compared with NNES, NES found both language and culture to hinder them more in sharing information, as well as understanding messages from NNES.

It was found that time shortage was the most important hindrance for personnel to share information. It also seemed that culture affected communication; those from a low Pd culture reported to communicate more with peers and subordinates than did those from a high Pd culture.

The self-reports indicated that the team and the assignment meant most in creating a sense of belonging and identity for our respondents. Age and gender were reported to be the least important.

### **3.1.1 Background [AW04 Study]**

This chapter will present the organizational analysis from the Deployable Joint Task Force (DJTF) at the Allied Warrior 2004 (AW04) exercise. The personnel at the DJTF from HQ Naples were the focus of our study.

Organizational changes had been introduced in a preceding exercise in 2004, making this the second time the personnel in the DJTF exercised the new organizational structure. The reorganization of the DJTF aimed to approach a structure in line with Effects Based Operations (EBO)<sup>2</sup>. This included a change from the formerly used J-structure into to a cellular “EBO structure”, a change from separate services into a joint structure, and increased focus on the commander’s goals.

This study aimed to research what this reorganization meant for the personnel, in terms of their individual perceptions of organizational and group processes, decision-making, and information-sharing, and how these variables interacted with language skills and culture.

The study has been reported in more detail in Bjørnstad, 2005 [51] and 2006 [52].

### **3.1.2 General Aims**

Even though the study was exploratory, we had some ideas and a few hypotheses built on previous research and theory that we wanted to explore. The main focus areas are presented here, but the more detailed theoretical basis will be presented where it is appropriate in the results and discussion chapters (3.1.4 and 3.1.5). The organizational areas of focus were partly chosen for their expected relationship to culture.

#### *Information-sharing*

As information is crucial to any organization, and especially to an HQ’s functioning, we aimed to get a better understanding of how information is shared in a multinational HQ and how language and culture may affect this. Areas of focus included information push/pull, communication in the hierarchy and obstacles for information-sharing.

#### *Organizational and group processes*

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<sup>2</sup> EBO is e.g., described in the “NATO networked enabled capability (NNEC) foundation document” (NATO HQ SACT, 2004 [79]).

Organizational and group processes were at the core of our focus. Areas include: decision-making (who makes decisions), timeliness, speed and quality of decisions, organizational change, hierarchy, centralization and flexibility, change in tasks and responsibilities, cooperation and control. We also wanted to better understand what formed the personnel's identity and trust in the organization, as these may be important factors influencing organizational processes. The possible influence of language and culture was considered for all areas of focus.

### *Language skills and culture*

There are ample indications from multinational military settings that language proficiency (English) may be affecting organizational processes. We wanted to understand this better as well as control for this, to avoid confusing language proficiency with culture in the analyses. Cross-cultural organizational studies also indicate that culture is a very important variable to consider for research on multinational organizations [53][54],[55],[56].

### **3.1.3 Method**

The study was exploratory in kind and used both qualitative and quantitative measures and methods of analysis. More specifically, a combination of observation, semi-structured interviews and questionnaires were employed for the data collection. Observation played a secondary role.

Although the results reported are primarily based on statistical analyses, qualitative analyses also play an important role. The latter has helped us achieve a better understanding and context-sensitive analysis of the quantitative findings, as well as having been critical to the development and evaluation of the new survey tool.

#### **3.1.3.1 Participants**

The military personnel at the DJTF from HQ Naples were the focus of our study. They counted approximately 90 persons and were from 12 different nations; the majority of whom had their daily work at the NATO HQ in Naples.

We had two key informants, who gave us an overview of the exercise and the organization. 13 persons from the DJTF were interviewed<sup>3</sup> and 15<sup>4</sup> filled out the questionnaire on organization-related topics, rendering a total of 28 respondents. 11 out of these also answered a computerized questionnaire on culture.

#### **3.1.3.2 Materials**

##### *ORGANIZATION*

This was considered the pilot work in the development of an organization-focused questionnaire. The questionnaire endeavours to measure organization and organization-related variables anticipated to be of importance for the cooperation and decision-making in a military multicultural setting like a NATO headquarter. The questionnaire covers the topics of: Group roles and processes, Organization, Decision-making, Information-sharing, Language, Identity and Culture.

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<sup>3</sup> The interviews were semi-structured and had the same questions in the base as the organizational questionnaire (the main tool for the quantitative data collection).

<sup>4</sup> 5 of these questionnaires were mailed to us and arrived after the main part of the organizational analyses had been conducted (Bjørnstad, 2005 [51]). N=23 for most of the organizational analyses.

*Evaluation of the organizational tool of measurement*

On the basis of the AW04 data (both qualitative and quantitative) analyses, the questionnaire was revised for later use. For more details on this methodological process, please be referred to Bjørnstad, 2005 [51]. The content validity of the form should have been satisfactorily established by the measures taken. The feedback given by the respondents, primarily in the interviews, but also through comments that were made in writing, gave indications of good face validity.

*CULTURE*

The cultural data was collected through Meridian Global's "Globesmart" Self-Assessment Profile tool (SAP) developed in cooperation with David Matsumoto [53][49],[57];[60]. The SAP contains 36 questions on culture-related topics and behaviors essential in business relations across cultures [53]. These questions give scores on six dimensions of cultural values and attitudes considered to be relevant in a business context. In addition, data were collected on demographics.

The dimensions are called: Independence/Interdependence, Egalitarian/Status, Risk/Restraint, Direct/Indirect Communication, Task/Relationship, and Short-term/Long-term Orientation.

- Independence/Interdependence (I/I) refers to whether people are primarily oriented towards and organized around the individual or the group. Group orientation is linked to tight ties between people, whereas individual orientation is linked to loose ties between people. High scores indicate interdependence (Int).
- The Egalitarian/Status (E/S) dimension refers to differences in status orientation, i.e. to which degree the people in an organization find status differences important for how they act and perceive other members of the organization. High scores indicate status (S) orientation.
- The Risk/Restraint (R/R) dimension refers to differences in willingness to engage in risk-taking behavior. People from restraint oriented cultures are more rule oriented. High scores indicate restraint (Re).
- Direct/Indirect Communication (D/I) refers to the degree to which people prefer to communicate a message in a direct or indirect manner. High scores indicate indirect (Indir) communication.
- The Task/Relationship dimension pertains to differences in whether people tends to focus on the task at hand or on the relationships in the organization in order to get the work done. High scores indicate Relationship (Rel) orientation.
- Short-term/Long-term Orientation (St/Lt) refers to differences in time orientation; i.e. the degree to which people focus on today or the distant future when for instance making decisions. High scores indicate long-term orientation (Lt).

The dimensions have been validated through studies of industry and business teams in different countries ([www.meridianglobal.com](http://www.meridianglobal.com)). There is no research publication on all the dimensions collectively, i.e. the SAP tool of measurement, but there are separate publications establishing the basis from which five of the dimensions have been developed (Egalitarian/Status: [49]; Independence/Interdependence<sup>5</sup>: [57]; background

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<sup>5</sup> Adapted from the IC Interpersonal Assessment Inventory [57].

for Short-term/Long-term Orientation: [60]; background for Risk/Restraint<sup>6</sup>: [58],[59]; background for Task/Relationship<sup>7</sup>: [61]).

It is important to be aware that different cultural dimensions developed by different researchers in the field both have differences and similarities that can easily be confused when they use the same or similar name for a dimension which may have the same core meaning, but differ in important other aspects. For instance, the Individualism/Collectivism (I/C) dimension of Hofstede and Triandis carry the same name and reflect the same in the core, i.e. to which degree a culture has group or individual orientation [56],[55]. However, Triandis' dimension is a much more inclusive dimension than Hofstede's dimension, in that it for instance also refers to variations in power orientations (i.e. the subcategories, vertical/horizontal), which in Hofstede's system is defined as variations within a different dimension, Power distance (Pd). Thus, using both Triandis' I/C dimension and Hofstede's Pd dimension, would lead to a considerable overlap in meaning of the two measurements and procure the tool's discriminate validity. The risk of using overlapping dimensions has previously been identified by many researchers in the field (see e.g., [56],[62]). It is a problem that may apply to the SAP dimensions from the Globesmart tool. The definitions that are used seem to be somewhat overlapping, as well as there currently being no overall validation of the dimensions used together in one tool (discriminate validity).

The SAP dimensions have much in common with the most well-established and empirically tested cross-cultural work in the field; Triandis' cultural dimension of Individualism/Collectivism [56], and the work related value-dimensions developed by Hofstede [55]: Individualism/Collectivism, Power distance, Uncertainty avoidance, Masculinity/Femininity, Short-term/Long-term Orientation.

Hofstede's dimensions can in short be explained as follows [55]:

- Individualism/Collectivism (I/C) refers to a cultural difference in group as opposed to individual orientation. Group orientation is linked to tight ties between people, whereas individual orientation is linked to loose ties between people. High score indicate individualism (I).
- Power distance (Pd) is defined as a difference in the actual and experienced distribution of power between people in a hierarchy. High scores indicate high Pd.
- Uncertainty avoidance (Ua) refers to a difference in need for predictability and rule orientation. High scores indicate high Ua.
- Masculinity/Femininity (M/F) refers to whether the culture values toughness, assertiveness and a focus on material success as opposed to modesty, concern for others and a focus on the quality of life. High scores indicate masculinity (M).
- Short-term/Long-term Orientation (St/Lt) refers to a difference in focus; the present versus distant future. The former indicates a propensity for action whereas the latter indicates a propensity for planning. High scores indicate long-term orientation (Lt).

Three of the SAP dimensions are, deducted from the information available, somewhat similar to three of Hofstede's dimensions; Independence/Interdependence (I/I) seem to equal Individualism/Collectivism (I/C),

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<sup>6</sup> Adapted from Matsumoto et al.'s tool for measuring adaptability, the ICAPS [58],[59].

<sup>7</sup> Developed from Schwartz' Value scale [61].

Egalitarian/Status (E/S) seem to equal Power distance (Pd), and Short-term/Long-term Orientation (St/Lt) shares both name and much of the content with Hofstede's dimension. The Risk/Restraint (R/R) dimension has some in common with Hofstede's Uncertainty avoidance dimension (Ua)<sup>8</sup>, and the Task/Relationship (T/R) dimension seem have some overlap with both Hofstede's Masculinity/Femininity (M/F) and Individualism/Collectivism (I/C) dimensions. The content of the Direct/Indirect Communication (D/I) seems to some extent to be covered in both Hofstede's and Triandis' Individualism/Collectivism dimension, especially pertaining to the subcategories High/Low context and Tight/Loose society of Triandis' dimension [56].

### *Challenges of measurements*

Unfortunately the data collected on culture with the SAP matches less than half of the sample that we have organizational data on<sup>9</sup>. This has obviously made analyses difficult, and it was deemed useful to explore other sources of cultural data. Since we had information about the nationality of almost the whole sample, we were able to match this with Hofstede's cultural data for the subjects from these nationalities. In other words, Hofstede's national scores were employed in order to provide a supplementary basis for the cultural analysis. The use of such national scores is quite customary within cross-cultural research.

The choice of Hofstede's data and research to complement the SAP-data is based on this being the most well-established and researched cross-cultural data we have – especially as concerns organizational and work related issues. His work has been corroborated and expanded through numerous other studies, also with military samples (e.g., [63],[64][65],[66], [67]).

### *Evaluation of the cultural tools of measurements*

As indicated earlier in this chapter, it seemed that three of the dimensions of Matsumoto and Hofstede were similar enough for us to expect them to correlate. These were the St/Lt dimensions of Matsumoto and Hofstede, Matsumoto's I/I dimension and Hofstede's I/C dimension, as well as Matsumoto's ES and Hofstede's Pd dimensions; St/Lt pertaining to a variation in focus (present/distant future), I/I and I/C pertaining to a variation in group-individual orientation, ES and Pd pertaining to a variation in power distribution. Even though carrying the same name, the St/Lt dimensions of Matsumoto and Hofstede did not prove to be related in this sample. For the other two dimensions there were found relationships, however, in the opposite direction of what was expected; I/I was negatively related to I/C ( $r=-.291$ ,  $p=.415$ )<sup>10</sup> and ES was negatively related to Pd ( $r=-.434$ ,  $p=.210$ ). Of course, these relationships were not significant, and with such a small sample there could be numerous sources to this irregularity. But if the tendencies reflect some accuracy, it could either indicate a coding error or that at least one of the measurements is less than valid or reliable in this context. The fact that Hofstede's tool is by far the most corroborated and researched, speaks in favor of his tool. However, the fact that we have individual scores on Matsumoto's dimensions instead of aggregated scores, speaks in favor of the scores from his tool.

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<sup>8</sup> The definition of the R/R dimension seems to have some elements in common with Hofstede's Uncertainty avoidance (Ua) dimension, i.e. the rule orientation part ([www.meridianglobal.com](http://www.meridianglobal.com) [47]). However, Hofstede is very clear about his dimension referring to uncertainty and not risk (Hofstede, 1991 [55]). Hence, the differences seem to be more prominent than the similarities. All in all the definition of this dimension seems somewhat unclear; in the descriptions, risk orientation is for instance both linked to decision-making by consensus and by authority.

<sup>9</sup> This is true also for the demographic data; these data matches only for the same respondents as the SAP.

<sup>10</sup> These dimensions were scored in the opposite direction, thereby giving the positive correlation opposite meaning.



This confusion, together with a very small sample (N=11 for the SAP, Matsumoto's cultural tool of measurement), has made interpreting the results difficult at times.

The Risk/Restraint (R/R) dimension did not show much variance for this sample, thus making it difficult to use. Therefore, there are no analyses reported that have used this dimension. This adds to the previous reservations, as to whether this is a good measure.

The last two dimensions in the SAP (CSQ), D/I and T/R, did not show any relationship to Hofstede's dimensions.

### 3.1.3.3 Procedure

The data-collection was carried out in the course of 6 days, November 2004. As indicated above, observation, semi-structured interviews and questionnaires were employed for the data collection. Observation was primarily carried out in the Combined Joint Operations Centre (CJOC) of the DJTF during and in connection with a "walk-through" with one of our key informants and during a brief held by the Commander. The organizational questionnaires and the interviews were completed on site towards the end of the exercise. The cultural questionnaires were filled in from the beginning of the exercise and continued throughout. The organizational questionnaires were pen & paper while the cultural were computerized.

The subjects were recruited on the basis of free willingness. LTAMC made a presentation of the project and the exercise commander made an appeal for the personnel to participate. The subjects would then at their own convenience drop by our "office" within the exercise quarters.

## 3.1.4 Results

### 3.1.4.1 Information Sharing and Culture

#### *Information push-pull related to Rank and Culture (I/C, I/I, Pd, ES)*

There were two questions in the questionnaire measuring whether the respondents primarily pushed or pulled information. These questions were significantly correlated ( $r=-.45$ ,  $p<0.05$ ,  $N=23$ ); individuals who indicated that they mostly pushed information to *many* persons, tended to indicate that the information was pushed *to* them, and those who indicated that they only pushed information to *a few* persons, tended to indicate that they pulled information *themselves*.

Qualitative data suggest that the choice between these strategies might depend on the position the person had in the exercise. Controlling for the effect of rank gave a non-significant and weaker relationship between the two variables ( $r=-.311$ ,  $p=.382$ ,  $N=8$ ). It seems that some of the covariance in the push-pull behavior is explained by a difference in rank; there is less connection between the variables for personnel higher in the hierarchy. However, as sample size is very small, this can only be viewed as tendencies. Controlling for culture (I/C and Pd) did not affect the relationship much.

Theory and empirical research on the effects of culture on cooperative behavior has indicated that there is a difference in willingness to cooperate with others depending on their culturally defined predispositions. Collectivistic cultures have been found to emphasize cooperation more than individualistic cultures (e.g., [68],[69]); Diaz-Guerrero, 1984 in [68]). Diaz-Guerrero found that individualistic cultures rather emphasized competition. However, while some researchers (e.g., [70]) have suggested that collectivism mainly predisposes to show cooperative behavior towards people from one's own group or team ("in-group"), later research [68] have shown that this tendency also extends to relations with people from other groups. The sharing of information with other members of an organization is deemed to be an example of cooperative

behavior, and we hypothesized that people from collectivistic cultures would be more willing to share information (i.e. “push”) than people from individualistic cultures.

The data from AW04 seems to support this supposition, even if the sample is too small to provide any significant numbers. There was found a small tendency for people from a collectivistic culture to report that they push information to more people than those from individualistic cultures ( $r=-.255$ ,  $p=.241$ ,  $N=23$ ).

However, confusing the results somewhat, the SAP measurement, I/I, showed the opposite ( $r=-.343^{11}$ ,  $p=.301$ ,  $N=11$ ); that people from an independent culture push information to more people. This is in line with the finding presented in chapter 3.1.3.2, of I/I and I/C being negatively related<sup>12</sup>. This is of course only a pilot study, and it is our hope that further research will clarify such discrepancies.

Based on previous research it was also anticipated that a culture’s degree of Pd might affect the degree to which people pull the information themselves. Low Pd has been linked to less leader supervision and more initiative from people lower down in an organization’s hierarchy (see e.g., [55];[71];[56]).

There was no relationship with the Pd scores. However, the ES dimension was found to correlate negatively with the degree to which a person reported to seek out the information him/herself ( $r=-.662$ ,  $p=.027$ ,  $N=11$ )<sup>13</sup>. This result would confirm the hypothesis, that an equality orientation is linked to more initiative to seek out information.

#### *Information-flow in the hierarchy and Culture (Pd)*

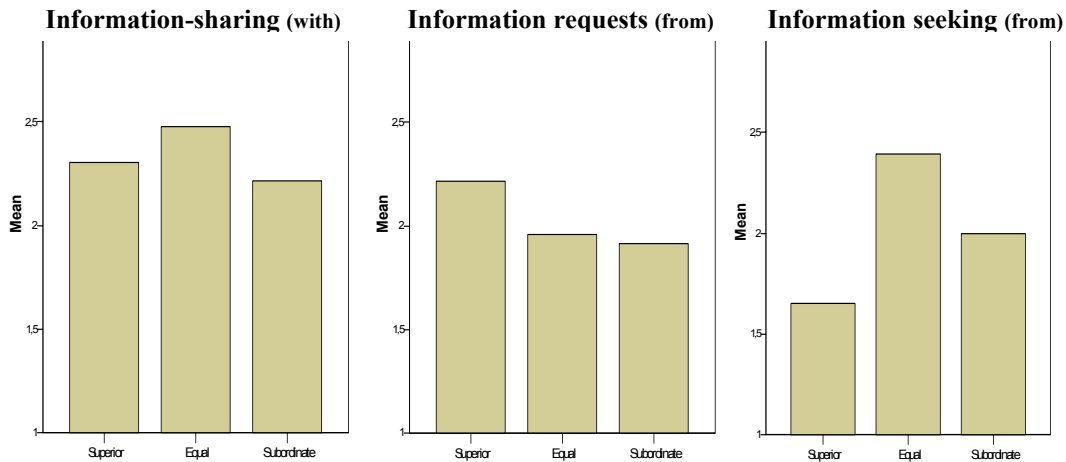
Different information-sharing behaviors between superior, equal and subordinate were compared (Figure 4). It was found that that the respondents tended to both share information with, and seek information from, equals most of the time, while information requests were most often received from superiors. The only significant difference in mean score was found between information seeking from superior versus equal ( $t = -3.51$ ,  $p =.002$ ); the personnel tended to seek more information from equals.

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<sup>11</sup> Low I/I indicates the opposite of low I/C. See chapters 3.1.3.2 for more on this.

<sup>12</sup> I.e. positively correlated while carrying the opposite meaning.

<sup>13</sup> Controlling for rank did not affect the relationships much.

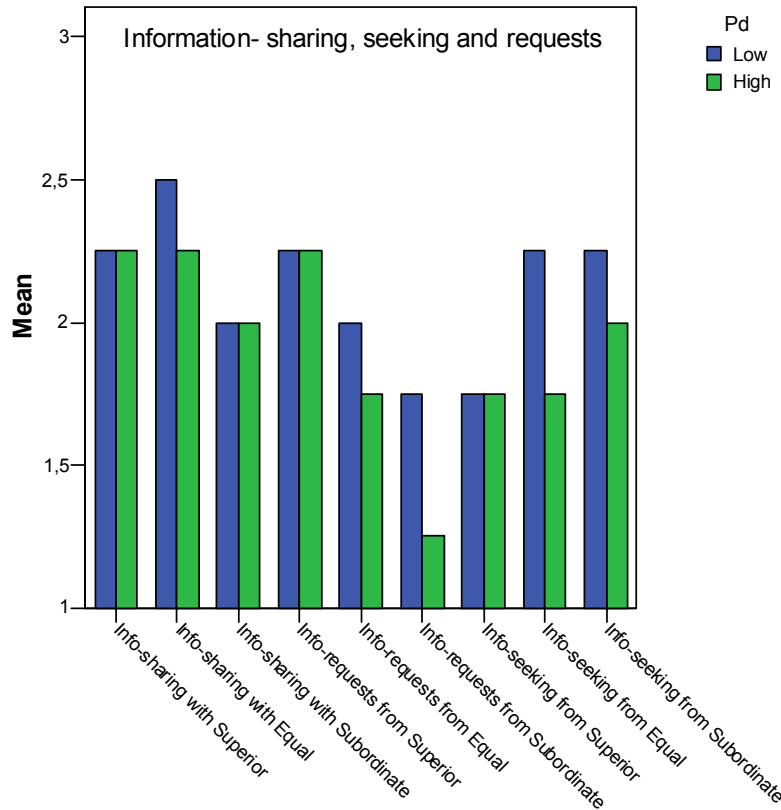


**Figure 4: Differences in information-sharing, requests and seeking, between superior, equal and subordinate (1=min.score, 3=max.score).**

We wanted to find out whether this communication pattern related to culture. Offermann & Hellmann [72] found Pd to be negatively related to leader delegation and communication with subordinates, i.e. low Pd indicating higher leader communication. The question was whether our findings of different types of communication in the hierarchy related to Pd.

The difference between information seeking from superior and equal was not found to be significantly related to Pd. Nevertheless, as Figure 5 shows, there were some differences in the communication pattern depending on Pd<sup>14</sup>. In general, lower Pd scores seemed to be related to: more information-sharing, requests and seeking with/from equal, and more information-requests and seeking from subordinate. These differences were not significant, which may be as expected from such a small sample.

<sup>14</sup> Results have been controlled for rank; i.e. the two enlisted (who had no subordinates to communicate with) were cut from the sample in these analyses, as well as all those we had no rank information available for (n=14).

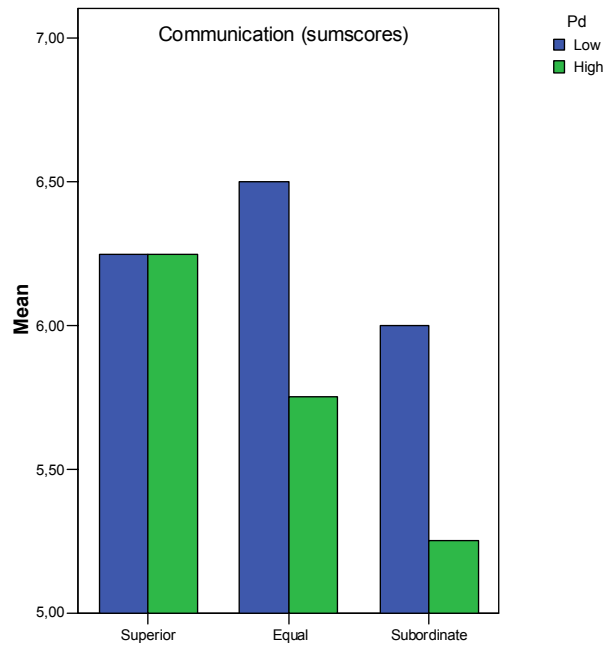


**Figure 5: Differences in information-sharing, requests and seeking, between superior, equal and subordinate (1=min.score, 3=max.score) depending on degree of Pd (low [n=4] vs high [n=4]: blue=low, green=high.)**

We used sumscores<sup>15</sup> to see whether the *general* communication pattern would be related to Pd. As indicated above, Offermann & Hellmann [72] found Pd to be negatively related to leader communication with subordinates. Results seem to corroborate this finding; those with low Pd report more communication both with equals and subordinates (Figure 6)<sup>16</sup>. These differences are, however, not significant, and should only be looked upon as tendencies<sup>17</sup>.

<sup>15</sup> Factor analysis demonstrated a pattern of reported sharing, receiving requests for, and seeking information, which indicated that the respondents may not have differentiated much between the different types of communication they were rating (see Bjørnstad, 2005[51]). A high score means a high degree of communication. <sup>16</sup> Results have been controlled for rank; i.e. the two enlisted (who per definition had no subordinates to communicate with) were cut from the sample in these analyses as well as those we had no rank information available for (n=14).

<sup>17</sup> The difference in communication with subordinates depending on degree of Pd had a p-value of 0.675.

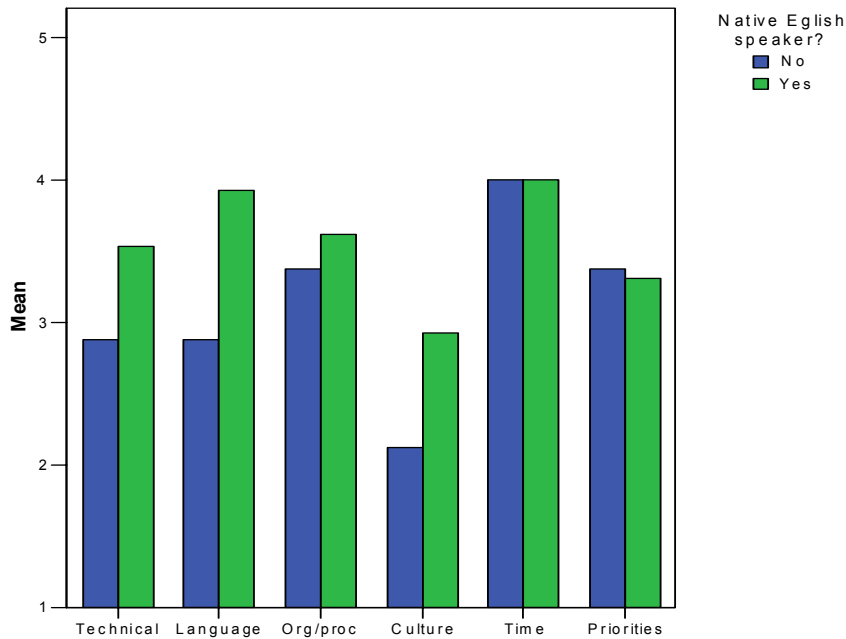


**Figure 6: Sumscore for amount of communication (sharing, seeking, and receiving requests for information) (3=min.score, 9=max.score) with superior, equal and subordinate, depending on degree of Pd (low vs high: blue=low, green=high).**

*Obstacles for information-sharing, Language and Culture (Ua)*

Time constraints were rated as the most important obstacle for a person to share information, while culture was rated as the least important obstacle.

Native English-speakers were found to perceive language and culture to be a greater problem for their information-sharing than did non-native English-speakers. This is shown in Figure 7.



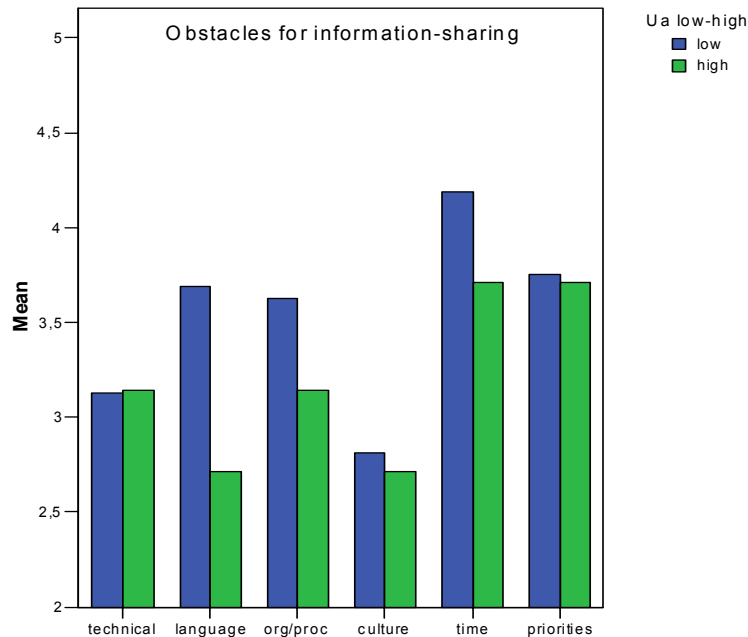
**Figure 7: Obstacles for information-sharing: native English-speakers (n=15) and non-natives (n=12) (min.score=1, max.score=5).**

Language is the one obstacle for information-sharing where people differed significantly depending on whether they were native English-speakers or not ( $t=-2.08$ ,  $p=.05$ ). The differences in the ratings of culture were not significant.

Ua is the cultural dimension that primarily would be expected to cause a difference in the rating of obstacles for information-sharing. Since high Ua is indicating a culture where what is different is considered dangerous [55], one would have expected that people high in Ua find differences in language and culture to be more difficult than those with low Ua. However, the data here does not support this expectation (Figure 9). Figure 8 rather shows that people with low Ua rate language, organization & processes, and time as more important obstacles for information-sharing than do those with high Ua.

In other words, Ua does not seem to influence whether people find language and culture to be a problem when sharing information, while language<sup>18</sup> does. However, due to the small sample, no conclusions can be made at this stage.

<sup>18</sup> I.e. native compared to non-native English speakers.



**Figure 8: Obstacles for information-sharing: low Ua (n=17) and high Ua (n=7) (min.score=1, max.score=6).**

### 3.1.4.2 Decision-Making

#### *Who makes decisions?*

73,9% of the respondents reported that their superior made most of the decisions in their environment, while the remaining 26,1% reported that they made the decisions themselves. None said that a subordinate made most decisions. These data reflect a traditional hierarchic organization. Qualitative data also indicate traditional hierarchic processes and a largely centralized decision-making process in the organization (see also chapter 3.1.4.3 for more on this).

34,8% reported that decisions were made by one person (leader), while 47,8% reported that decisions were made by one person (leader) in cooperation with a team. The remaining 17,4% report that most decisions were made by a team.

#### *Timeliness, speed, quality and success*

The analysis showed that around 60% of the respondents rated the decision-making as timely, speedy, of good quality, and successful in some degree. Respondents tended to rate the quality of decisions somewhat higher than the success of decisions.

Qualitative data revealed that the quality ratings tended to be based on the respondents' understanding of the decision-making process, while the success ratings tended to be based on the feedback they had received on the outcome. This means that the quantitative results referred to above, indicate that people tended to rate the decision-making process (quality) somewhat more favorable than its outcome (success). On the positive side, explanations of decision quality could look like this: "Most decisions here are done very well, based on appropriate team-work in a correct and timely manner", or like this: "There is strong leadership and guidance,

better communication than usual, and a very accessible general.” On the negative side, respondents said things like: “Decision quality is often ridiculous – a lot of impulsiveness on the leadership, it seems to me”, and: “Input to decisions is not as complete as it could be. Input to decisions is shaped by what the boss will want. Intermediate leaders are not guiding the process”.

### *Culture*

Analyses of decision-making in relation to culture did not provide any results.

### **3.1.4.3 Organization and Culture (Pd and Ua)**

#### *Organizational change*

87% of the respondents rated this organization as different from what they were used to. A moderate majority (54,6%) rated the organizational changes to have been for the better. In the interviews, people who were positive to the organizational changes linked this to an increase in the speed of decision-making and information-flow, flatter organization and more effective team processes. Those who felt the changes had been for the worse, pointed to NATO bureaucracy, micromanagement, and a lack of time and manning.

The personnel had been confronted with this organizational structure only once before in this series of NRF 4 DJTF exercises. In the interviews, most of the personnel said that it was chaotic in the first exercise as well as in the beginning of this one, as it took some time for them to learn and remember how to work in this structure. We were informed that the organizational changes also meant that many people were put in positions where they did not possess the expertise they felt they needed in order to do the work. As they were experienced higher officers, they had many years of experience working within the traditional structure and underlined how important it was to train together to have at chance at making a new one work.

#### *Organizational change and Culture*

According to previous findings it was hypothesized that people with high Ua would be more negative to organizational change than those with low Ua [55]. Splitting the file in low and high Ua showed that for those from low Ua cultures, there were no relationship between the experienced degree of organizational changes and the rating of the organization. However, for those from high Ua cultures, there was found an almost significant negative relationship ( $r=-.718$ ,  $p=.069$ ). This means that, the type of organizational change experienced here tended to be understood as negative for those from high Ua cultures. Hence, the data seems to support the hypothesis of high Ua predisposing people to perceive organizational changes as negative. This makes sense. As indicated above, there were reports of chaos linked to the organizational changes implemented, indicating that the environment is less predictable and more ambiguous. According to theory, people from high Ua cultures will have more difficulties dealing with this [55].

#### *Hierarchy, centralization and flexibility*

Three questions were asked in order to decide some of the details of the organizational changes introduced, pertaining to the respondents’ perception of the hierarchy, centralization/decentralization, and flexibility of this organization compared to what they were used to.

Responses indicated that hierarchy may have been flattened in this organization (48% said the organization was flatter, 22% that it was more hierarchic), but also that this was not accompanied by an equal amount of decentralization (39% said the organization was more decentralized, 35% that it was more centralized). Indeed, there was found no relationship between degree of hierarchy and decentralization<sup>19</sup>. One of the

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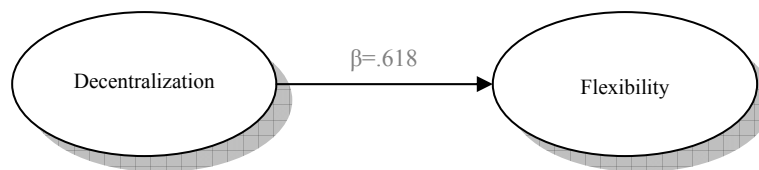
<sup>19</sup>  $r=.062$ ,  $p=.778$ .



respondents explained increased centralization like this: “Intermediate leaders are not empowered to make decisions, so sometimes there is a chokepoint from the top for guidance.” Another one saw it from the other side; he thought the problem was that subordinates forwarded too many questions to their superior out of convenience. Such comments indicate, from two different standpoints, negative consequences when centralization accompanies a flattening of the hierarchy (see also the discussion, chapter 3.1.5.3).

56,5% found the organization to be more flexible, while 26% found it to be less flexible. Regression analysis was conducted and there was found a significant relation between perceived decentralization and flexibility ( $\beta=.618$ ,  $p=.002$ ,  $R^2=.036$ ), indicating that people who found the organization to be flexible also tended to find the organization to be decentralized.

The current findings suggest a relationship between decentralization and flexibility as portrayed in the model below, Figure 9.



**Figure 9: Relationship between decentralization and flexibility.**

Stepwise regression analysis was conducted in order to check how well the variables (hierarchy, centralization, flexibility)<sup>20</sup> explained why people rated the organization as changed in this exercise. Degree of decentralization turned out to explain 29,4% of the variance (adjusted  $R^2=26,1\%$ ,  $p=.007$ ). See table 3 below. Adding the other variables (hierarchy and flexibility) to the model did not increase its explanatory value. Indeed, it turned out to explain less of the variance (Adjusted  $R^2=22,6\%$ ,  $p=.050$ ).

**Table 3: Regression analysis: Ability of the variable, degree of centralization, to explain why people rated the organization as changed in this exercise.**

	<i>B</i>	<i>SE b</i>	<i>Beta</i>	<i>t</i>	<i>p</i>
<i>Constant</i>	.442	.428	-	1.033	.313
<i>Degree of centralization</i>	.580	.196	.543	2.959	.007

<sup>20</sup> The independent variables were recoded for this analysis, so that high scores represented change in any direction (in line with the scoring of the dependent variable).

### *Hierarchy, centralization, flexibility, and Culture*

We also expected that Pd would affect how the respondents rated the organizational changes. Low Pd has been linked to liking to work in flatter and more decentralized organizations [55]. Thus, we expected that those with low Pd would look more positively on the organization changes if they perceived that the organization had become flatter and/or more decentralized. There was found a positive relationship between perceiving this organization as more decentralized and rating the organization as better for those from low Pd cultures ( $r=.595$ ,  $p=.091$ ) For those with high Pd, there was found no relationship between centralization and rating the organization as better or hierarchy and rating the organization as better.

#### **3.1.4.4 Group Roles and Processes and Culture (Ua, Pd, ES and M/F)**

##### *Changes in tasks and responsibilities, and Culture (Ua)*

70% of the respondents reported that their tasks and responsibilities were different from usual in this exercise. In the interviews, many of the personnel expressed that they found the changes in their roles and responsibilities in this DJTF to be bewildering. However, those who were given increased responsibilities in this organization tended to like it ( $r=.477$ ,  $p=.025$ ) as well as rate the organization positively ( $r=.559$ ,  $p=.007$ ). Regression analysis revealed that the amount of responsibility explained 31,2% of the variance (adjusted  $R^2=27,8\%$ ) in the rating of the organization.

The question is whether these findings can be related to culture. As previously indicated (chapter 3.1.4.3), Ua could predispose for handling change less well.

The link made between increased responsibilities and liking the change (increase) in responsibilities, was only found for those from low Ua cultures ( $r=.513$ ,  $p=.042$ ,  $n=16$ ). This could mean that, in line with the findings in the previous chapter (3.1.4.3); a propensity for disliking change in high Ua cultures may have affected how change was rated.

However, the link between increased responsibilities and rating the organization positively was found for both low and high Ua personnel. Seen together, these findings may indicate that those with high Ua may not like the change per se (increased responsibility), but producing a secondary effect; improving their insight into the organizational processes and thereby making the organization more predictable, less ambiguous, and thus more likable for persons from a high Ua culture. This interpretation is reinforced by the finding that increased responsibilities seemed to have a bigger effect on those with high Ua than on those with low Ua for their rating of the organization (high Ua:  $r=.785$ ,  $p=.037$ ; low Ua:  $r=.520$ ,  $p=.039$ ). This is of course hypothetical at this time; we had a small sample and will need further research clarify such interpretations.

##### *Cooperation, organization and Culture (Pd, ES, M/F)*

45% reported that the changes in tasks and responsibilities had affected cooperation in some degree, and 46,2% of these reported that it was for the better. Thinking the change was for the better for how they cooperated with their colleagues, related significantly to reporting that they had more responsibility than usual ( $r=.593$ ,  $p=.033$ ), liked having more responsibility ( $r=.691$ ,  $p=.009$ ), and were integrated into central processes ( $r=.610$ ,  $p=.027$ ; see also next headline). This indicates that there is a link between having more responsibility, being more integrated into central processes, and better cooperation. It seems that having a more central role in the organization (more responsibility and more included in central processes), may influence the perception of group processes (in terms of cooperation) positively.

The relationship (correlations) between these variables were re-estimated, to decide the effects of culture (Pd, M/F). Partial correlation showed that these relationships were not affected much by culture (Pd, M/F).

Correlations with organizational variables were conducted in order to see whether organization could have an effect on cooperation. It was found that decentralization was significantly correlated with how the person liked the changes in cooperation ( $r=.698$ ,  $p=.008$ ). Indeed, a regression analysis revealed that decentralization explained 48,7% of the variance (adjusted  $R^2= 44,1\%$ ) in how the person liked the changes in cooperation. Thus, it seems that more decentralization may bring on more contentment with cooperation.

Using partial correlation, it was controlled for culture (Pd and ES); it did not have much effect on the relationship between decentralization and contentment with cooperation.

On a question of which nationalities the respondents cooperate with, the majority reported that they cooperated most with people from the US and the UK. Our respondents explained that this was due to the general make-up of the organization, indicating that these nationalities simply outnumbered other nationalities in the organization. However, some reported that they also, to a certain degree, choose whom to cooperate with based on whom they felt most similar to and most at ease with, and that this sometimes had a root in cultural similarities. Several interviewees pointed to that similarities in language, ways of thinking/understanding, and values, guided their choice of interaction with other people.

#### *Inclusion into organizational processes and Culture (I/C & I/I)*

Three questions aimed to measure to what degree the respondents were included into the organizational and team processes. These were questions on how well they felt integrated, their activity level, and the amount of things they had to do in their position. 71%<sup>21</sup> of the respondents reported that they were well included into the organizational and team processes.

There was found no significant relationship between culture and inclusion into organizational and group processes.

#### **3.1.4.5 Language**

##### *English language proficiency level*

9 out of 23 in the sample were non-native English speakers. To evaluate their level of English proficiency, the personnel answered questions on comfort, stress and tiredness experienced when speaking English.

44,4% said they either sometimes or often became more stressed when working in English, and 75% said they either sometimes or often became more tired when working in English. The question on comfort showed very little variance, respondents all rated themselves as “quite” or “very comfortable”, and confirmed our expectations of this possibly being a poor measure due to the social desirability of answering the question positively.<sup>22</sup> The respondents’ answers to the question about tiredness came closest to how they saw it from the outside. Respondents claimed that their colleagues either sometimes (83,3%) or often (16,7%) had problems understanding or making themselves understood in English.

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<sup>21</sup> I.e., 71% is the average on the three questions on integration, activity level, and amount of things to do (for more details, see Bjørnstad, 2005 [50]).

<sup>22</sup> For more details on these measurements, please be referred to Bjørnstad, 2005 [51].

*Language and the choice of medias of communication*

A question on preference for the use of oral versus written medias of communication seemed to indicate a slight inclination towards written medias of communication for non-English speakers. This is shown in the crosstabulation below (table 4).

**Table 4: Personal preference for the use of oral versus written medias of communication and whether the person is a native English speaker or not.**

		Comm. preference			Total
		<i>Oral</i>	<i>No preference</i>	<i>Written</i>	
Native English speaker?	<i>No</i>	3	4	2	9
	<i>Yes</i>	9	5	0	14
<b>Total</b>		12	9	2	23

The interviews revealed that the choice of oral or written medias of communication may depend on several circumstances, such as language (of both the receiver and the sender: native/non-native English speaker), hierarchy (message to superior or subordinate), time (shortage), and familiarity (how comfortable with the person). Except when the choice was due to time shortage, people’s preference for oral communication was generally based on face-to-face interaction.

People said they chose oral communication first of all because they could get immediate feedback on the other party’s understanding and could, if necessary, clarify the message. This was especially understood to be an advantage when communicating with non-native English speakers. However, several interviewees experienced that the telephone was the least well functioning medium when communicating with non-native English speakers. Furthermore, the choice of oral means of communication was deemed to depend on whether or not they felt comfortable with the person they were communicating with.

Written medias of communication were often chosen by the interviewees if the message was of high importance, so that the receiver could keep it for reference. The possibility of keeping the message for reference was deemed to be of even greater importance when communicating with non-native English speakers. The written communication allowed the non-natives more time and the option to consult co-workers if they should need a clarification of meaning. This would explain the slight tendency found in the quantitative data for non-native English speakers with a lower English language proficiency level to choose written medias of communication.

Making sure that the receiver had understood the message, seemed to be the most obvious concern for the people I spoke with. This was the reason given by both people who preferred written and oral communication. However, on a personal level, some individuals appeared to be more comfortable in a face-to-face situation, while others preferred the computer.

*Language and power relations*

It was expected that language proficiency might influence power relations. There were four questions aiming to measure language-related power relations. These focused on: persuasion, understanding of another person’s point of view, domination in cooperative situations, and the act of interrupting. 66,6% of non-native English speakers said that they sometimes or often found it harder to persuade their colleagues of their ideas in English than in their native language, but only 22,2% said that they sometimes or often were interrupted more when communicating in English than in their native language. 81,8% of the respondents found it harder to understand non-native English speakers point of view than native English speakers. 95,5 % of the respondents found native English speakers to dominate cooperative situations more than others<sup>23</sup>.

From this, we understand that a great majority of the respondents found it harder to understand non-native English speakers’ point of view than native English speakers, as well as finding native English speakers to dominate cooperative situations in this organization. This seems like a logic connection. Indeed, these two variables (finding it hard to understand non-native English speakers and finding native English speakers to dominate) were significantly correlated ( $r=.543$ ,  $p=.009$ ).

There also appears to be a tendency for native English speakers to find non-native English speakers’ point of view to be more difficult to understand than what non-native English speakers do. This is shown in the crosstabulation below (table 5). There was found a significant correlation of ( $r=.428$ ,  $p=.047$ ) between the two variables. This is in line with the findings reported in chapter 3.1.4.1; native English speakers were also found there found to rate language as a more important obstacle to information-sharing than did non-native English speakers.

**Table 5: Relationship between being a native English speaker and finding that non-native English speakers often have problems making themselves understood.**

		Finding Non-native English Speakers to have Problems Making Themselves Understood					Total
		Never	Seldom	Sometimes	Often	Very often	
Native English speaker?	No	1	3	3	1	1	9
	Yes	0	0	6	6	1	13
Total		1	3	9	7	2	22

*Culture*

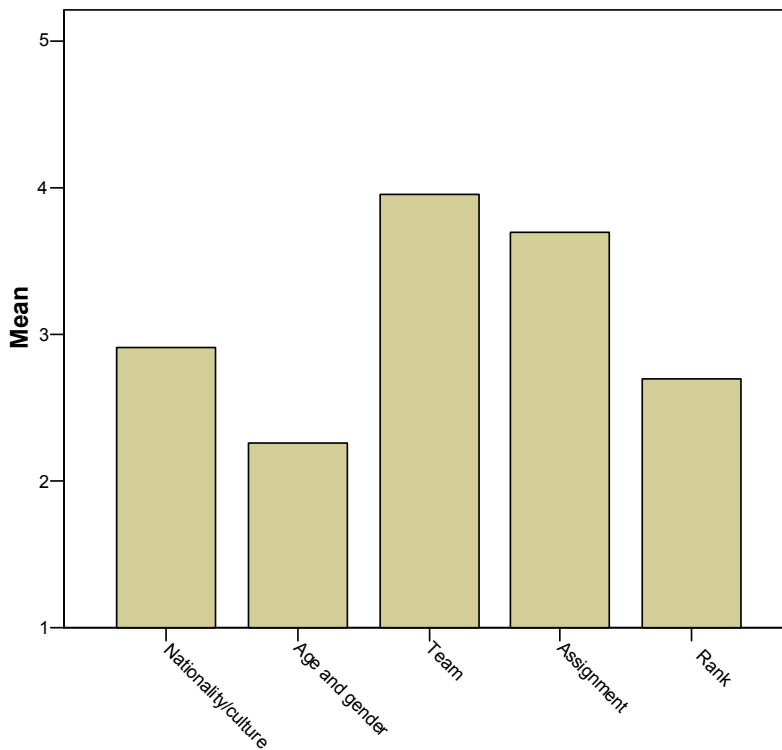
Analyses of language in relation to culture did not provide any results.

<sup>23</sup> There were not found any significant differences between native English speakers and non-native English speakers on their responses to this question.

### 3.1.4.6 Identity and Culture (I/C)

#### *Affinity*

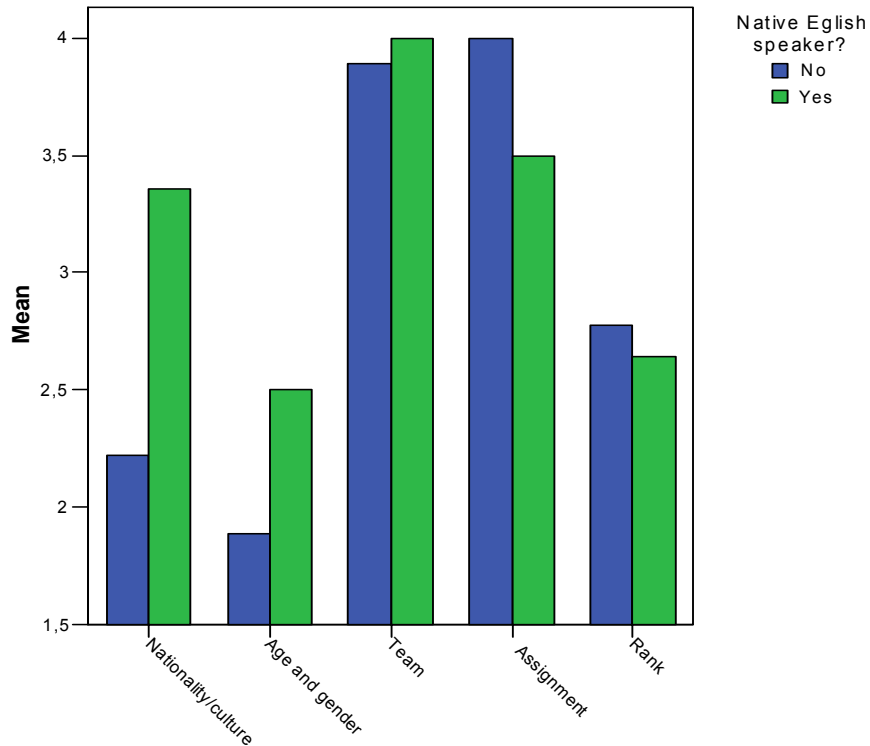
It was found that the team and the assignment meant most in creating a sense of belonging for our respondents. Age and gender was found to be the least important. This is portrayed in Figure 10.



**Figure 10: Ratings of what gives a sense of belonging (min.score=1, max.score=5).**

#### *Affinity and Language*

Further analysis was conducted in order to see if there were any differences between native and non-native English speakers in what created a sense of belonging. This is presented in Figure 11.



**Figure 11: Differences between native English speakers and non-natives in ratings of what gives a sense of belonging.**

A t-test demonstrated that there was a significant difference between native English speakers and non-natives in their ratings of nationality/culture ( $t=-2.446$ ,  $p=.023$ ). Native English speakers found nationality/culture to be significantly more important for their sense of belonging in this environment than did non-native English speakers.

#### *Affinity and Culture*

Relating the findings on belonging to culture, it was found that assignment was the only affinity which seemed to be related to culture; I/C was related to rating assignment as important ( $r=-.386$ ,  $p=.062$ ,  $N=24$ ). This means that the respondents from collectivistic cultures tended to rate common assignment as more important for their sense of belonging than what the respondents from more individualistic cultures did.

It was furthermore checked whether culture (I/C) had an effect on how important the respondents rated affinity. There did not seem to be any difference in how they rated the importance of the affinity.

*Meaning of affinity, and culture (I/C, I/I)*

Three questions aimed to measure the meaning of the personnel's affinities. These questions asked them to rate the importance of belonging, whether it is an aid in doing their job and whether it is an obstacle for them in doing their job. Descriptive statistics show that affinity was deemed to be important by 87% of the respondents. 92,3% found it to be important for them to do their job while only 4,3% found it to be an obstacle.

Both finding affinity to be important and an aid in doing the job were related to finding assignment to give a sense of belonging ( $r=-.525$ ,  $p=.01$ ;  $r=-.394$ ,  $p=.063$ ). This indicates that a sense of belonging can help people working on the same assignment to get the job done. Culture (I/C, I/I) did not seem to affect this relationship much. It appears that this is valid for both individualists and collectivists.

**3.1.4.7 Controlling Behavior, Trust and Culture (Pd, Es, Ua, I/C and I/I)**

*Controlling behavior, and Culture*

One question aimed to obtain a rating of the use of controlling behavior. Descriptive statistics show that there were an approximate equal number of people who reported that they often, sometimes, or never found it necessary to increase downward control. There was no significant difference between native English speakers and non-natives.

In order to find out whether there were any cultural differences in how people answered this question we explored both qualitative and quantitative data. From the interviews we found that people from low Power distance (Pd) cultures seemed more often to rely on the ability of their subordinates to manage on their own, while people from high Pd cultures were more liable to indicate that the subordinates had to be guided in order for them to "get it right". People from low Pd cultures also tended to reveal more positive attitudes to their subordinates than did people from high Pd cultures. An example of a statement from a low Pd representative: "The members of the organization are generally rather experienced, so I don't feel a strong need to exercise an increased control." Interviews with high Pd representatives, on the other hand, left us with statements like this: "Some people tend to escape their tasks when they realize that the superior control is insufficient."

We also wanted to find out whether this could be supported by the quantitative data; was there a link between the self reported controlling behavior and the Pd, ES and Ua dimensions of culture? There was found no such relations in our data.

*Trust and Culture*

There were two questions pertaining to how the respondents generally related to people from different cultures and how they trusted them. 36,4% reported that there were differences in how they related to people from different cultures, while 50% said that there were no differences. Qualitative data indicated that whether people chose to treat people the same, independent of culture, or differently, depending on culture, they did it because they believed it was the "right thing to do". Some found it most correct to treat everyone the same (independent of culture), while others argued that there were advantages to "being sensitive to different cultures".



Very few (13,6%) said that they trusted people from other cultures less than people from their own culture.<sup>24</sup> Qualitatively, on this question, interviewees generally said that trust depended more on person than on nationality. However, some also specified that they more readily trusted someone from a culture or group that they knew normally performed well on the task at hand, and that others first had to prove themselves. One said it like this: “There is more of a need to get to know people from different cultures for you to trust them; to know what to expect, etc.” Some furthermore linked trust to understanding, “You trust those you understand”. In other words, it seems that trust has a lot to do with familiarity, in terms of ability to understand and knowing what to expect.

Quantitative data demonstrated no relationship between the direct question on trust and the cultural dimensions of Individualism/Collectivism (I/C, I/I) and Uncertainty avoidance (Ua). However, the question on whether the respondents related differently to people from other cultures, revealed correlations with both the I/C and the Ua dimensions; I/C was almost significantly negatively related ( $r=-.366$ ,  $p=.078$ )<sup>25</sup> and Ua was significantly positively related ( $r=.408$ ,  $p=.048$ ). This indicates that respondents from individualist and low Ua cultures tended to report that the culture of the other person influenced how they related to them. Collectivists and high Ua persons, on the other hand, reported to distinguish less between how they related to people from different cultures.

### **3.1.5 Discussion**

#### **3.1.5.1 Information Sharing and Culture**

There was found a small tendency for people from collectivistic cultures to report that they push information to more people than those from individualistic cultures. This was in line with expectations; collectivism has previously been linked to more cooperative behavior, while individualism has been linked to competitive rather than cooperative behavior.

It was also checked for a link between information-sharing in the hierarchy and culture (Pd). It was found that those from a low Pd culture reported more total communication both with peers and subordinates than did those from a high Pd culture. This was in line with previous research having found Pd to be negatively related to leader communication with subordinates.

As high Ua may predispose for handling the unknown less well, it was found plausible that Ua would influence how people rated certain obstacles for their sharing of information. However, our results indicated no link between Ua and whether people find language and culture to be a problem when sharing information. But due to the small sample, no conclusions can be made at this stage.

On the other hand, there was found an important difference between native English-speakers and non-natives in how they saw language and culture as a potential problem; contrary to our expectations, native English-speakers perceived language and culture to be greater obstacles for their information-sharing than did non-native English-speakers<sup>26</sup>.

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<sup>24</sup> Due to a lack of variance in responses and indications in the interviews of this being a sensitive question (people generally will not admit to distrusting other nationalities, as this may appear racist), this low number may be somewhat misleading. The question has been rephrased in the revised questionnaire

<sup>25</sup> Due to the small sample, it is difficult to get significant numbers. As this was almost significant we chose to include the analysis, but ask the reader to be aware of uncertainties.

<sup>26</sup> The difference in the ratings of language was significant, while the difference in the ratings of culture was almost significant.

This finding is in line with the findings on language (chapter 3.1.4.5); native English speakers also perceived it as more difficult to understand non-native English speakers' point of view than did non-native English speakers. Thus, it seems that native English speakers find it more difficult both to understand non-native English speakers as well as to trust them to understand a message.

The notion that native English speakers may hesitate to share information because they are afraid that the non-native English speakers may not understand the message is supported by the qualitative data from the interviews. Native English speakers often reported that they were unsure of non-native English speakers understanding.

### **3.1.5.2 Decision-Making**

Both qualitative and quantitative data support the finding of traditional hierarchic processes and a largely centralized decision-making process in the organization (see also chapter 3.1.4.3 for more on this). About three quarters of the respondents indicated that their superior made most of the decisions. Over one third reported that decisions were made by the leader alone, while almost half reported that the leader also included a team in the process. Only some, about one in 6, indicated that most decisions were made by a team.

The analysis showed that a relatively stable majority (around 60%) of the respondents rated the decision-making as timely, speedy, of good quality, and successful. People tended to rate the decision-making process (quality) somewhat more favorable than its outcome (success).

There were found no relations to culture.

### **3.1.5.3 Organization and Culture**

87% of the respondents rated this organization as different from what they were used to. It is very possible that this could influence the effectiveness of the organization. The optimal situation is that there is congruence between the organization one is used to and the organization one is to work in during an exercise or real operation. What has been practiced daily for years will evidently form a person's basic understanding of how the organization works and how he/she should do his/her work within it, in time becoming automatic and less subject for conscious evaluation. Especially in situations of high mental demand (stress), people increasingly depend on their most salient mental models, i.e. what they are most used to doing (e.g., [73]). Changing the organizational structure and processes is therefore a difficult and long process (see also [55]); people's basic understanding, or existing mental models, will continue to influence their behaviour until new mental models become more salient. One cannot really expect a change in organizational structure and processes to become efficient until this has become the norm for the people working in it.

On the other hand, a moderate majority did rate the organizational changes to have been for the better. One has to start somewhere in order to make changes, and it takes time and experimentation to change the NATO organization and processes. Thus, the organizational and procedural changes introduced in this DJTF, can be understood more like a step on the way than being final or complete in any way (i.e. the organizational changes aiming for EBO). Hopefully, what studies like this may contribute to, is to increase the understanding of the effects of the changes and learn from the experiences of people who are in the middle of it.

High Ua predisposes for handling change (especially chaos and ambiguity) less well, and it was anticipated that Ua could affect the rating of organizational change. For those with high Ua there was found an almost significant negative relationship between the experienced degree of organizational change and the rating of the organization. High Ua seemed to predispose people to perceive organizational change as negative.

The respondents tended to rate this organization as more centralized than what they were used to. This was reflected both in relation to the questions on organization and to the questions in relation to tasks and responsibilities (see chapter 3.1.4.4). At the same time, the organization tended to be rated as flatter. This is in line with other empirical findings from the field; decentralization and flattening of the hierarchy do not always go hand in hand (e.g., [74]). Indeed, new technology and flattening the hierarchy often mean a centralization of decision-making rather than decentralization (see e.g., [75]). However, this is not optimal for the efficiency of organizational processes, as the top end of the hierarchy easily gets overloaded when too many decisions are routed upwards (see e.g., [76],[75]). This latter interpretation was further supported by the qualitative data. Such organizational processes make personnel lower down in the hierarchy less able to make decisions. This may be linked to the process of learned helplessness<sup>27</sup>; there is a risk that people become passive in systems where they get used to having insufficient authority to achieve their goals. If the person gets used to not being able to make a difference, it is a natural consequence to stop trying.

Decentralization and flexibility were found to be closely related; people who found the organization to be flexible also tended to find the organization to be decentralized. This confirms the classic finding of a link between centralized organization and inflexibility (see e.g., [77],[78],[75]) and supports the theory proposed in the concept of Network Enabled Capabilities (NEC)<sup>28</sup> (e.g., [79],[75]). This is in line with organizational studies by e.g., Morgan[77], describing bureaucratic type organizations as hierarchic, centralized and inflexible - indicating a link between these variables. A later study with a larger sample (N=55) from a tactical level at a NATO exercise (Battle Griffin 2005), confirmed this relationship further [80].

Hence, both theory, current, and later findings indicate that there may be a causal relationship where decentralization predicts/explains flexibility.

On culture, it was found that respondents from a low Pd culture who perceived the organization to be more decentralized, tended to rate the organization positively (almost significant positive relationship). This was in line with expectations; low Pd should make it more natural to work in flatter and more decentralized organizations. However, there was found no relationship for high Pd cultures. Is it possible that people from low Pd cultures find it harder to adapt to a more centralized organization than people from high Pd cultures find it to adapt to a more decentralized organization? This is of course only a very small sample, making it risky to read too much into the results, but it could be interesting to follow up on this in later research.

#### **3.1.5.4 Group Roles and Processes and Culture**

It was found that a majority of the respondents perceived their tasks and responsibilities to be different from usual in this exercise. Those who were given increased responsibilities in this exercise/organization were found to like it better as well as rate the organization as better.

The significant link between increased responsibilities and liking it was only found for those from low Ua cultures. This could mean that, in line with the findings in chapter 3.1.4.3; a propensity for disliking change in high Ua cultures may have affected how change was rated. However, there were indications that those with high Ua did not like the change per se (increased responsibility), but that the increased responsibility had a

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<sup>27</sup> A classic psychological finding [81]; people learn quickly to stay passive when they previously have learned that their actions are unsuccessful. This knowledge is furthermore transferable to different situations than where it was learned.

<sup>28</sup> Comparable to the previously used terms: Network Centric Warfare (NCW) and Network Based Defense (NBD – used in Norway, e.g., [75]).

secondary effect - improving their insight into the organizational processes and thereby making the organization more predictable, less ambiguous, and thus more likable for persons from a high Ua culture.

There were found significant positive relationships between responsibility and contentment with cooperation, and integration and contentment with cooperation. Culture did not seem to influence these relationships.

Results indicated a link between decentralization and contentment with cooperation. This could indicate that teamwork is ameliorated by decentralized control. Such an interpretation is supported by research on team decision-making; democratic leadership has been found to be more effective and advantageous in many respects (e.g., [82],[83],[84]). The other positive links to contentment with cooperation, responsibility and integration, support this interpretation; high responsibility for all and high integration into central processes are characteristics of a decentralized organization. There was found no link between culture and how the respondents rated cooperation.

A majority reported that they cooperated most with US and UK due to the make-up of the organization. However, qualitative data revealed that similarities in language, ways of thinking/understanding, and values, may influence the personnel's choice of whom to interact with. This may influence the cooperative processes, in terms of who cooperates with whom.

Most respondents reported that they were well included into organizational and group processes. There was found no significant relationship between culture and inclusion.

### **3.1.5.5 Language**

The results indicated that three quarters of the non-native English speaking personnel were negatively influenced by having to work in English instead of in their native language. Increased tiredness and stress were such factors. This means that non-native English speaking personnel are subject to a larger cognitive load relative to what natives experience, and that they consequently may be more vulnerable to additional stressors (see e.g., [73],[85]). The poorer the language proficiency, the higher the cognitive load. This will have an impact on their function in the organization, especially in times of high demands.

When it comes to the choice of means of communication, there seemed to be a very slight preference for written means of communication when the receiver and/or the sender were a non-native English speaker. However, quite a lot of respondents also preferred face-to-face interaction. The telephone was the least preferred medium, perceived to augment the risk for misunderstandings.

It was found that almost all of our respondents (96%) perceived native English speakers to dominate cooperative situations more than others. Native English speakers also tended to find it more difficult to understand non-native English speakers' point of view than what non-native English speakers did. These findings indicate that non-native English speakers clearly have a disadvantage in the organization and in cooperation compared to native English speakers. This is understood to be due to the language advantage native English speakers have. Seen together with the results presented in chapter 3.1.4.4, native English speakers may not only dominate cooperative situations, they may also outnumber the non-native English speakers in the organization. Another possibility is that they may have more leading positions.

### **3.1.5.6 Identity and Culture**

It was found that the team and the assignment meant most in creating a sense of belonging for our respondents. Age and gender was found to be the least important.

Both language and culture were found to affect some of the ratings. Native English speakers rated nationality/culture significantly more important for their sense of belonging in this environment than did non-native English speakers. In chapter 3.1.4.1, it was also found that native English speakers rated culture as more of a hinder for their information-sharing than did non-native English speakers. This may indicate that native English speakers focus more on culture than non-native English speakers do, both as something positive (giving a sense of belonging) and as something negative (an obstacle for sharing information).

Assignment was the only social affinity which turned out to be related to culture. Respondents from collectivistic cultures tended towards rating common assignment as more important for their sense of belonging than what their colleagues from individualistic cultures did. There did, however, not seem to be any cultural difference in how the respondents rated the importance of the affinity in general. Previous research have found that group belonging is more emphasized in collectivistic than in individualistic cultures (e.g., [55],[56]). This difference did not show up in our material.

Almost all respondents found affinity to be important and an aid to get the job done. This was further related to finding the assignment to give a sense of belonging, indicating that a sense of belonging can help people working on the same assignment to get the job done. From another angle, this may also indicate that having a common goal (in terms of assignment) bring people closer (in terms of cooperation and group belonging/identity). This is in line with classic research on group processes; common goals and mutual dependency has the ability to create a common identity (i.e. psychological sense of belonging; see e.g., [86]) and to bring people even from conflicting groups together in cooperation [87]. Culture was not found to affect these ratings and relations much; it was valid for individualists and collectivists alike.

### **3.1.5.7 Controlling Behavior, Trust and Culture**

There was found no link between self reported tendency for controlling behavior and culture (Pd, ES and Ua) in the quantitative data. However, in the qualitative data there was found a tendency for people from low Pd cultures to expect their subordinates to manage on their own, while people from high Pd cultures were more liable expect their subordinates to need close guidance. People from low Pd cultures also tended to reveal more positive attitudes to their subordinates than did people from high Pd cultures. These qualitative data supports findings from cross-cultural organizational research (e.g., [71],[88],[55],[72]). Bochner & Hesketh, for instance, found that high Pd was related to a preference for closer supervision and a belief in the necessity of having to *make* people work hard. Clegg found high Pd to be linked to controlling behaviour on the leader's part.

About half of the respondents said that they did not differentiate between people from different nationalities/cultures while just over one third said that they did. Respondents from both individualist and low Ua cultures tended to report that the culture of the other person influenced how they related to them. Persons from collectivistic and high Ua cultures, on the other hand, tended to report to distinguish less between how they related to people from different cultures. The finding that respondents from high Ua cultures tend to report that they do not make any differences in how they relate to people from various cultures may reflect an effect of them being more rule oriented; they may believe it is correct not to make any difference and report their behavior accordingly. Minding the sample size, this is little more than speculations. Based on high Ua indicating that people are more uncomfortable in ambiguous situations [55], and interpreting the relating to people from other cultures to be an example of an ambiguous situation, we had more readily expected the opposite effect. The problem with self-reporting is of course that the representatives may not be aware of their own actual behavior and thus unknowingly give biased self-ratings founded more on what they think is correct

than what they really did.<sup>29</sup> As far as the link with I/C is concerned, it is interesting to note that even though collectivists are more group oriented and therefore also more aware of, and sensitive to, differences between groups, in our sample they did not report to differentiate more, rather less. A question for further research would be to check whether this is found in larger samples, and if so, why it is that individualists may differentiate more.

Qualitative data revealed that trust may have a lot to do with familiarity, both in terms of ability to understand and knowing what to expect. The respondents pointed to being able to understand and knowing what to expect as important factors to trust in other people. This is in line with research on trust, which have shown that similarity and time to get to know one another, are important factors in the building of trust (e.g., [89],[90],[91],[92]). Trust has in turn been found to be essential for the cooperation and flow of knowledge in organizations [93], [94],[90], hence an essential prerequisite for information-sharing.

There was no relationship found between the direct question on trust and the cultural dimensions of Individualism/Collectivism (I/C, I/I) and Uncertainty avoidance (Ua) in the quantitative data. Previous research has, however, indicated that the cultural dimensions I/C and Ua may affect people's tendency to trust people from different cultures [68],[55].

### **3.1.6 Conclusions**

This pilot study has provided some initial analyses of the organizational changes introduced in a multinational NATO Headquarter (DJTF). It has given some preliminary insights into organizational processes linked to cooperation and culture in this setting. The results presented here are, due to its exploratory nature and the small sample, seen as preliminary. They do, however, give us an indication of the many influences that culture and language can have on the processes in such an organization. It is expected that follow-up studies<sup>30</sup>, will amend some of this and allow some wider and more generalizable results.

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<sup>29</sup> Indeed, this is a tendency that may be strengthened by high Ua. Because high Ua means more attention to rules, it makes it logic that high Ua people also may focus more on what they perceive to have been the correct behaviour rather than what was the actual behaviour. This supposition was strengthened through some of the interviews. We experienced that some individuals from high Ua cultures had a difficulty answering questions on their own and others' actual behaviour – they insisted on describing only how things should be done (rules). It appears high Ua indicates that people are more focused on ideal states than actual states.

<sup>30</sup> Studies include data and analyses from Battle Griffin 2005 (BG05) and Multinational Experiment 4 (MNE4). The BG05 study is reported in Bjørnstad (2006b[80]) while the MNE4 analyses have not yet been completed.

### **3.2 ASSESSMENT #2: ORGANIZATIONAL AND GROUP PROCESSES, COMMUNICATION, TRUST INFORMATION SHARING, DECISION MAKING, LANGUAGE, GROUP GOALS/PROCESSES, SOCIAL IDENTITY, AND CULTURE IN A SIMULATED MISSION**

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#### **ABSTRACT**

This chapter presents the initial analyses of the data from the LTAMC experiments on organization, culture, communication, trust, language and group processes. Both experimental and survey data was collected.

It was shown that the VSM/Hofstede measurement of culture gave more variance between national cultures than the GCS/Matsumoto measurement, and was found the most useful for analyses. When comparing the participating nations' scores on the cultural dimensions, some of them were rather surprising compared to previous research on this; on the Individualism/Collectivism dimension the current scores as well as the rank order were quite different from what Hofstede found in his original IBM study. In the original study, the USA and the Netherlands scored the most individualistic, while Sweden and Norway scored the most collectivistic. In the current study this was the other way around; Sweden and Norway scored the most individualistic and the USA and the Netherlands the most collectivistic. Reasons suggested were sample differences (military versus civilian/IBM), and/or that one or more questions in the survey may be less suited for military samples.

There was found higher levels of trust within the national than within the international teams. This result supports existing research, and suggests a need to invest more time and training in order to build trust within culturally diversified teams in NATO coalitions. The more culturally different the team composition, the higher will the need be to focus on this.

Amount of communication varied greatly between the groups. Some of the variation was linked to English language capability; the better in English, the more they communicated. This underlines the importance of language proficiency for personnel in NATO work.

Flat organizational structure was shown to be related to flexibility. In this game environment, respondents also seemed to have a more positive view of the team organization when they experienced it as more hierarchic and centralized. Suggested reasons for this finding: simple task situation (has previously been linked to making a centralized organization advantageous), game communication and information management systems (e.g. it took more time to communicate and share information with all in a decentralized manner than in a centralized manner if the team was dispersed), and military and cultural sample preference (people tend to prefer and work most efficiently in systems to which they are accustomed). These findings implicates the importance of having the organization fit both the task and the personnel (both in terms of their cultural make-up and what they are trained for), as well as the information management and collaborative systems being aligned to support the organizational structure and processes.

Subjects from low Pd cultures tended to rate the team organization more positively than those from high Pd cultures. There was no relationship found between rating the organization and Uncertainty avoidance (Ua).

### **3.2.1 Background [LTAMC SABRE Study]**

In the following, there is a brief description of background, theory, method, participants, materials and procedure; please be referred to chapter 2 and 3.1 for a more comprehensive presentation of these subject areas.

The LTAMC project members collected experimental data in the period April 2006 – May 2007. Cross-cultural cooperation was the main focus in the experiments. This chapter presents the initial descriptive analyses of the data from these experiments on organization, culture, communication, trust, language and group processes<sup>31</sup>.

A total of 56 experiments were conducted and 5 nations contributed. The experiments were conducted in Norway (16+6)<sup>32</sup>, Sweden (9+6), Bulgaria (8+6), the Netherlands (8+8) and the USA (7+6). 48 experiments (the national experiments) were conducted using local networks while 8 experiments (the international experiments) were conducted on the internet.

Many researchers in the field of cross-cultural psychology have shown how nations vary across various aspects of culture, e.g. [54][55][56][49][61]. The most well-established and researched theory of cross-cultural differences that we have are Hofstede's dimensions of culturally based values – especially as concerns organizational and work related issues. His work has been corroborated and expanded through numerous other studies, also with military samples (e.g., [63] [64] [65] [66] [67]). The culturally based value-dimensions developed by Hofstede [55] are called: Individualism/Collectivism, Power distance, Uncertainty avoidance, Masculinity/Femininity and Long-term/Short-term Orientation. Individualism/Collectivism (I/C) refers to a cultural difference in group as opposed to individual orientation. Group orientation is linked to tight ties between people, whereas individual orientation is linked to loose ties between people. High score indicate individualism (I). Power distance (Pd) is defined as a difference in the actual and experienced distribution of power between people in a hierarchy. High scores indicate high Pd. Uncertainty avoidance (Ua) refers to a difference in need for predictability and rule orientation. High scores indicate high Ua. Masculinity/Femininity (M/F) refers to whether the culture values toughness, assertiveness and a focus on material success as opposed to modesty, concern for others and a focus on the quality of life. High scores indicate masculinity (M). Long-term/ Short-term Orientation (Lt/St) refers to a difference in focus; the present versus distant future. The former indicates a propensity for action whereas the latter indicates a propensity for planning. High scores indicate long-term orientation (Lt).

But there are also newer developments in the field, like MeridianGlobal and Matsumoto's six dimensions of culture [47], which nevertheless bare some resemblance to Hofstede's dimensions. They have built on existing research in the field and developed the dimensions: Independence/Interdependence, Egalitarian/Status, Risk/Restraint, Direct/Indirect Communication, Task/Relationship, and Short-term/Long-term Orientation.

Two of the many areas culture affects are organizational and team behavior. As also indicated in 3.1, organization structure as well as culture, have an impact on team processes. For instance, how is organizational and team structure affecting processes as well as being interpreted differently in different

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<sup>31</sup> The Norwegian focus has mainly been on organizational and social factors, team cooperation and culture. This reflects the focus in the FFI projects NBD in operations and Collaboration in Networks, within which the Norwegian LTAMC work has been conducted.

<sup>32</sup> The first number in the parenthesis indicate the number of national experiments in each country, with a nationally homogenous subject composition, while the latter number indicate the number of international experiments, with a nationally heterogeneous subject composition, that each country participated in. In Norway, there were conducted a total of 16 Norwegian national experiments, with samples from two different Norwegian military populations, plus 6 international experiments.



cultures? Does English language ability affect cooperative processes? And is the level of trust the same in national and international groups? We wanted to explore such themes in the experiments conducted.

For more theoretical aspects, please be referred to chapter 2 and 3.1.

### **3.2.2 Method**

#### **3.2.2.1 Participants**

There were a total number of 224 subjects participating in the experiments, 4 in each experiment. The experiments were conducted with participants from 5 nations; 48 of the groups were culturally homogenous (i.e. same nationality) while 8 of them were culturally heterogeneous (i.e. different nationalities). All participants were military officers, 52 male and 4 female. In Norway, there were conducted two series of national experiments, with samples from two different Norwegian military populations (one from a graduate and one from an undergraduate military college), which are also intended to function as a control when making comparisons across national cultures.

#### **3.2.2.2 Materials**

In order to study the different issues related to cooperation in multinational teams in a controlled environment, the LTAMC chose to employ a computer based role play (NeverWinter Nights, NwN), adapted for our research purposes (Situation Authorable Behavior Research Environment, SABRE), as the main instrument, the method being both explorative and innovative.

In addition, there were 6 computerized surveys distributed before, under and after the experimental game session. 4 pre-game computerized surveys were administered on background<sup>33</sup>, personality (NEO-PI<sup>34</sup>) and culture (GCS<sup>35</sup> and VSM-94<sup>36</sup>). During the experiment session, the subjects were at three different times in the game interrupted by a prompt to answer questions measuring their Situation awareness (SA). 2 surveys were administered after the experimental game session was over, called debriefing questionnaires 1<sup>37</sup> and 2. These were constructed for the purpose of the LTAMC experiments. Debriefing questionnaire 2<sup>38</sup> is an organization questionnaire containing 36 organization related questions constructed on the basis of the organizational survey employed in the field studies (AW04, BG05, presented in chapter 3.1). The questions covered topics such as organization (hierarchy, centralization, leader behavior), decision-making, work-load, trust, information-sharing, communication and language.

#### **3.2.2.3 Procedure**

In the experimental set-up, the 4 subjects in each experiment were randomly assigned to a role in the game. In the game scenario, the subjects were given an assignment as a team and could cooperate to solve the

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<sup>33</sup> Including demographics, language and computer use/knowledge.

<sup>34</sup> Short version of Costa & Mc Crae's NEO Personality Inventory [44], [45].

<sup>35</sup> MeridianGlobal and Matsumoto's Globesmart Commander Survey [47].

<sup>36</sup> Hofstede's Value Survey Module [55]. The VSM survey does not measure culture at an individual level – it has been validated to measure culture at the level of countries or regions. The GCS, on the other hand, is intended to be used on an individual level, but has not yet been validated.

<sup>37</sup> Debriefing questionnaire 1 is a general survey asking 51 questions from the game.

<sup>38</sup> Questions were reviewed by peers and revised on the basis of feed-back from the subjects in two pilot studies conducted in Norway prior to the first experiments.

assignment. They communicated through “chat”. The national experiments there were conducted within local networks while the international experiments were done over the internet. The experiments were timed to one hour, but subjects were in for 5-6,5 hours on the experiment day. This included: getting an introductory brief, game learning and planning sessions, completing surveys, and receiving a debrief in the end. (For more details, see chapter 2).

### **3.3 ASSESSMENT #3: CULTURE AND TEAMWORK IN AN OPERATIONAL ENVIRONMENT**

Dr. Joan Johnston, Research Psychologist, Naval Air Training Systems Division, U.S.A.

#### **3.3.1 Background [AW05 Study]**

The original purpose of the AW05 research initiative was to extend development of: (1) the model of organizational and interpersonal factors (Chapter 4), (2) the model of cultural adaptability (Chapter 4), and (3) training cultural adaptability (Chapter 5). Allied Warrior 05 (AW05) was a SHAPE/Allied Command Operations (ACO) Computer Assisted Exercise designed to certify the NATO Response Force VI (NRF-6) capability, under the command of Joint Force Command Lisbon (JFC Lisbon), for the six month period starting January 2006. The planned experimental design was based on the whole headquarters concept with the intent of studying J2 and J3 staffs. Similar to AW04, AW05 data collection was expected to take place with the same participants in two waves; at two different times and two different sites. Objectives 1 and 2 were addressed in a first wave of data collection at the Joint Force Command Headquarters in Lisbon before the actual AW05 exercise. The first wave results are reported in Chapter 4.

The second wave of data collection with the same participants was expected to take place at the AW05 exercise (CPX) at Montijo, Portugal Air Base. The plan was to collect anecdotal data from the wave 1 participants for: 1) content development of the GlobeSmart® Commander culture and teamwork training tool, the primary deliverable for the LTAMC project, and 2) assessing the impact of three GlobeSmart® Commander training modules on multicultural teamwork at the operational level. However, two external events resulted in a completely revised data collection plan at the CPX. First, a natural disaster in Pakistan resulted in deployment for many of the AW05 DJTF before the CPX, who therefore could not participate in the second wave. In addition, inadequate internet bandwidth at the CPX resulted in the inability of researchers to present the computer-based GlobeSmart® training. Therefore, the first objective was revised to provide a presentation to a new group of participants on the GlobeSmart training program and obtain their observations and feedback on the potential for using GlobeSmart with DJTF staff.

The second objective also had to be revised. The extensive national diversity of NATO officers in this study enabled us to explore, through semi-structured interviews, propositions based on a model for understanding cultural diversity in cognition and teamwork developed by Sutton and Pierce (see Chapters 2 and 5 for further discussion). Past research has found that normative scores on the GlobeSmart® cultural dimensions strongly distinguish country of origin or nationality. Past research has also established that effective communication strategies for teamwork (e.g., information exchange, initiative, and support), are considered important for successful team performance outcomes. Therefore, we proposed that this widely diverse sample of experienced NATO officers would be expected to have extensive knowledge about what makes multi-cultural teams effective. Therefore, based on the Sutton and Pierce model's expectations for effective teamwork, we proposed the NATO officers would tend to describe important teamwork behaviours with:

a) An egalitarian perspective (e.g. being "self-directed," using "flexible roles," and "challenging opinions of others in power") vice a "status" perspective (e.g., team members follow and enforce rules/guidelines, expect to use appropriate behaviours for specific roles, and respect status and position power) (Proposition 1);

b) A "low need for certainty" perspective (e.g., demonstrate quick results, value flexibility and initiative, and speed is valued more than thoroughness) vice a "high need for certainty (e.g., spend time on background research, establish proper processes and systems, and take time before making a change) (Proposition 2); and

c) an "interdependent" perspective (e.g., focus more on cooperation and group goals, use group decision making styles, and reward and recognize the group) vice an "independent" perspective (e.g., take more individual initiative, use individual decision making styles, and reward/recognize individuals) (Proposition 3).

### **3.3.2 Method**

The study was exploratory in kind and used both qualitative and quantitative methods of analysis. A semi-structured interview strategy was designed to identify trends in NATO officer attitudes about teamwork in the context of the GlobeSmart<sup>®</sup> culture dimensions.

#### **3.3.2.1 Participants**

Twenty-two NATO officers volunteered to answer a series of interview questions on the three dimensions of teamwork. These officers represented a good diversity in NATO countries: Canada, Denmark, France, Germany, Greece, Netherlands, Norway, Portugal, Romania, Spain, Turkey, and the United Kingdom.

#### **3.3.2.2 Materials**

Interview questions were created to elicit officer attitudes toward three dimensions of teamwork that have been found to be effective team member behaviors. The interview questions were designed to take an unobtrusive approach to gaining insight out the potential influence of the cultural dimensions. Therefore, we attempted to avoid obtaining opinions about cultural biases or effective teamwork. The questions were designed to obtain responses about how officers did their job in the context of teamwork dimensions that were known to be effective. The officers were asked the following questions about how they expected to work with other people, both at their NATO Headquarters and during the Allied Warrior exercise:

##### Information Sharing

- How do you share information with others?
- Do you modify your approach depending on the nationality of the person you are dealing with?

##### Initiative/Leadership

- How do you provide guidance? For example, directing someone to take action or instruct them on how to perform a task. How does that change depending on nationality of the individual?
- How do you communicate your priorities for others? Does it change depending on nationality?

##### Backup/Support

- How do you bring an error to a team member's attention and see that it is corrected?
- How does this procedure change depending on nationality of the team members?
- What do you do when you see that a team member is overloaded or is having difficulty performing a task?

### **3.3.2.3 Procedure**

The Montijo command post was established in an air craft hanger with dividers separating work groups and teams as designated by the commander. LTAMC experimentation was conducted in an eight foot by four foot area enclosed on three sides by dividers. Privacy was not an option. The area contained two tables, two unclassified computers, and several chairs. Observation of the command post was unobtrusive and occurred constantly throughout the day and some evenings.

On the afternoon of 28 Nov, we identified 30 individuals for training based on their role in the CPX, specifically individuals playing FOPs, JMC, SYNK, COM, and J 2. Survey feedback was available to all participants who completed the surveys at Joint Force Command Lisbon, but not all persons who completed the surveys were members of the DJTF and not all members of the DJTF had completed the surveys.

That afternoon and the following morning, the experiment coordinator went to each of the identified players individually and let them select an available 30-minute training time from 0830 to 1500 on 28 or 29 Nov. These training dates had been agreed upon at the FPC in July 05. Two researchers were available to train on each of those dates, and except time off for lunch, DJTF staff had 40 time slots from which to choose. It was the intent of the researchers to administer the GlobeSmart<sup>®</sup> Commander prototype cultural awareness training to select DJTF staff. Unfortunately, there was insufficient unclassified bandwidth at the Montijo site to support the on-line training venue. Therefore, researchers had to make do by providing 30 minutes of verbal cultural/teamwork training on an individual basis to experiment participants. Feedback and reactions to the presentation were obtained from the participants. It is likely that receiving training in this manner frustrated the staff. All training was completed as planned by 1500 on 30 Nov.

Planned follow-up interviews were conducted on 4-5 Dec. Four researchers conducted the approx. 1-hour interviews between the hours of 1200 and 1700 on the 4th and 0900 to 1500 on the 5th, giving targeted interviewees (i.e., those individuals who had received cultural/teamwork training) 44 time slots from which to choose. Again, the experiment coordinator went to each of the interviewees individually to schedule their interviews. Each interview was conducted with the interviewer asking the questions for each of the teamwork dimensions. In addition participants were asked whether or not they modified their approach based upon the nationality of the person they were speaking to. Specifically, they were asked if there were any workarounds in which the participants modified their approach based upon the nationality and language ability of the person they were dealing with. Interviewers hand wrote interviewee responses to each question. Each interview was begun with the questions about information exchange, but in keeping with the natural flow of the interview, the progress of the remaining interview questions depended on the direction the interviewee's answers took. In the end, however, each interviewer addressed all of the questions.

Two raters, blind to interviewee nationality, independently reviewed transcripts of each of the participant interviews. They each rated the interview responses to the teamwork dimensions using a six-item Likert-type scale for each cultural dimension (egalitarian/status; risk/restraint; independent/interdependent; direct/indirect; task/relationship; and short-term/long-term. The scales were provided by Aperian Global © with their permission and have been used extensively in prior work within the GlobeSmart<sup>®</sup> Commander training they built. Each scale item allowed for a single rating of 1, 2, 3, 4, or 5. For example, a score of 1 or 2 on the egalitarian/status scale indicated the interviewee's response had phrases that supported a somewhat (2) or strong (1) egalitarian perspective. Whereas, a score of 4 or 5 on the same scale indicated the interviewee's response was had phrases that supported a somewhat (4) or strong (5) status perspective. A "3" indicated the interview response had equal numbers of phrases that supported a "balanced" egalitarian *and* status perspective. A rating of "Not Applicable" ("N/A") was applied if no response was given or when a response did not include sufficient detail to allow for a rating. For responses in which there was initial disagreement

between raters, a discussion led to a consensus rating. The first type of rater disagreement occurred when a number of responses did not provide very much information and were subsequently rated by one rater (but not the other) as "N/A." Upon discussion, it was often the case that one rater was able to provide an adequate description of the observed behaviour to the second rater, and consequently a consensus rating was made. The second type of rater disagreement occurred when one rater suggested, for example, a rating of "3" and the other suggested a rating of "4." The raters then discussed the interview response in detail and came to a consensus on a single rating.

### **3.3.3 Results**

The purpose of the analyses in this section was exploratory and not subjected to statistical analysis due to the small dataset. Therefore, propositions, rather than hypotheses were tested to identify if trends in the results would justify further analyses.

Frequency analyses were converted to percentages for the cultural ratings on each of the three teamwork dimensions. For each culture dimension, the rating frequencies were reduced to three categories. For example, a score of 1 or 2 was converted to a percentage representing an "egalitarian orientation," a score of 3 was converted to a percentage representing a balanced egalitarian/status orientation, and a score of 4 or 5 was converted to a percentage representing a "status orientation."

Results of cultural dimension ratings for each teamwork dimension are presented as percentages in Tables 6, 7, and 8 the tables are formatted with the percent rating results listed in the shaded columns under the headers "orientation." Percentages are listed in the columns next to each of the six pairs of cultural dimensions. The "balanced" orientation percentages are listed between each dimension. Results will be described as a tendency toward an orientation, but significance tests have not been made. Therefore, the findings are descriptive rather than confirmatory. The response rate is listed in the last column and was calculated as the sum of the response rates for the teamwork category. The total number of interviews included in the analysis is listed in parentheses. A high response rate might indicate a cultural dimension has some relevance to the officer's perception of a particular teamwork dimension. Conversely, if a low response rate was obtained from the ratings, then it might indicate the cultural dimension had little relevance to the teamwork dimension.

Table 6 presents the percent of the leadership/initiative interview responses rated for degree of orientation toward the six culture dimension. The response rate was very good for the majority of the ratings except it was fair (57%) for the short term/long term dimension. Proposition 1 was partially supported. The ratings tended toward an egalitarian (32%) and interdependent (27%) orientation, but there was also a tendency toward the balanced orientation on both, 23% and 32%, respectively. In contrast, the responses were almost evenly split on the risk (27%)/restraint (32%) orientation, with only a few "balanced" (9%) responses. For the remaining cultural dimensions, the responses tended to have a direct (67%), task (42%), and short-term (33%)/balanced (19%) orientation.

**Table 6: Percent of Leadership/Initiative interview responses rated for degree of orientation on the six culture dimensions.**

	Orientation	Balanced	Orientation		Response Rate (N)
Egalitarian	31.82	22.73	18.18	Status	73 (22)
Risk	27.27	9.09	31.82	Restraint	68 (22)
Independent	13.64	31.82	27.27	Interdependent	73 (22)
Direct	66.67	4.76	9.52	Indirect	81 (21)
Task	42.86	14.28	23.81	Relationship	81 (21)
Short-Term	33.33	19.05	4.76	Long-Term	57 (21)

Table 7 presents the percent of the backup/support interview responses rated for degree of orientation toward the six culture dimensions. The response rate ranged from fair (57%) to good (73%) across the dimensions. Proposition 1 was supported. The responses tended toward an egalitarian (45%), restraint (38%), and interdependent (41%) orientation. For the remaining dimensions, the responses tended to have a direct (45%) and relationship (33%) and short-term (29%) orientation.

**Table 7: Percent of Backup/Support interview responses rated for degree of orientation toward the six culture dimensions.**

	Orientation	Balanced	Orientation		Response Rate (N)
Egalitarian	45.45	18.18	9.09	Status	73 (22)
Risk	14.28	4.76	38.09	Restraint	57 (21)
Independent	9.09	13.64	40.91	Interdependent	64 (22)
Direct	45.45	4.54	22.73	Indirect	72 (22)
Task	19.05	14.28	33.33	Relationship	67 (21)
Short-Term	28.57	9.52	19.05	Long-Term	57 (21)

Table 8 presents the percent of the information sharing interview responses rated for degree of orientation toward the six culture dimensions. The response rate was fair (57%) on two dimensions, but very low on the remaining dimensions. Therefore, any conclusions drawn from these results are very questionable. Proposition 1 was partially supported. The responses tended toward an egalitarian (23%) and interdependent (23%) orientation, but were evenly split on risk (24%)/restraint (24%) orientation. For the remaining dimensions, the responses tended to have a direct (23%) and short-term (24%) orientation. The responses for the task-relationship dimension were mainly balanced (24%), with the remaining responses split between task (19%) and relationship orientation (14%).

**Table 8: Percent of Information Sharing interview responses rated for degree of orientation toward the six culture dimensions.**

	Orientation	Balanced	Orientation		Response Rate (N)
Egalitarian	22.73	13.64	9.09	Status	45 (22)
Risk	23.81	9.52	23.81	Restraint	57 (21)
Independent	4.54	0	22.73	Interdependent	27 (22)
Direct	22.73	0	4.54	Indirect	27 (21)
Task	19.05	23.81	14.28	Relationship	57 (21)
Short-Term	23.81	14.28	9.52	Long-Term	48 (21)

### 3.3.3.1 Language

English language proficiency level is deemed to affect team processes. It was measured through the average of 4 questions in the background questionnaire. An internal consistency test of these questions showed very good reliability; Cronbach's Alpha = .895. See table 9 for details.

**Table 9: Language ability scale items: Item reliability.**

Questions	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Is English your native language?	,754	,886
How would you rate your ability to read and write in English?	,729	,897
How often do you feel that you get more easily stressed when working in an English-speaking environment rather than in your native language?	,860	,831
How often do you become more reserved about presenting your point of view in English than in your native language?	,842	,836

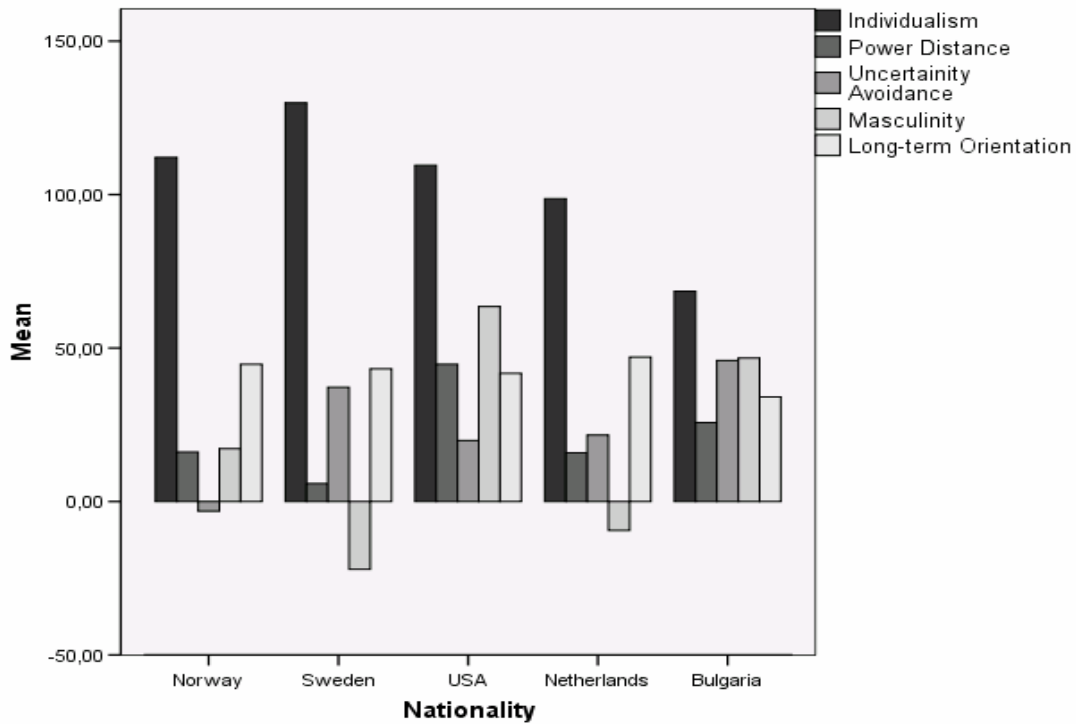
N=223.

35 out of 224 subjects were native English speakers, the rest having Norwegian, Swedish, Dutch and Bulgarian as their native languages.

Language ability was expected to have an effect on team cooperation and processes. We therefore wanted to be able to better understand, as well as control for this, in order to more correctly interpret for instance the effects of culture.

**3.3.3.2 Culture**

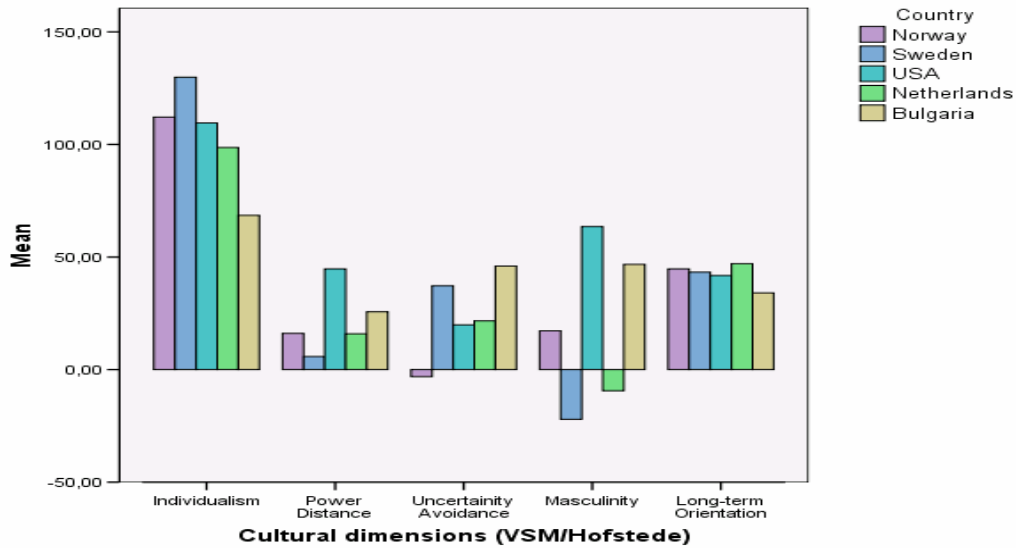
As indicated above (chapter 3.2.2.3), culture was measured using the VSM (Hofstede) and the GCS (Matsumoto). Figure 12 shows the VSM/Hofstede cultural scores by nationality, while Figure 13 shows the scores by dimension. The latter demonstrate the most variance between the countries on the masculinity dimension, while the long-term/short-term orientation dimension has the least variance.



**Figure 12: Culture scores (Hofstede) by country (N=221).**

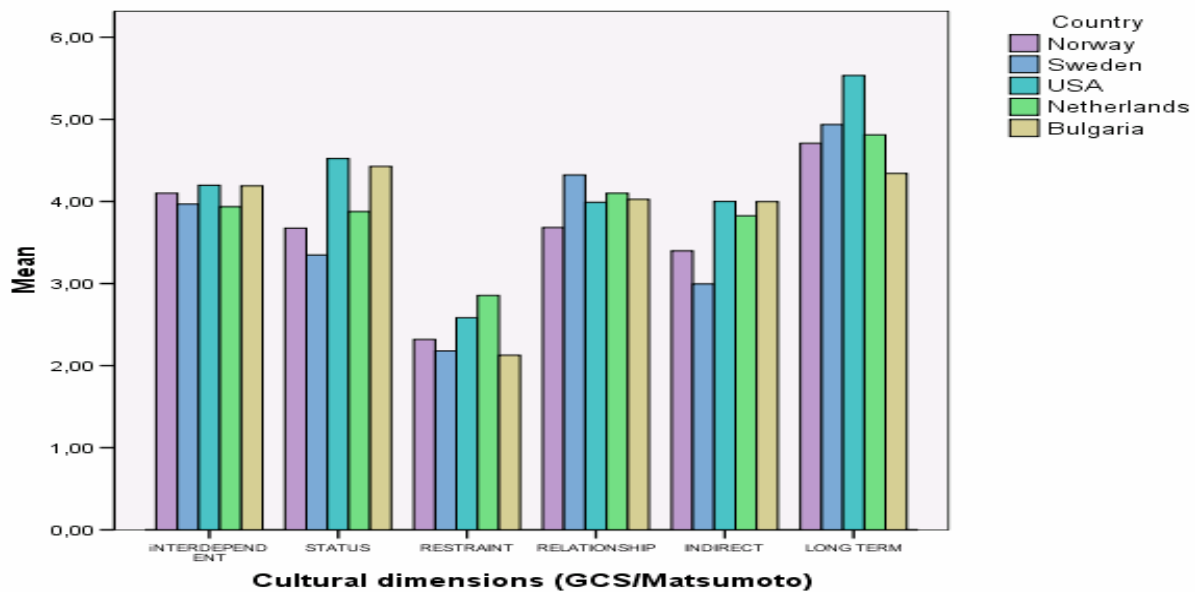
As anticipated from previous studies, Figures 12 and 13 indicate some obvious similarities between the cultural make-up of Norway, Sweden and the Netherlands. Bulgaria seems to be the most different.





**Figure 13: Culture scores (VSM/Hofstede) by dimension (N=221).**

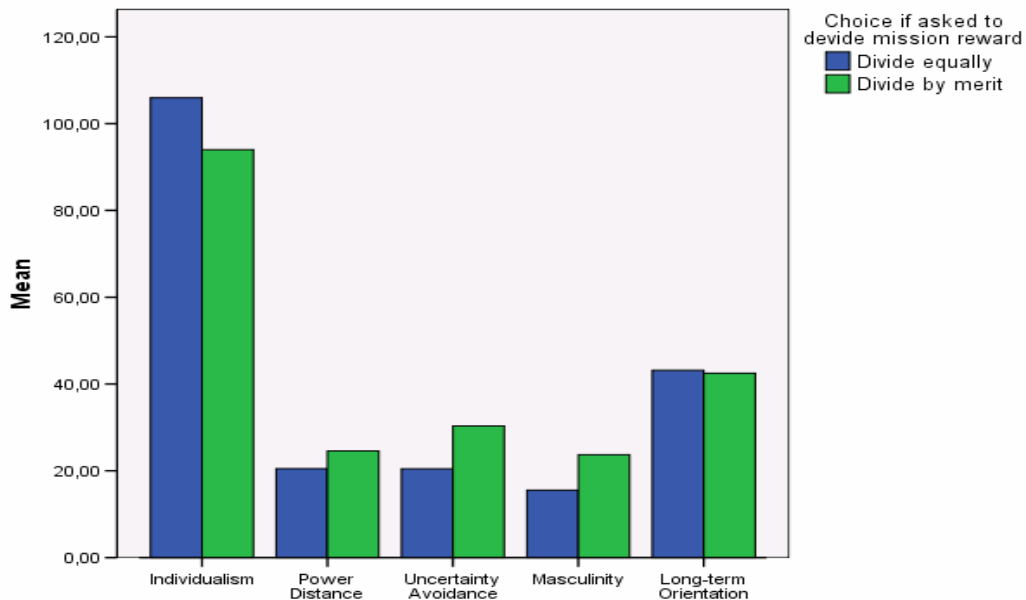
Figure 14 below shows the GCS/Matsumoto cultural scores by dimension. It becomes clear when comparing with Figure 13 above that the VSM/Hofstede scores demonstrate the most variance between the countries on the dimensions. This should make it more applicable in the subsequent analyses.



**Figure 14: Culture scores (Matsumoto) by country (N=221).**

As anticipated, due to the low variance in the GCS, there were found no correlations with any of these cultural dimensions and the choice of reward strategy. With the VSM, on the other hand, there seemed to be some relationships to culture (Figure 15).

Surprisingly, persons from nationalities scoring high on individualism tended towards the choice “divide equally” ( $r=-.212, p=.002$ ). The strengths of the relations are shown in table 10.



**Figure 15: Reward strategy by culture (VSM).**

**Table 10: Correlations: Reward strategy with culture (VSM). 1=divide equally, 2=divide by merit.**

<b>VSM Dimensions</b>	If you were asked to divide up a mission reward the team was given between the team members, how would you prefer to divide it?	
Individualism	Pearson Correlation	-,212(**)
	Sig. (2-tailed)	,002
Power Distance	Pearson Correlation	,123
	Sig. (2-tailed)	,067
Uncertainty Avoidance	Pearson Correlation	,174(**)
	Sig. (2-tailed)	,010
Masculinity	Pearson Correlation	,098
	Sig. (2-tailed)	,146
Long-term Orientation	Pearson Correlation	-,199(**)
	Sig. (2-tailed)	,003

\*\* Correlation is significant at the 0.01 level (2-tailed). N=222.

### 3.3.3.3 Trust

Trust, defined as task related confidence in team-members, was expected to affect team processes, and possibly also be linked to culture. Team trust was measured through 3 questions in the background questionnaire <sup>39</sup>. Internal consistency test shows satisfactory reliability of the measure; Cronbach's Alpha = .714. See table 11 for details; mean score was computed on the basis of the items listed.

**Table 11: Team trust: Items and reliability of measure. N=133.**

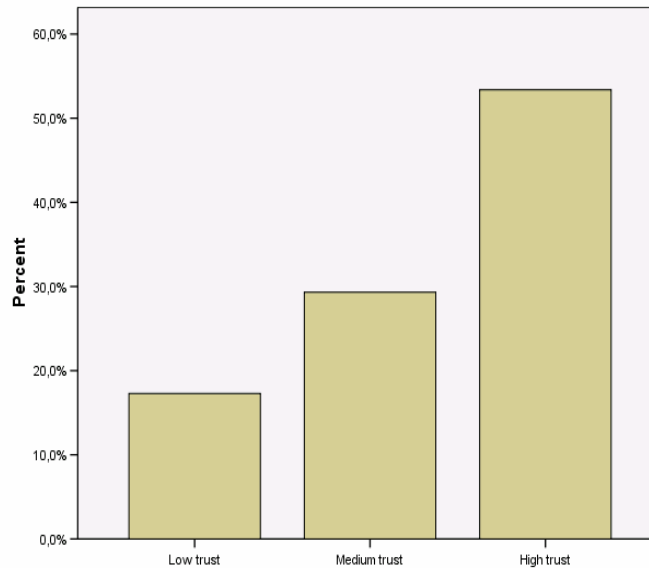
Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
How confident were you that team members would assist you if you needed help?	,548	,610
How confident were you that team members would fulfill their responsibilities?	,490	,676
How confident were you that your team members would share important information with you?	,569	,579

Answer categories: 5-point scale from very confident to very doubtful.

Figure 16 below shows the distribution of answers on trust in all<sup>39</sup> the experiments while Figure 17 shows the distribution of answers on trust split in national and international experiments<sup>40</sup>. The latter indicates higher

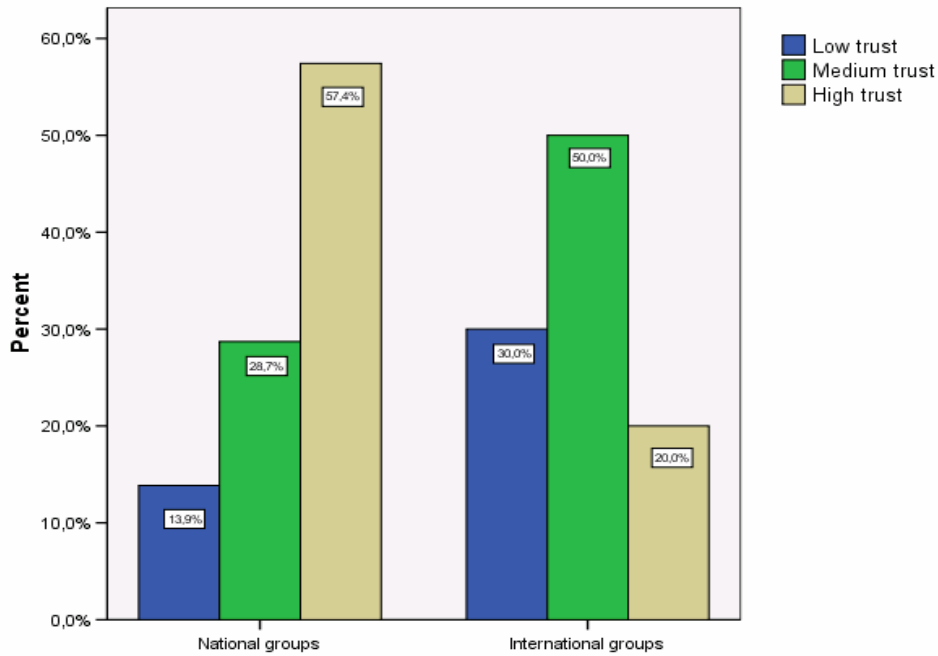
<sup>39</sup>As the Debrief 2 questionnaire had failed to be activated in the Bulgarian, Swedish and approximately half of the Dutch national experiments, we lack data on the measurements of trust from these. Therefore, N=133.

trust within the national than within the international groups. The difference in mean scores was 0.7 on a five-point scale,  $p < .001$ . The lack of answers from all countries in the national experiments was controlled for<sup>40</sup>.



**Figure 16: Distribution of answers on team trust in all experiments. N=133.**

<sup>40</sup> As we had no data from the Bulgarian and Swedish national experiments, the data from the Bulgarian and Swedish participants in the international experiments were excluded when comparing the national and international groups, in order to have matched samples for comparison purposes. Therefore, N=121.

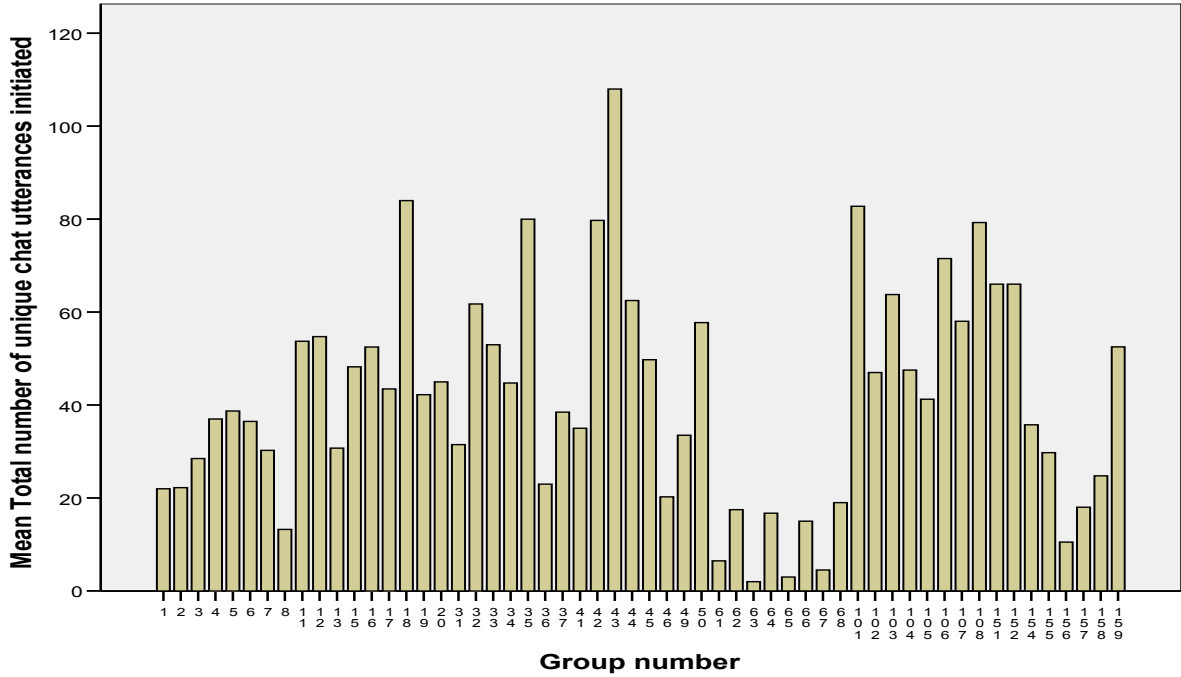


**Figure 17: Trust within nationally homogenous groups and nationally heterogeneous groups. N=121.**

Trust was not found to be related to the choice of reward strategy (“divide by merit/equal”). It was expected that trust may be related to the Individualism/Collectivism (I/C) dimension of culture, but there was found no such relationship in our data.

### 3.3.3.4 Communication

Team-members communicated through chat. This was also the main tool for information-sharing. The total number of chat messages written per group varied greatly. This is shown in Figure 18 below.



**Figure 18: Group-wise mean number of chat messages written.**

The table below, 12, shows the relationship between language ability and chat messages written. As expected, language ability did influence the number of chat messages written, but explains only just over 3% of the variance.

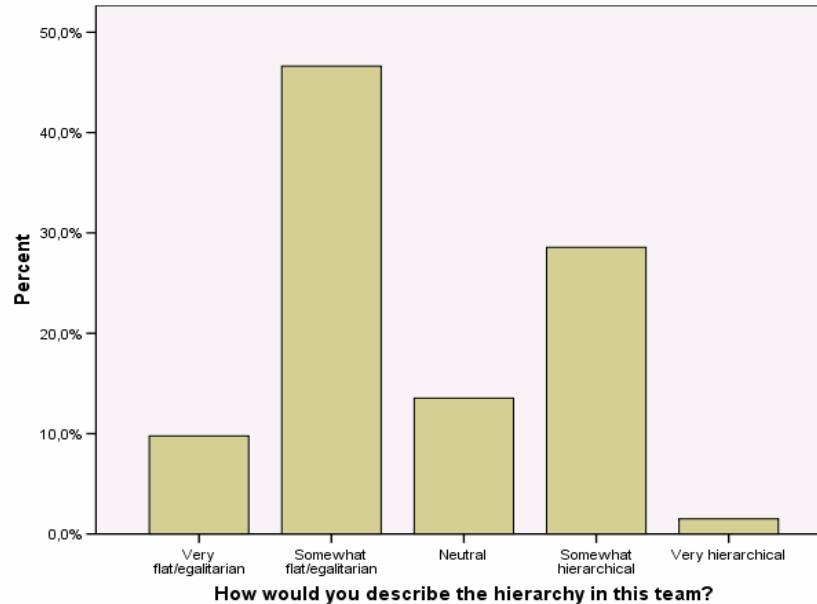
**Table 12: Correlations: Language ability and chat messages written.**

		Average Language ability
Total number of chat messages	Pearson Correlation	,180(**)
	Sig. (2-tailed)	,007

\*\* Correlation is significant at the 0.01 level (2-tailed). N=223.

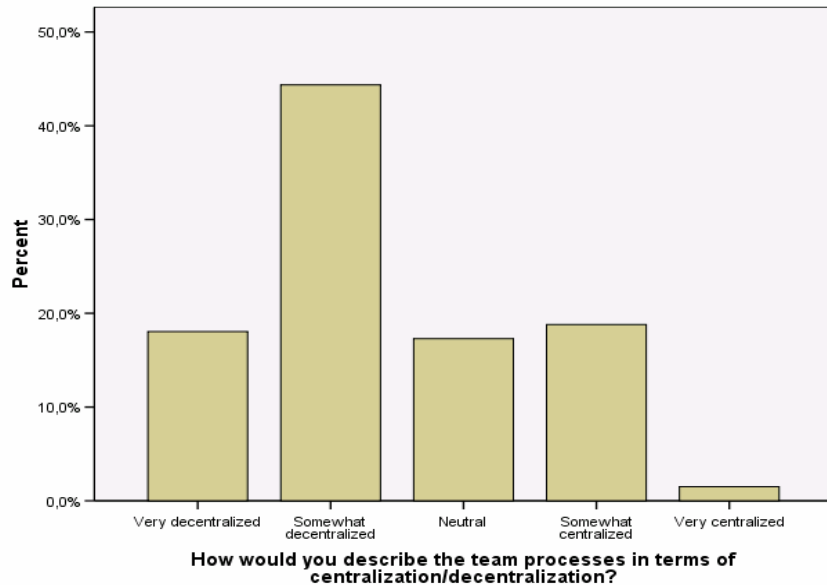
### 3.3.3.5 Organization (Hierarchy, Centralization, Leader Behaviour)

In the Debrief 2 questionnaire, we asked questions on perceived hierarchy and centralized/decentralized processes. Figure 19 and 20 show the distribution of answers to these questions from all groups<sup>41</sup>. As can be seen from these figures, a majority of subjects found the team structure to be flat and the team processes to be decentralized.



**Figure 19: Perceptions of hierarchy in national and international groups. N=133.**

<sup>41</sup> As previously indicated, we were lacking data on the Debrief 2 questionnaire from Sweden and Bulgaria on the national experiments; hence, N=133.



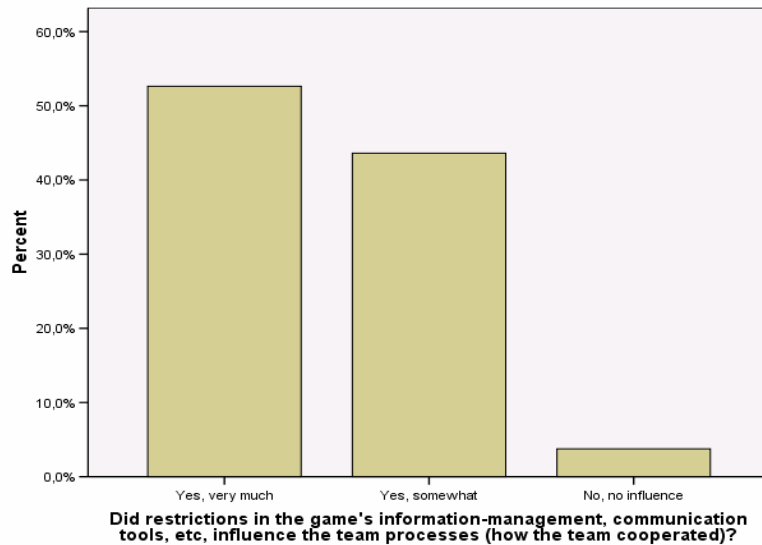
**Figure 20: Perceptions of centralization/decentralization in national and international groups. N=133.**

There were found significant correlations between perceptions of hierarchy, centralization, rating the organization, and Pd, including both national and international groups (N=133)<sup>42</sup>. Flat structure & decentralization was positively related ( $r=.439$ ,  $p=.000$ ). In turn, flat structure & decentralization were each related to flexibility (flat structure & flexibility:  $r=.243$ ,  $p=.005$ ; decentralization & flexibility:  $r=.252$ ,  $p=.004$ ). Flat structure as well as decentralization were, however, negatively related to rating the organization positively in our experiments ( $r=-.340$ ,  $p=.000$ ;  $r=-.365$ ,  $p=.000$ ). In other words, respondents seemed to have a more positive view of the team organization when they experienced it as more hierarchic and centralized. The same tendency was found both for those who had previously spent a lot of time playing computer games as well as for those that had played little or nothing. But the correlations were somewhat stronger for those who had played more games.

Qualitative and quantitative data indicated that the game may have had an influence on the team-processes. Figure 21 shows that almost all respondents indicated that the game tools did influence group processes.

<sup>42</sup> Looking at the same for the international groups only, gave the same relations, just a bit stronger.

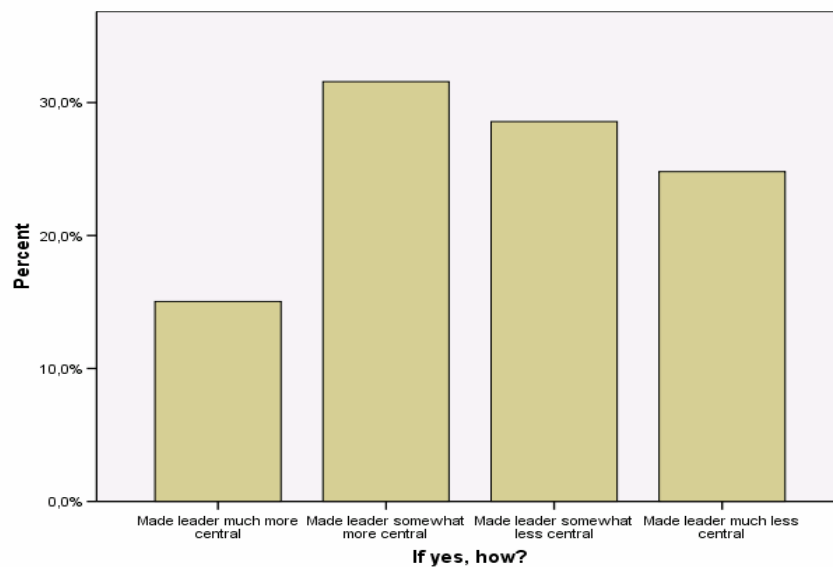




**Figure 21: Game influence on group processes. N=133.**

In the game, communication could for instance only take place to all other players at the same time if they were standing in each others vicinity, otherwise they would have to type the same message repeatedly to all.

The quantitative data were very mixed when it came to *how* the game affected the process. As Figure 22 shows, there were no overweight of subjects finding the game to induce more centralized processes.



**Figure 22: Game influence on group processes and its effect on leadership. N=133.**

Qualitative comments indicate that subjects often found the communication through chat and the information management system to be cumbersome and take too much time: *“Not being able to communicate with everybody at the same time while not within range of sight slowed things down.”* and *“The information management system was difficult (...)”*.

Subjects also pointed to that there was some confusion: *“Without clear tasks, I was not sure who to send the information too, or request help from.”* and *“Information overload and poor communication/planning made everyone run around solving individual tasks with no clear plan.”*

But finally, many indicated that it was advantageous to have hierarchic/centralized organization in the game: *“Power goes up because the game implicates having a leader”, “It was cumbersome to cooperate decentralized in the game (...) it favors hierarchy.”* and *“Command and control was needed, but not present.”*

The comments suggest that playing may have been more time efficient, as well as less chaotic and confusing if the team organization was more hierarchic and centralized. The very last comment could also indicate that our subjects interpreted the game organization in light of what they are used to in their military organization.

In terms of relationship to culture, it was expected that perceptions of hierarchy, centralization, and rating the organization might be related to Power distance (Pd). There were found correlations only between Pd and rating the organization:  $r=-.193$  and  $p=.026$ . This means that there was a tendency for subjects from low Pd cultures to rate the team organization more positively than those from high Pd cultures. There was found no relationship to between rating the organization and Uncertainty avoidance (Ua).

### **3.3.4 Discussion**

Although very diverse in national origin, experienced NATO officer opinions tended toward an egalitarian, interdependent, direct, and short-term orientation for leadership/initiative and backup/support. In addition, a good percentage of ratings indicated officers had a "balanced" orientation, giving support for the notion of adaptation of attitudes and behaviours. The finding for the risk/restraint orientation tended to be split with the balanced orientation. For leadership/initiative, the officers tended to be task oriented, but for backup/support they tended to be relationship oriented.

Caution should be taken in drawing any strong conclusions from this dataset. Such methodological issues as non random selection of officers, low response rate, and the employment of just two raters to evaluate the interviews must be considered. Low response rate in particular can lead to skewed results based on a small sample of officers. For example, in reviewing the low response rate for information sharing, the researchers think the interview questions may have been inadequate in eliciting more detailed responses from the officers. Also, all the interviews began with the question about information sharing, therefore, the low response rate may have been due to the initial interaction between the interviewer and interviewee, as English was a second language for many of the officers. Also, English as a second language may have resulted in less information being recorded by the interviewer, thus skewing the interview results in favour of those officers with better English speaking skills.

Nevertheless, with response rates on many of the cultural dimensions greater than 70%, this topic is fruitful for further study. The findings described above satisfy the need to test hypotheses to determine if they hold up under the scrutiny of statistical analysis.

### **3.3.4.1 Culture**

It was shown that the VSM/Hofstede measurement of culture gave more variance between national cultures than the GCS/Matsumoto measurement, and was found the most useful for analyses.

When comparing the participating nations' scores on the cultural dimensions, some of them were rather surprising compared to previous research on this. One of the reasons for the somewhat different scores is that the VSM-94 that we used is a revised version of the questionnaire Hofstede used in his IBM-study. However, as Hofstede indicates, even though the numbers may not be directly comparable, the relative relationship between the countries (rank order) on how they score should largely be maintained [55].

Some of the most interesting scores are found on the Individualism/Collectivism dimension; the current scores on this dimension as well as the rank order were quite different from what Hofstede found in his original IBM study. In general, the scores are all higher than Hofstede's original scores, and with the exception of Bulgaria, the rank order seems to have shifted between the countries. In the current study, Sweden and Norway scored the most individualistic, while the USA and the Netherlands scored the most collectivistic (i.e. when not counting Bulgaria). In the original study, on the other hand, the USA and the Netherlands scored the most individualistic, while Sweden and Norway scored the most collectivistic.

There could be many reasons for this. One possible explanation is the samples. Military officers may have chosen this occupation for different reasons in the various countries, given societal differences in opportunities, educational system, etc, and hence constitute a source of systematic differences in the selection. The same could of course be said for any matched samples across nations, also the IBM study; there are probably always some differences across countries as to why people have chosen the same job<sup>43</sup>. A study by Netland comparing women's reasons for joining the army in the US and Norway supports this explanation. In addition to pointing at societal differences in education and health care as possible motivators, it indicated that women in the Norwegian army may be more inclined to join in a search for challenge than women in the US army. If this is true also for our predominantly male sample, this could mean that one of the questions measuring the I/C dimension, regarding the importance of having an element of variety and adventure in the job, could make the Norwegians score relatively more individualist and the US relatively more collectivist than previous studies. The data seem to support this explanation in some degree: Norway score over average while the US score under average on this question. Furthermore, a replication study by Soeters [66], also with a military population, found the same rank order as we did. However, as he was using the original IBM-survey, the scores are generally lower.

Another possibility is that the national cultures simply have evolved in different directions since Hofstede's original study. Hofstede found the I/C dimension to correlate positively with a country's GNP (gross national product); i.e., individualism correlates with high GNP. Since the IBM study, there has been a relative increase in GNP in Norway compared to the other countries in the study, which could explain a shift in an individualist direction.

However, as individualism means being more individually rather than group oriented, we would have expected this to show in a question the subjects answered on how they would divide a reward within their group. As shown in the results section, this relationship was quite the opposite of what was expected;

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<sup>43</sup> The USA is also a culturally heterogeneous country, where there may be different subgroups represented in the IBM as opposed to the military. Such subgroups have been shown to potentially have different cultural values [68].

individualism was negatively correlated with the individualist strategy (dividing by merit) while positively correlated with the collectivist strategy (dividing equally). This finding supports the first explanation of sample differences, but also indicates that there may be a problem with at least one question on the I/C dimension when using the VSM on military samples.

#### **3.3.4.2 Trust**

It was indicated in the results section that there were quite large and significantly higher levels of trust within the national than within the international teams. This supports the findings from AW04, reported in 3.1, as well as previous research [89][90][91], indicating that it is harder to build trust in heterogeneous than in homogeneous groups. The lesson from these studies is that one needs to invest more time and training together in order to build trust in international work groups, like NATO coalitions, as compared to national work groups, and the more culturally diversified at the outset, the more time needed.

There was found no links, neither between the I/C dimension of culture and trust, nor between choice of reward strategy and trust.

#### **3.3.4.3 Communication**

There was found great variation between the groups in terms of how much they communicated. This was also found to be linked to English language capability; the better in English, the more they communicated. Even though the relationship was not very strong, this underlines the importance of language proficiency in cooperative situations, and supports findings from AW04, reported in 3.1.

#### **3.3.4.4 Organization**

There were found significant correlations between perceptions of hierarchy, centralization, rating of the organization, and Pd. The finding that flat structure is related to flexibility supports the results from AW04, reported in chapter 3.1.

However, contrary to what was found in the AW04 analysis, respondents seemed to have a more positive view of the team organization when they experienced it as more hierarchic and centralized. The question is why this is so. We know already from ample research on organization and problem-solving [96], [97] that simple tasks tend to make a centralized organization advantageous. Could this be the reason also in this case; that the experiment situation could be deemed a simple task situation? Certainly, a military operative organization is both more complex and deals with more complex issues than what a small controlled lab experiment can be. Nevertheless, qualitative data indicated that many subjects experienced the game as a complex environment, and possibly more so the subjects with less experience playing computer games. But as indicated in the results chapter, even though the correlations were somewhat stronger for the gamers, the same relationships were found both for gamers and non-gamers.

As presented in the results chapter, in the game, long distance communication was restricted to sending messages to only one other player at the time. Hence, it would take more time to communicate and share information with all in a decentralized manner than in a centralized manner if the team was dispersed. This could explain why the subjects seemed to prefer a hierarchic/centralized organization. It simply saved time and effort in the game.

Qualitative data also indicated that playing may have been more time efficient, as well as less chaotic and confusing for the subjects, if the team organization was more hierarchic and centralized. Some comments also indicated that our subjects interpreted the game organization in light of what they were familiar with in their

jobs in a military organization. In other words, if the organization was less hierarchic and centralized in the game than in the teams subjects were used to working in, they could interpret this as being the problem if there was confusion. What we know is that people work most efficiently in systems to which they are accustomed. Please see chapter 3.1 for a discussion on this topic.

The finding that subjects from low Pd cultures tended to rate the team organization more positively than those from high Pd cultures, strengthens the above assumptions of the game's team organization being less hierarchic than what many subjects were used to. Since organizations in low Pd cultures typically are flatter and more decentralized, subjects from these cultures are naturally more inclined to liking such organizations.

There were found no relationship between rating the organization and Uncertainty avoidance (Ua). Considering that there were reports of confusion and ambiguity in the game, one could have expected there to have been a relation here. This was not found.

In sum, these organizational findings implicates the importance of having the organization fit both the task and the personnel (both in terms of their cultural make-up and what they are trained for), as well as the information management and collaborative systems being aligned to support the organizational structure and processes.

### **3.3.5 Conclusions**

This study of cultural, organizational and team variables, has provided some initial analyses of the team processes in the experimental setting of a simulated mission. It has given some additional insights into organizational processes linked to cooperation and culture in addition to the former analyses from an operational environment (AW04), reported in chapter 3.1. As there are still unexplored questions and details to look into, we expect there to be further analyses going more in depth into the data and analyses in the time to come. However, the insights reported to date should add valuable understanding to the topics treated.



## Chapter 4 – MODELLING CULTURAL ADAPTABILITY

### 4.1 BACKGROUND

Based on previous research conducted at Stabilization Force (SFOR) headquarters in Bosnia-Herzegovina, Dr. Janet Sutton (U.S. Air Force Research Laboratory) and Dr. Linda Pierce (U.S. Army Research Institute) identified several cognitive styles and culturally based behavioural dimensions to be either enablers or potential barriers to individual and team adaptability in multicultural military environments. They shared these findings with the NATO ACT CD&E / RTO HFM RTG 138 Leader and Team Adaptability in Coalition Teamwork (LTAMC) project team and a plan was developed to leverage their knowledge for the purpose of developing a conceptual model of cultural adaptability, then validating the model with empirical data. Cultural competence is a critical enabler of information sharing, situation awareness, and team performance in multicultural collaborative environment and, as such, it is imperative that nations address the need to understand what it means for officers to culturally adapt, as needed, to ensure mission success.

### 4.2 MODELLING CULTURAL ADAPTABILITY

To expand on the idea that statistically related cognitive styles and/or personality traits might predict cultural adaptability, survey data was collected from 150+ NATO officers participating in two Deployable Joint Task Force (DJTF) headquarters. The initial model of cultural adaptability was developed from field research at the NRF certification exercise Allied Warrior 04. The model was then validated with data collected at a second NRF certification exercise, Allied Warrior 05. A summary paper, originally presented in April 2008 at a NATO RTO Human Factors and Medicine Panel Research Symposium (HFM RSY 142), is included here in its entirety. When referencing content from this paper, the following format should be used: Svensson, E., Lindoff, J. Sutton, J.L., (2008, Apr). Predictive Modelling of Personality Traits – Implications for Selection so Operational Personnel (MP-HFM-142-06). In J. L. Sutton (Chair), *Adaptability in Coalition Teamwork*. Symposium conducted at the HFM-142/RSY, Copenhagen, Denmark.

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## Predictive Modelling of Personality Traits – Implications for Selection of Operational Personnel<sup>44</sup>

### ABSTRACT

*A series of factors have impact on teamwork in coalitions. Individual differences in personality traits represent powerful factors that, in interaction with culturally based cognitive biases, influence collaboration and performance. By means of factor analyses, multidimensional scaling, and modeling ad modum LISREL, 17 personality measures have been reduced to models of three interrelated factors. From initial model analyses, we found that the co-variances between variables were explained by a sequential relation between the factors Emotional Stability, Adaptability, and Need for Structure. An interpretation of the model is that if you have a high rating in Emotional Stability, your rating in Adaptability will be high. And, if your rating is high in Adaptability, your rating in Need for Structure is low. In a second series of validation analyses the initial model was confirmed. An alternative model to the sequential was proposed. In this model Emotional*

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<sup>44</sup> The work on predictive modelling has been supported by U.S Air Force European Office of Aerospace Research and Development (EOARD).

*Stability directly affects Need for Structure and Adaptability. Confirmative analyses of the alternative model showed that this model has the same fit as the sequential. We have tested the fit of the models when using two of the main markers of each factor, and we found an almost perfect fit of the sequential as well as the alternative model. Accordingly, six of the measures used can represent the models adequately. Our conclusion is that the subjects can be ordered or classified with respect to the three factors by means of six measures. Four trait dimensions of the 'Big Five' are markers of our factors Emotional Stability and Adaptability, and the interaction between two fundamental dimensions behind the 'Big five' is in accordance with these two factors of our model. Emotional Stability and Adaptability are fundamental aspects in selection of personnel working under stressful conditions with high stakes and risks. By mean of the factors found and validated, we have reliable and practicable measures of basic aspects predicting the performance and co-operative ability of personnel working in coalitions.*

## **1.0 INTRODUCTION**

A series of factors have impact on teamwork and performance in coalitions. Individual differences in personality traits represent aspects that, in interaction with culturally based cognitive biases, we believe influence collaboration and performance. Especially personality traits reflecting aspects of emotional stability have, since long, been considered important in selection of personnel working under high psychological stress, task load and risk. Selection of e.g. military pilots by means of personality traits as well as intellectual, perceptual and motor skills was introduced as early as during World War I. Similar procedures for selection were then developed and introduced in the army and naval branches. Procedures for selection with respect to operator and team performance in command and control environments are of a later date and in progress.

Selection of military operators has been extensively discussed in the scientific literature. Several meta-analyses have shown that personality traits, in spite of their considerable face validity, have a restricted predictive power on operational performance as compared to job sample tasks. In general terms, we can conclude that personality measures have a common variance of about 10 to 20 percent with different performance criteria [96]. The corresponding values for job sample tasks are about 30 to 40 percent [99]. On the other hand, personality or trait measures are easily administered and, in many situations, the most practicable and *the* remaining possibility to predict and optimize operational performance. Accordingly, an optimal combination of personality and task-related measures gives the best predictive power in selection of operators.

To cite the steering program for the task group *Leader and Team Adaptability in Multinational Coalitions*, a “*complicated assemblage of coalition partners will be required to perform as a team in complex environments that place high demands on the command and control of forces. This complex environment makes **adaptive performance** more critical than ever, yet the presence of **adaptable leaders** and **teams** continues to be elusive*” [100].

## **1.1 Methods, Assumptions, Procedures**

### **1.1.1 Factor Analysis (FA)**

#### *1.1.1.1 Rationale.*

Factor analysis is an analytical technique that makes possible the reduction of a larger number of interrelated manifest variables to a smaller number of latent variables or factors. The FA technique is based on the co-variation between manifest measured variables, and the goal of the technique is to achieve a parsimonious and simplified description by using the smallest number of explanatory concepts needed to explain the maximum amount of common variance in a correlation matrix (i.e., a table showing the inter-correlations among the



variables to be factored). The factors can be considered as hypothetical constructs laying behind and explaining the co-variation between their markers, and the constructs find their manifest expression in their markers.

The factor extraction procedures can be divided into *exploratory and confirmative* (hypo-thesis testing) methods. Explorative solutions cannot be generalised to populations. Generalisation requires replications in new samples. Factor solutions from confirmative methods of factor extraction, on the other hand, can be generalised from a sample to a population of subjects.

The exploratory methods as *principal factors analysis* assume populations of subjects and variables, and provide descriptive solutions. Principal FA (also called common FA) is the method preferred when analysis of common variance is desired. Principal FA is a practicable tool for generation of hypotheses about factor structures to be analysed further and confirmed in future research [101] [102] [103] [104].

From inferential and confirmatory methods as *maximum likelihood FA*, on the other hand, generalisations to other members of the population are possible. *LISREL* (analysis of linear structural relationships) is a practicable tool for confirmation and generalisation of factor structures [105] [106] [107] [108].

### **1.1.2 Structural Equation Modelling (LISREL)**

#### *1.1.2.1 Rationale*

In the LISREL model, the linear structural relationship and the factor structure are combined into one comprehensive model applicable to observational studies. The model allows 1) multiple latent constructs indicated by observable explanatory variables, 2) recursive and non-recursive relationships between constructs, and 3) multiple latent constructs indicated by observable response variables. The connections between the latent constructs compose the structural equation model; the relationships between the latent constructs and their observable indicators or outcomes compose the factor models. All parts of the comprehensive model may be represented in a path diagram and all factor loadings and structural relationships appear as coefficients of the path. LISREL gives a series of Goodness of Fit measures of the whole model [106]. Examples of psychological models are given in [108] [109] and [110].

### **1.1.3 Multidimensional Scaling (MDS)**

#### *1.1.3.1 Rationale.*

MultiDimensional Scaling (MDS) is a procedure for fitting a set of objects or variables in a space (or plane) such that the distances between the objects correspond as close as possible to a given set of similarities or dissimilarities between the objects. Similarities can be measured directly or derived indirectly from e.g., correlation matrices [111] [112]. Usually MDS can fit an appropriate model in fewer dimensions than can FA. Furthermore, MDS provides a dimensional model even if a linear relationship between distances and dissimilarities cannot be assumed. As compared to other multivariate techniques MDS is easy to use and the statistical assumptions are mostly easy to fulfil. In contrast to FA no statistical distribution assumptions are necessary, even if some metric conditions must be satisfied.

## MODELLING CULTURAL ADAPTABILITY

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### 1.1.4 Assumptions and Data

#### 1.1.4.1 Assumptions.

Results of research on the impact of individual and cultural factors on adaptive performance can be used to address personnel selection, modelling and simulation, and training, resulting in development of new measurement scales designed to assess the impact of culture on teamwork and new training tools designed to turn cultural diversity into mission strengths.[113]

#### 1.1.4.2 Instruments.

Besides a demographic questionnaire a large number of questionnaires or measurement scales tapping different cognitive aspects as well as mental states and traits have been answered by the participants of NATO's Allied Warrior 2004 (AW04), and Allied Warrior 2005 (AW05) exercises.

Seven instruments comprised of seventeen distinct measures tapping different emotional and cognitive states and traits, formed the base for a series of data reduction and modelling analyses. The measures are named as follows: *Personal Need for Structure (PNS)* [114], *Personal Fear of Invalidity (PFI)* [114], *Need for Cognitive Structure (NCS)* [115], *Ability to Achieve Cognitive Structure (AACCS)* [115], *Uncertainty Response Scale (URS)* [116], *Intercultural Potential Adjustment Scale (ICAPS)* [117], and the *NEO-FFI Personality Inventory* [118]. The URS has three subscales measuring *Emotional Uncertainty*, *Cognitive Uncertainty*, and *Desire for Change*. The ICAPS has five subscales measuring *Cultural Adjustment*, *Emotion Regulation*, *Need for Openness*, *Flexibility*, and *Critical Thinking*. The NEO-FFI has five subscales measuring *Neuroticism*, *Extroversion*, *Openness Agreeableness*, and *Consciousness*. All instruments have been validated in other studies, and their reliabilities have been scrutinized.

## 2.0 ANALYSES AND RESULTS

As a first step of analyses based on data from AW04, the linear relationships between the measures by means of product moment correlations were calculated<sup>45</sup>. This matrix of correlations was then used as input in explorative principal factors analyses with oblique<sup>46</sup> rotation of factors. Rotation of factors results in a more even variance distribution, and in a more interpretable and simple factor structure.

From the analysis we found that 54 percent of the total variance<sup>47</sup> between the manifest variables could be explained by means of three latent variables or factors. Two practicable criteria for optimisation of number of factors, Kaiser's criterion and Cattell's scree-test were used [101] [104]. Kaiser's criterion states that, only factors with 'eigenvalues' greater than 1.0 should be retained. Cattell's scree-test identifies the number of factors that can be extracted before the amount of unique and error variance begins to dominate over the amount of common and true variance. Both criteria indicated a three factors solution as optimal.

Figure 23 presents the three tentative groupings of variables into factors. Two of the instruments used, '*Critical Thinking*', and '*Agreeableness*', had low or insignificant amount of common variance with the other measures, and were therefore excluded from further analyses.

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<sup>45</sup> Optimal estimates of correlations were extracted by means of PRELIS, a sub-routine to LISREL.

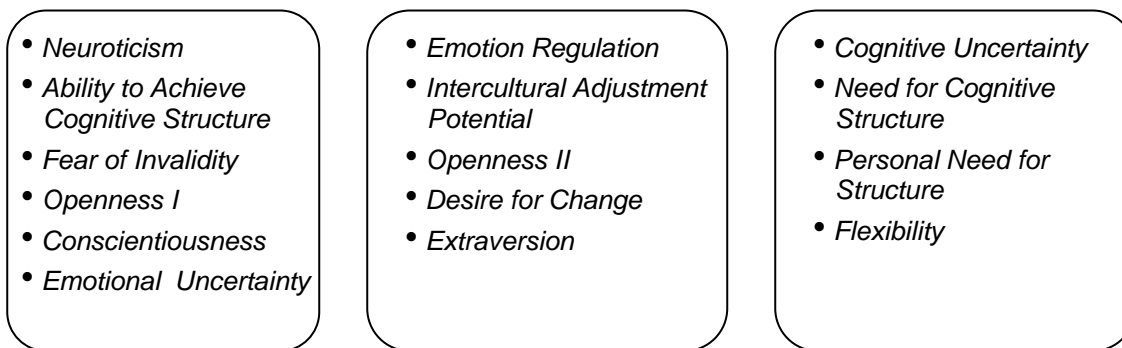
<sup>46</sup> In oblique rotation factors are free to correlate.

<sup>47</sup> The total variance is the sum of common variance, unique variance, and error variance.

Our tentative interpretation of this first grouping is that the measures ‘*Neuroticism*’, ‘*Ability to Achieve Cognitive Structure*’, ‘*Fear of Invalidity*’, ‘*Openness I*’, ‘*Conscientiousness*’, and ‘*Emotional Uncertainty*’ represent a factor or latent variable named ***Emotional Stability***. Multidimensional analyses show that the variables ‘*Neuroticism*’, ‘*Emotional Uncertainty*’, and ‘*Fear of Invalidity*’ represent the core of the factor.

An interpretation of the second grouping is that the measures ‘*Emotion Regulation*’, ‘*Inter-cultural Adjustment Potential*’, ‘*Openness II*’, ‘*Desire for Change*’, and ‘*Extraversion*’ represent a factor named ***Adaptability***. Dimensional analyses showed that ‘*Openness II*’ was an outlier and that the other measures represent the central aspects of the factor.

The interpretation of the third grouping is that the measures ‘*Cognitive Uncertainty*’, ‘*Need for Cognitive Structure*’, ‘*Personal Need for Structure*’, and ‘*Flexibility*’ represent a factor named ***Need for Structure***. Multidimensional analyses indicated that ‘*Flexibility*’ was an outlier and that the other variables represent the core of the factor.



**Figure 23: Groupings of variables from explorative factor analyses of the 17 measures. Fifteen out of 17 measures (88 %) are represented in the groupings or factors. Fifty-four percent of the common variance between the measures is explained by the three factors.**

The three factors structure from the exploratory analysis was used as a hypothesis in confirmative factor analyses ad modum LISREL. From the Goodness of Fit Statistics (GFI) of the confirmative analyses, we found that a three factors model significantly explains the co-variances between the manifest variables. The Weighted Least Squares Chi-Square equals 72.03 and has a p-value of 0.20<sup>48</sup>. The standardized Root Mean square Residual (RMR) equals 0.093, the Goodness of Fit Index (GFI) equal to = 0.84, and the Adjusted Goodness of Fit Index (AGFI) equal to 0.73.

In contrast to the explorative analyses, significant relationships were found between the three factors. These relationships were used in an attempt to build a causal structural model explaining the co-variances between the manifest variables by means of the inter-related factors.

When we scrutinized the factor structure of the confirmative analysis we found that the factors ***Emotional Stability*** and ***Adaptability*** correlated, and that factors ***Adaptability*** and ***Need for Structure*** correlated,

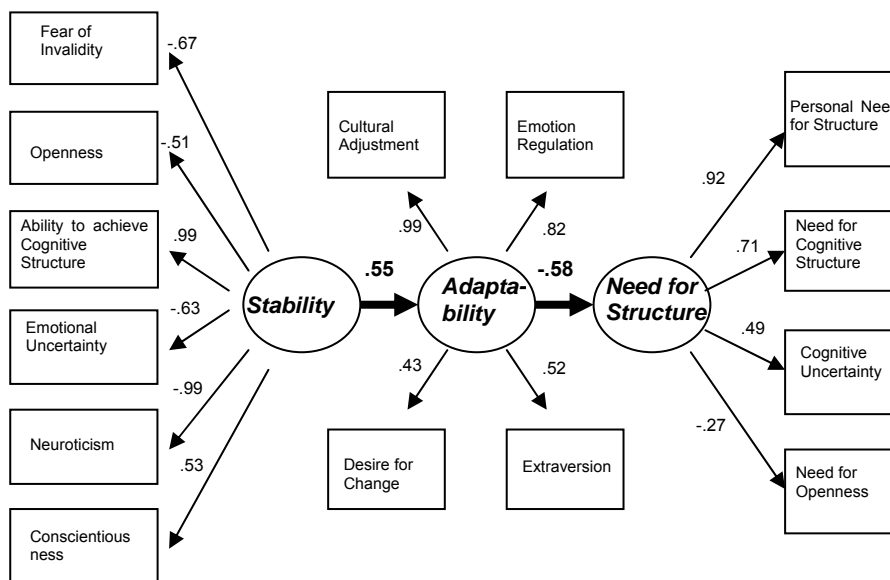
<sup>48</sup> High p-values indicate that the factor model exhaustively explains the co-variances between the markers.

## MODELLING CULTURAL ADAPTABILITY

respectively. This means that *Adaptability* relates to both *Emotional Stability* and *Need for Structure*. Accordingly, *Adaptability* seems to be a mediator between the other two factors.

Accordingly, we tested and confirmed a three factors structural model by means of LISREL. In this model factor *Emotional Stability* precedes *Adaptability*, and *Adaptability*, in its turn, precedes *Need for Structure*. The final model from these analyses is presented in figure 24.

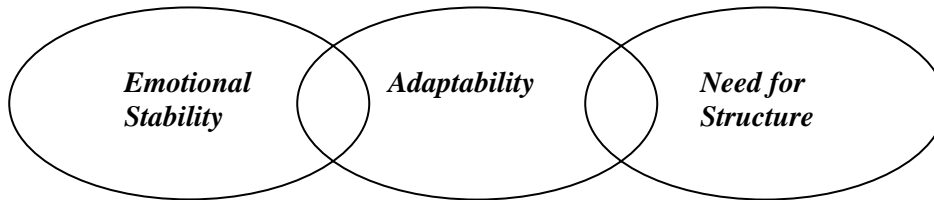
As can be seen from figure 24 the three factors can be ordered in a sequence, in which *Adaptability* is a mediator between factors *Stability* and *Need for structure*. There are no direct effects from *Stability* to *Need for structure*, but a significant indirect effect. The Weighted Least Squares Chi-Square equals 80.54 and has a p-value of 0.093. The standardized Root Mean square Residual (RMR) equals 0.14, the Goodness of Fit Index (GFI) equal to = 0.82, and the Adjusted Goodness of Fit Index (AGFI) equal to 0.70. All loadings are significant ( $p < .05$ ). The fit of the model is acceptable<sup>49</sup>.



**Figure 24: A structural LISREL model of the relationships between *Emotional Stability*, *Adaptability*, and *Need for Structure*. The Goodness of Fit Index (GFI) = 0.82. All effects (thick arrows) and factor loadings (thin arrows) are significant ( $p < .05$ ).**

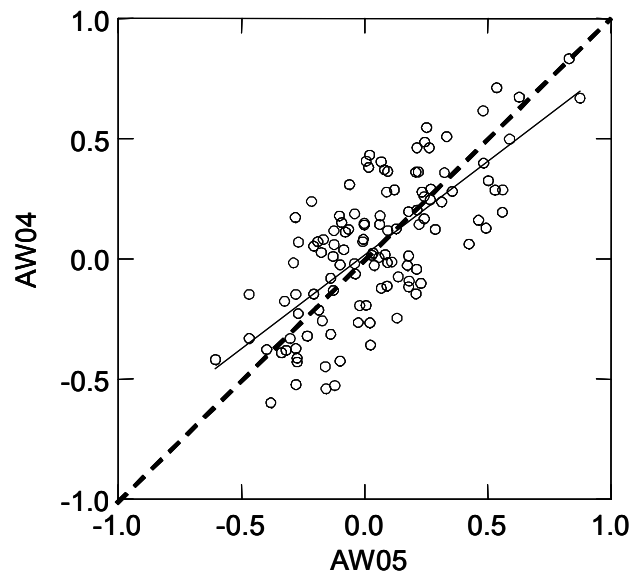
Our interpretation of the model is that if you have a high rating in Emotional Stability i.e. low scores in fear of invalidity, neuroticism, openness, and emotional uncertainty as well as high scores in ability to achieve cognitive structure, and in conscientiousness, your rating in Adaptability will be high, i.e. you will have high scores in emotional regulation, cultural adjustment, desire for change, and extraversion. And, if your rating is high in Adaptability, you will have low scores on personal need for structure, cognitive need for structure as well as cognitive uncertainty, i.e., your rating in Need for Structure is low. Figure 25 summarizes the sequential relationships between the three factors.

<sup>49</sup> The manifest variable 'Openness II' was found insignificant and was excluded from the structural model.



**Figure 25: The sequential relationships between Emotional Stability, Adaptability, and Need for Structure.**

In a second series of analyses, data from AW05 was added. In order to analyze to what extent data from AW05 was similar to the data from AW04, the correlation structures (i.e. the internal relations between the variables of the two studies, respectively) were compared. Figure 26 illustrates the correlation between the two structures.



**Figure 26: The relationship between the correlation structures (inter-variable correlations) from AW04 and AW05. The correlation ( $r$ ) is .72, ( $p > .01$ ). The common variance ( $R^2$ ) is 52 percent.**

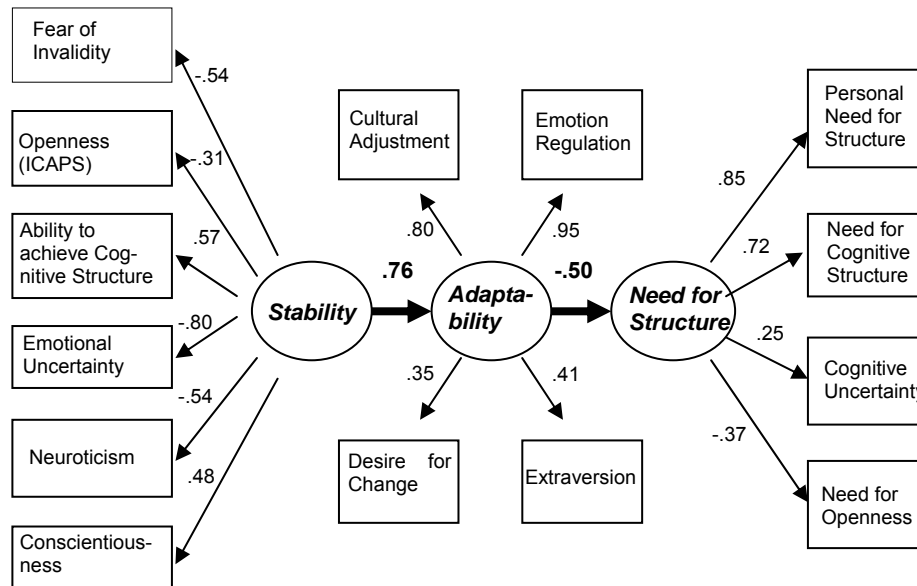
The proportion of common variance between the two structures was .52. Accordingly, the similarity between the rank-orders of the correlations from AW04 and AW05 is significant ( $p > .01$ ) and high. As can be seen from the figure, the variance of the AW05-distribution of correlations tends to be greater than the AW04-distribution.

Our conclusion from the finding of a close similarity between the databases from AW04 and AW05 was that the three factor model based on data from AW 04 could be tested on data aggregated from AW04 and AW05. Accordingly, the addition of the data from AW05 represents a test of the validity of the model in an extended sample. The number of subjects from the two exercises was 155.

Figure 27 presents the three factors structural model based on data from AW04 **and** AW05. The Weighted Least Squares Chi-Square equals 85.11 and has a  $p$ -value of 0.03. The standardized Root Mean square

## MODELLING CULTURAL ADAPTABILITY

Residual (RMR) equals 0.10, the Goodness of Fit Index (GFI) equal to = 0.85, and the Adjusted Goodness of Fit Index (AGFI) equal to 0.75. All loadings are significant ( $p < .05$ ).

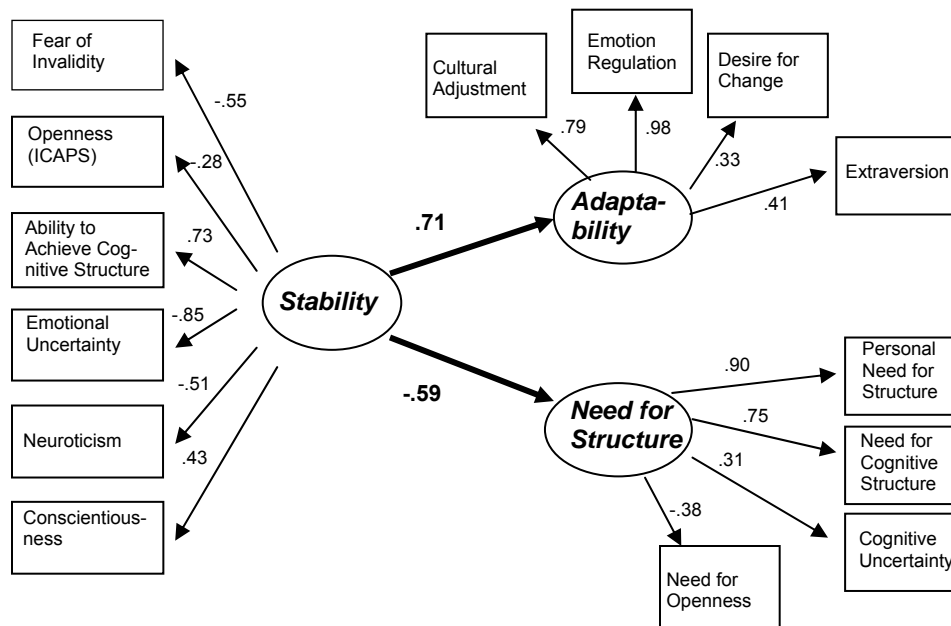


**Figure 27: A structural LISREL model of the relationships between *Emotional Stability*, *Adaptability*, and *Need for Structure*. The Goodness of Fit Index (GFI) = 0.85. All effects (thick arrows) and factor loadings (thin arrows) are significant ( $p < .05$ ).**

Our conclusion is that the fit of the model is acceptable, and that the data from AW05 support and validate the model based on data from AW04.

From the explorative as well as from the confirmative analyses we have found a three factors model in which the factors are ordered sequentially (*Stability* affects *Adaptability*, and *Adaptability*, in its turn, affects *Need for Structure*). However, from discussions within the research group an alternative solution was suggested. In this model *Emotional Stability* will directly affect *Need for Structure* as well as *Adaptability*.

From LISREL-analyses we found that the fit of this model was as good as the fit of the original model. The Weighted Least Squares Chi-Square equals 82.89 and has a p-value of 0.04. The standardized Root Mean square Residual (RMR) equals 0.11, the Goodness of Fit Index (GFI) equal to = 0.85, and the Adjusted Goodness of Fit Index (AGFI) equal to 0.75. All loadings are significant ( $p < .05$ ). Figure 28 presents the model in which *Emotional Stability* directly affects *Adaptability* and *Need for Structure*.



**Figure 28: A structural LISREL model representing the direct effects of *Emotional Stability* on *Adaptability*, and *Need for Structure*, respectively. The Goodness of Fit Index (GFI) = 0.85. All effects (thick arrows) and factor loadings (thin arrows) are significant ( $p < .05$ ).**

Accordingly, we have two models of equal fit. The models explain the same amount of common variance, they confirm the structures to the same extent, and they can both be generalized to the population of subjects. To determine which of the models that is to be preferred is both a theoretical and practical matter. Obviously, both can be used as complementary models.

The models of figures 27 and 28 are based on 14 markers. We have also tested the fit of the model when using two of the main markers of each factor (i.e. altogether six measures). By using the main markers we are optimizing the relationship between the proportion of variance explained and the number of measures used. Figure 29 presents this optimized model.

The Weighted Least Squares Chi-Square of the optimized model equals 4.09 and has a p-value of 0.76. The standardized root mean square residual (RMR) equals 0.04, the Goodness of Fit Index (GFI) equal to = 0.98, and the Adjusted Goodness of Fit Index (AGFI) equal to 0.94. All loadings and weights are significant ( $p < .01$ ). The fit of the model is almost perfect.

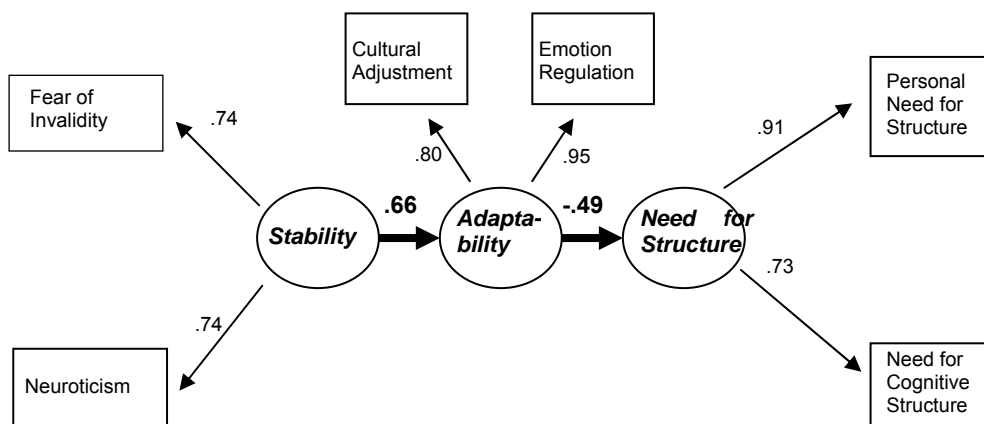


Figure 29: A structural LISREL model of the relationships between *Emotional Stability*, *Adaptability*, and *Need for Structure*. The model is based on six main manifest variables. The Goodness of Fit Index (GFI) = 0.98. All effects (thick arrows) and factor loadings (thin arrows) are significant ( $p < .01$ ).

The alternative model (in which *Emotional Stability* directly affects *Need for Structure* as well as *Adaptability*) has also been analyzed by using six main markers. Figure 30 presents the alternative and optimized model.

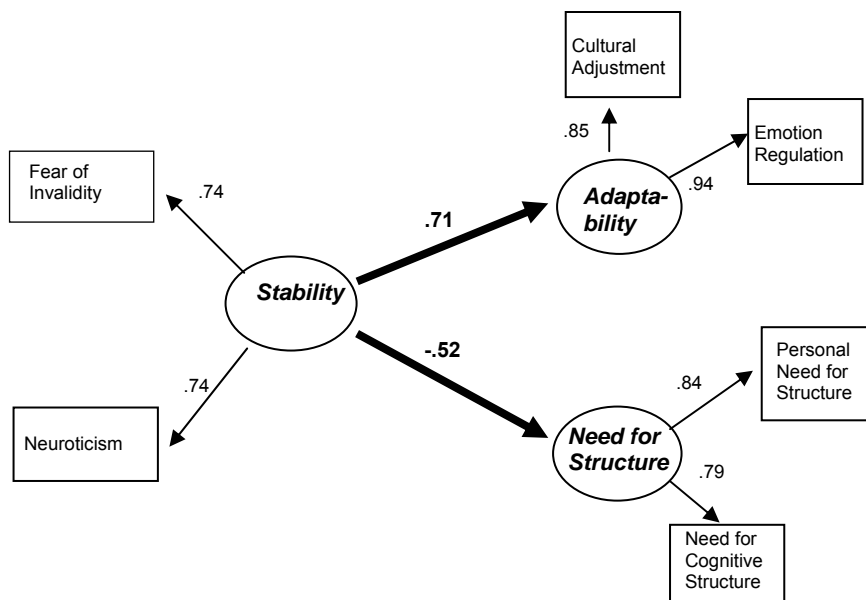


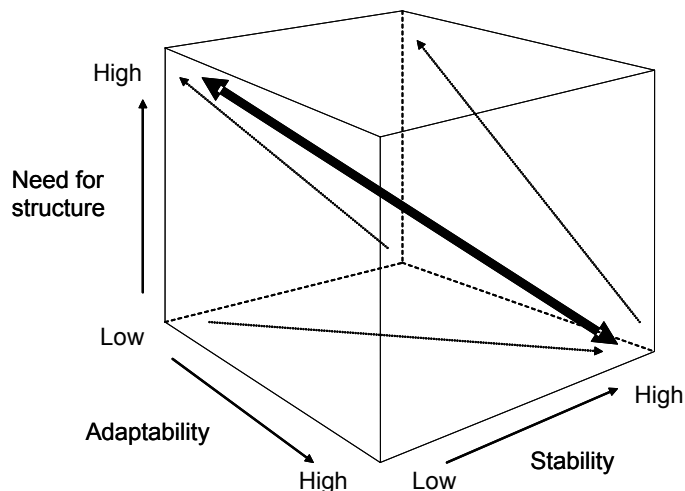
Figure 30: A structural LISREL model representing the direct effects of *Emotional Stability* on *Adaptability*, and *Need for Structure*, respectively. The model is based on six main manifest variables. The Goodness of Fit Index (GFI) = 0.97. All effects (thick arrows) and factor loadings (thin arrows) are significant ( $p < .01$ ).



The Weighted Least Squares Chi-Square of the alternative and optimized model equals 7.02 and has a p-value of 0.43. The standardized root mean square residual (RMR) equals 0.05, the Goodness of Fit Index (GFI) equal to = 0.97, and the Adjusted Goodness of Fit Index (AGFI) equal to 0.90. All loadings and weights are significant ( $p < .01$ ). The fit of the alternative optimized model is almost perfect.

When comparing the factors of the large models represented by 14 markers with the factors of the small models represented by six markers we found that the correlations between the stability factors was .89, the adaptability factors .76, and the need for structure factors .90. Accordingly, the common variances for the factors were 79, 58, and 81 percent, respectively.

As illustrated in figure 31, the structural model can be visualized in a Euclidean space, of which the three dimensions represent the factors *Emotional Stability*, *Adaptability*, and *Need for Structure*, respectively.



**Figure 31: A representation of the structural model in a Euclidean space. The three dimensions indicate the factors *Stability*, *Adaptability*, and *Need for Structure*. The double headed arrow illustrates a goodness of fit continuum.**

The vector or arrow from the lower right to the upper left corner of the cube, illustrates a continuum from high *Stability*, high *Adaptability*, and low *Need for Structure* to low *Stability*, low *Adaptability*, and high *Need for Structure*. We consider the integrated continuum to indicate a 'personality goodness of fit index' of importance for prediction of operational performance.

### 3.0 DISCUSSION

By means of factor analyses, multidimensional scaling, and modelling ad modum LISREL, 17 personality measures have been reduced to models of three interrelated latent variables or factors.

From the explorative analyses we hypothesized a three factors model as an optimal solution. From these analyses we found that 15 of 17 measures (82 %) have an acceptable communality (i.e. significant co-variances with the other measures) for confirmative analyses. From the confirmative analyses we found that a model of three interrelated factors significantly explains the co-variances between the manifest variables.

From the initial structural model analyses (data from AW04) we confirmed that the co-variances between the variables were thoroughly explained by a sequential relation between the factors *Emotional Stability*, *Adaptability*, and *Need for Structure*. We also found that the structural model can be generalized to the population.

An interpretation of the model is that if you have a high rating in *Emotional Stability* i.e. low scores in fear of invalidity, neuroticism, openness, and emotional uncertainty as well as high scores in ability to achieve cognitive structure, and in conscientiousness, your rating in *Adaptability* will be high, i.e. you will have high scores in emotional regulation, cultural adjustment, desire for change, and extraversion. And, if your rating is high in *Adaptability*, you will have low scores on personal need for structure, cognitive need for structure as well as cognitive uncertainty, i.e., your rating in *Need for Structure* is low.

In a second series of analyses data from AW04 **and** AW05 were used. Our conclusion from these analyses is that the data from AW05 support and validate the model based on data from AW04.

From discussions within the research group an alternative solution was suggested. In this model *Emotional Stability* directly affects *Need for Structure* and *Adaptability*. Confirmative analyses of the alternative model showed that this structural model has the same fit as the sequential.

Accordingly, we have two structural models of equal and acceptable fit. The structural models explain the same amount of common variance between the measures, they confirm the structures to the same extent, and they can both be generalized to the population of subjects. To determine which of the models that is to be preferred is both a theoretical and practical matter. Obviously, both can be used as complementary models.

We have tested the fit of the models when using two of the main markers of each factor (i.e. in all six measures). From these analyses we found an almost perfect fit of the sequential as well as the alternative model. Accordingly, six of the measures used can represent the models adequately.

Our conclusion is that the subjects can be reliably ordered or classified with respect to the three, factors by means of six measures. To use these six measures is an economic way of getting information representing all of the measures.

When scrutinizing the proportion of variance accounted for by the factors we found that *Emotional Stability* explains more variance than the other two factors. This is, of course, a reflection of the psychological content of the measures analysed, but it also reflects the prominence of the stability concept. The aspects representing emotional stability are related to operator performance and, since long, of central importance in e.g. selection of military pilots and conscripts.

Unlike many other situations of measurement, each measure has a proved reliability and validity, and most of them are, in themselves, personality factors. In fact, four trait dimensions of the ‘Big Five’ (Emotional Stability, Conscientiousness, Extraversion, and Openness to Experience) are represented in our analyses. This ‘inborn’ part of reliability and validity gives additional strength to the quality of the indices for the three factors and the structural models found. From a statistical point of view, *Emotional Stability*, *Adaptability*, and *Need for Structure* are second order factors (i.e. factors of factors). The fact of the matter that the factors have specific and logical relations to each other in the model strengthens further their construct validity.

Digman [113] has performed a series of confirmative factor analyses of the ‘Big Five’ dimensions (Agreeableness, Conscientiousness, Emotional Stability, Extraversion, and Intellect or Openness to Experience). In all analyses a two factors solution was con-firmed. As can be seen from figure 32, the trait dimensions Agreeableness, Conscientiousness, and Emotional Stability were markers of the first factor, called  $\alpha$ , and the dimensions Extraversion, and Intellect were markers for the second factor called  $\beta$ . As can also be seen, the factor *Emotional Stability* of our analyses is comparable to Digman’s factor  $\alpha$ , and our factor *Adaptability* is close to his  $\beta$ -factor. Digman considers his two factors to be orthogonal or un-correlated. However, in our re-analyses of Digman’s data we found factor  $\alpha$  and factor  $\beta$  to be correlated in the same way as *Emotional Stability* and *Adaptability* are in our models.

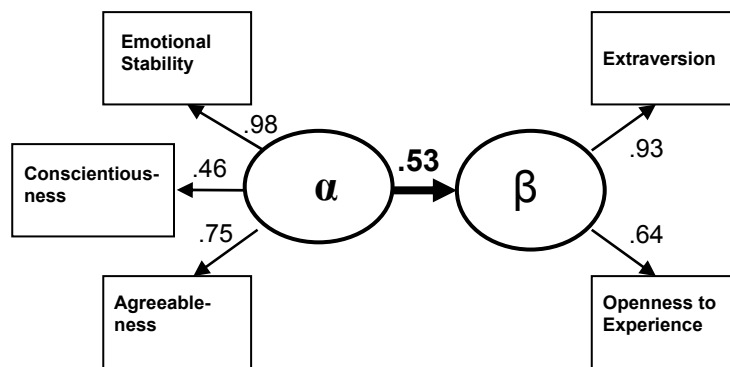


Figure 32: A structural LISREL model representing the direct effects of  $\alpha$  (*Emotional Stability*) on  $\beta$  (*Adaptability*). The model is based on six main manifest variables. The Goodness of Fit Index (GFI) = 0.97. All effects (thick arrows) and factor loadings (thin arrows) are significant ( $p < .01$ ).

Accordingly, from our re-analyses of the ‘Big Five’ dimensions, we can conclude that, from a statistical point of view, the ‘Big Five’ dimensions can be thoroughly explained in terms of two factors (close to ours *Emotional Stability* and *Adaptability*) and their relation.

#### 4.0 CONCLUSIONS

What are the implications of the structural models for leader and team adaptability? *Emotional Stability* and *Adaptability* are fundamental aspects in selection of personnel working under stressful conditions with high stakes and risks. With high emotional stability your cognitive performance (information handling and decision making) can stand high stress levels longer without deterioration. With high ability to adapt you are better at handling complex and ambiguous information and situations. We have in other modelling studies [109] found that emotional coping processes will increase and interfere with problem solving coping processes when the challenge (the combination of risk- and complexity aspects) of a task increases. Sooner or later emotional

coping dominates with deteriorated decision making as a consequence. Emotional stability counteracts and delays emotional coping. There are similarities between the effects of emotional stability and the effects of training – both delay emotional coping and support problem solving coping processes. It is not for nothing that emotional stability and intense training since long form corner stones for effective military operations.

Accordingly, there is strong evidence of relationships between stress tolerance or emotional stability and aspects of cognitive performance under high information load and psychological stress. Consequently, the factors of the models have a predictive potential in the recruitment of personnel to e.g. exposed or critical positions in  $C^2$ -systems. The reliability of the factors of the models increases the predictive power further, and, accordingly, the measures can be applied in situations where a few are accessible for a specific position.

We have mentioned that the validity and reliability of our factors are manifest and high as compared to specific and singular personality measures. However, even so, the predictive power of the measures or factors is not perfect. Furthermore, there is no one to one relationship between the personality measures and cognitive performance under stress and strain. On the other hand, from a statistical point of view, the probabilities of successful performance increase as a function of increased emotional stability and adaptability.

It is also of importance to notice that experience in and training of specific situations counteract interfering effects of personality factors. Personality traits can, partly, represent states, and, accordingly, change as a function of situation and surrounding factors. In the analyses of EW04 data we found a relationship between a demographic factor reflecting native background and experience and mental stability. However, this relationship was not found when the EW05 data was added.

In the databases analyzed, we have no data on performance aspects as mental workload, situational awareness, and operational performance, and, accordingly we were not able to directly relate performance to our stability- and adaptability measures. Information load, situational awareness as well as performance are central aspects in command and control situations. If we can relate these performance-related criterion variables to the personality traits of our models, and to states or moods as stress and activation, the map will be more complete. To that end, our next step is to use the model in  $C^2$  – studies at the Swedish Armed Forces Joint Concept Development and Experimentation Center.

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## Chapter 5 – TRAINING CULTURAL ADAPTABILITY

### 5.1 BACKGROUND

The primary deliverable to ACT CD&E was a cultural awareness training tool that addressed the need for improved teamwork and communication skills among officers representing Alliance and Partnership for Peace nations. To meet this objective, the ACT CD&E – HFM RTG 138 program leveraged an existing U.S. Small Business Innovative Research (SBIR) project initiated by the U.S. Army Research Laboratory to develop a self-paced, web-based tool called GlobeSmart Commander<sup>®</sup> designed for officers working in multicultural collaborative environment to enable cultural adaptability. This was done by significantly contributing to content development, specifically providing highly relevant and realistic multicultural interaction scenarios. These scenarios, and other content, were derived from behavioural observations and interviews conducted with 150+ NATO officers participating as the Deployable Joint Task Force (DJTF) at the Allied Warrior 04 and 05 Command Post Exercises. The cultural awareness training provided by GlobeSmart Commander<sup>®</sup> will enable NATO officers to navigate the challenges of cultural diversity during information exchange involving: team tasks, goals and mission; response sequencing; time and position coordination; load balancing; matching resources to task requirements; adjusting activities in response to errors and omissions, and general activity monitoring.

### 5.2 CULTURAL OPERATIONAL GAPS

To expand on the operational gaps that led to the development of GlobeSmart Commander<sup>®</sup>, a summary paper, originally presented in 2005 at a NATO RTO Human Factors and Medicine Panel Research Symposium (HFM RSY 124), is included in its entirety. When referencing content from this paper, the following format should be used: Sutton, J.L., & Gundling, E. (2005, Oct). Enabling Cultural Adaptability. In C.A. Rodriguez & R. Poisson (Chairs), *Strategies to maintain combat readiness during extended deployments – A human systems approach*. Symposium conducted at the HFM-124/RSY, Prague, Czech Republic.

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## Enabling Cultural Adaptability

### ABSTRACT

*Military staff performing command and control functions require a unique set of skills when working in a multinational environment that are not typically taught in national or NATO training venues. It is vital to be able to navigate the challenges of culture during information exchange regarding team tasks, goals and mission, response sequencing, time and position coordination, load balancing, matching resources to task requirements, adjusting activities in response to errors and omissions, and general activity monitoring. Lack of skill in multicultural teamwork has been found to be an unnecessary weakness in military staffs, specifically at the Joint Task Force level. This paper presents a technology solution: a web-based tool named “GLOBESMART<sup>®</sup> COMMANDER” currently under development by the U.S. Army Research Laboratory Human Research and Engineering Directorate and Aperian Global (formerly Meridian Resources, an international consulting company).*

## **1.0 INTRODUCTION**

Multinational alliances in war or peace are the way of the future. For example, alliances Bosnia-Herzegovina, Kosovo, Afghanistan, and Iraq are representative of this transformation. No where is the cultural diversity inherent in multinational teams more prevalent than at the operations level. Task forces executing Commander's intent in the performance of critical command and control functions in a multinational environment often have the capacity for more creative approaches to problem solving, but they can also experience difficulties in coordination, aligning team members to complete tasks, and error-checking. In these culturally diverse groups, failure to understand the impact of culture on thoughts and behaviour often results in distrust, confused priorities, frustration, misunderstanding, even conflicting goals. Extended deployments may magnify problems rooted in culture, resulting in increased experienced stress by individuals on those deployments.

## **2.0 IMPACT OF CULTURE ON TEAMWORK**

Culture is the totality of socially transmitted behaviour patterns, arts, institutions, and all other products of human work and thought typical of a population or community at any given time [119]. It is the acquired knowledge used to interpret experience, form values, create attitudes and influence behaviour. Values are basic convictions that people have regarding what is right and wrong, good and bad, important and unimportant. Values are relatively stable, not subject to sudden shifts or impulses of the moment, and serve as a standard for judging the behaviour of others. The ability to adapt, as necessary, to differences in cultural influences on behaviour is a key success factor for effective multinational team.

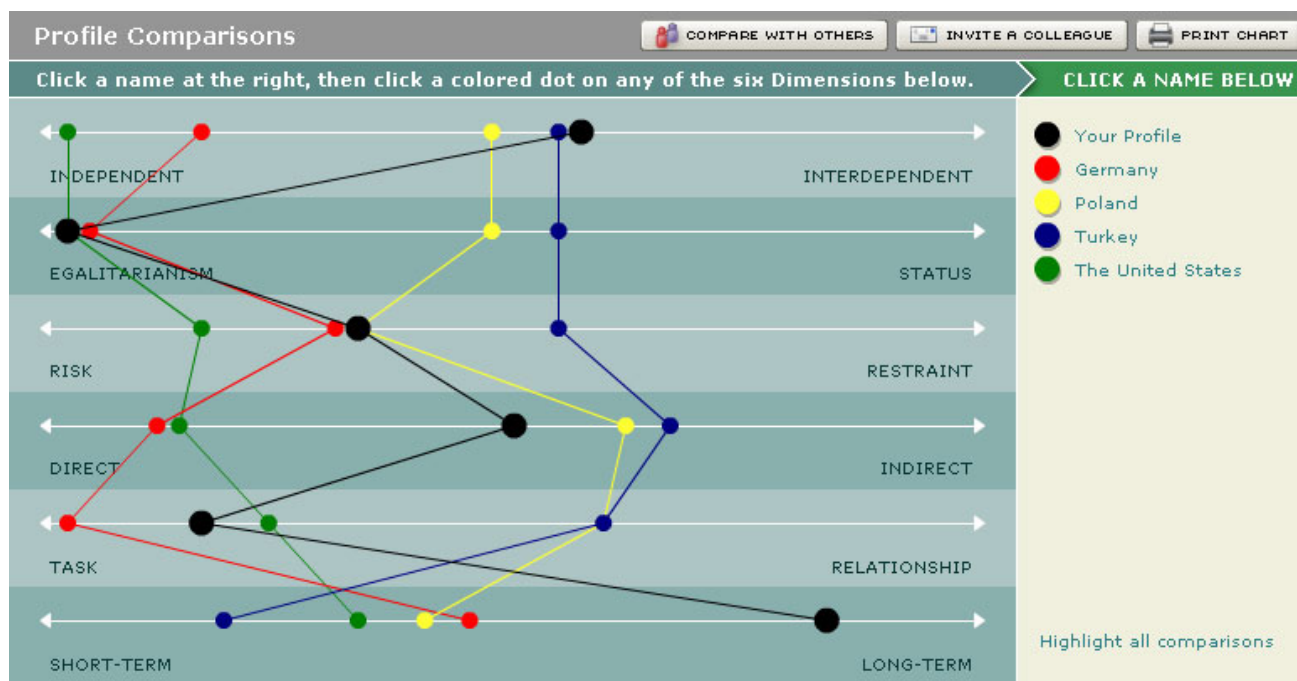
Culture impacts teamwork in various ways. Members of the military in any NATO country belong to organizations with related command structures and share some experiences in common. However, they also tend to behave in ways that are consistent with cultural norms for their own country. Several decades of research have led to the identification of dimensions of culture that shape individual behaviours; these behaviours affect team performance in both civilian and military settings. Table 13 presents six of the most commonly referenced cultural dimensions along with brief references to their practical implications.

**Table 13: Six Key Dimensions of National Culture.**

<u>Dimension</u>	<u>Practical Implications</u>
1. Independence/Interdependence:	Shapes a preference for individual initiative and action, or for a more group-oriented approach emphasizes the interests of the team as a whole
2. Egalitarianism/Status:	Shapes a preference for mutual consultation in decision-making, or for greater deference to rank and hierarchy
3. Risk/Restraint:	Shapes a preference for rapid action and risk-taking, or for more cautious and calculated actions based on ample information
4. Direct/Indirect:	Shapes a preference for open and explicit communication, or for careful attention paid to context or to implicit meanings in a given message
5. Task/Relationship:	Shapes a preference for immediate attention to getting the job done, or for establishing strong and trusting personal relationships first
6. Short-term/Long-term:	Shapes a preference for making choices based upon a narrow time horizon, or for considering the impact that choices will have over a longer span of time

It is important to stress that there are positive and negative aspects of both ends of the spectrum for each cultural dimension, and there is not a judgment attached to either extreme. Depending upon the situation that a team encounters, any of these cultural perspectives could be useful. The challenge for multicultural teams is to fully leverage the diverse perspectives of their members while also being able to reach closure and move to action when this is required. Recent data on multicultural teams confirm that such teams experience particular difficulty with areas such as establishing an effective decision-making process, giving and receiving critical feedback in a constructive manner, and creating procedures for resolving problems among team members [120].

Using several NATO countries as examples, national norms for the same six cultural dimensions are contrasted in Figure 33. The black circles represent points on the six continuums where an individual's culturally based behaviour may fall.



Copyright 2004, Meridian Resources Associates; based upon the Matsumoto Self-Assessment Tool, Copyright 2004 Dr. David Matsumoto.

Figure 33: Profiles for a sample of NATO countries.

Members of operational level multicultural teams that include this kind of wide range of perspectives can benefit from assistance in understanding the cultural norms of other members on the team. They can also benefit from recommendations for how to adapt their own personal styles to work most effectively with other team members.

### 3.0 GLOBESMART® COMMANDER

The concept for creating a tool that went beyond just raising cultural awareness was validated with a multinational pool of officers conducting peacekeeping at Stabilization Force headquarters (HQ SFOR), Camp Butmir, Bosnia-Herzegovina [121] [122]. There, research conducted by the U.S. Army Research Laboratory (ARL) Human Research and Engineering Directorate (HRED) found the inability to adapt to cultural differences among headquarters staff to be a critical barrier to effective teamwork [123]. As a result, ARL HRED partnered with MeridianEaton Global, in conjunction with Dr. David Matsumoto at San Francisco State University, CA, USA, to develop a tool, GLOBESMART® COMMANDER (*GS Commander*), designed to provide military staff performing command and control functions the necessary skills to adapt, as needed, to cultural influences on teamwork at the operations level. The utility of *GS Commander* for a multinational headquarters staff was validated with the Allied Warrior 2004 (AW04) Deployable Joint Task Force (DJTF) staff [124].

The *GS Commander* program includes ten learning modules. These modules introduce the topic of cultural differences, provide an orientation to each of the six dimensions of culture, and also cover several aspects of multicultural teamwork that correspond with the “Forming,” “Storming,” and “Norming” phases of team activity identified by Bruce Tuckman [125]. The standard outline for all of the modules incorporates the following five steps:



- Step 1 contains a brief survey and personal profile. Users respond to a short set of survey questions that result in the display of their personal profile for a particular cultural dimension, helping them to become more aware of their own preferred styles.
- Step 2 is a scenario that illustrates an unproductive interaction based on cultural differences. This segment includes a narrative that provides a fuller description of the cultural dimension under discussion in a particular module and contrasting behaviours that could result from an orientation towards one end of the cultural spectrum or the other. The narrative allows users to listen to perspectives from the characters in the video scene just presented that represent each side of a given dimension. Checkbox exercises are included for users to confirm their understanding of the lesson.
- Step 3 shows an animated display of country profiles. This segment helps users to seek out the country profiles for NATO allies they may be working with, and begin to consider contrasts between their personal styles and the norms for these other countries.
- Step 4 provides recommendations for working with different behavioural styles. Follow-on exercises offer opportunities for practice in recognizing other styles and suggestions for how to integrate them into a productive team effort through mutual style-switching and adaptation.
- Step 5 offers an opportunity for *GS Commander* users who are already in contact with members of other national groups to develop an action plan. This feature makes it possible to take key lessons from the program and apply them directly to upcoming tasks or activities.

Shown below in Figure 34 is a screen shot that illustrates some of the information provided to a *GS Commander* user in Step 2, described above. Information on this page is found in the Communication Styles module. The continuum of behavior associated with Direct and Indirect communication styles appears as a double-pointed arrow. The two dots appearing on the bar reflect a point on a theoretical behavioural continuum where individuals with a strong Direct or Indirect style, respectively, would be placed.

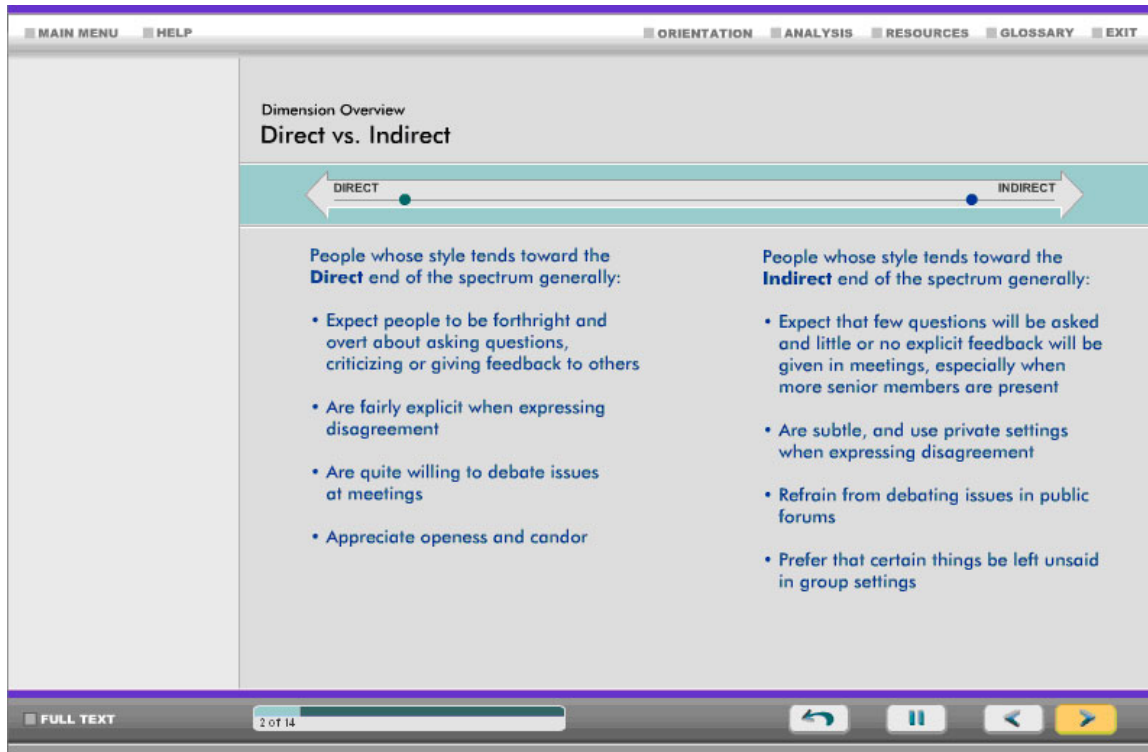


Figure 34: Direct and Indirect communication styles.

A drag-and-drop exercise on how best to obtain information from individuals with different communication styles than the user is shown in Figure 36. Again, the double-pointed arrow shows the continuum of behavior associated with Direct and Indirect styles. This time, however, the one dot appearing on that continuum shows the user’s own communication style based on the personal profile created in Step 1. Users are presented with four possible ways to adapt their style to that of others. One at a time, they can drag a suggested style-change to the appropriate column. Feedback is provided both when user placements are correct or incorrect.

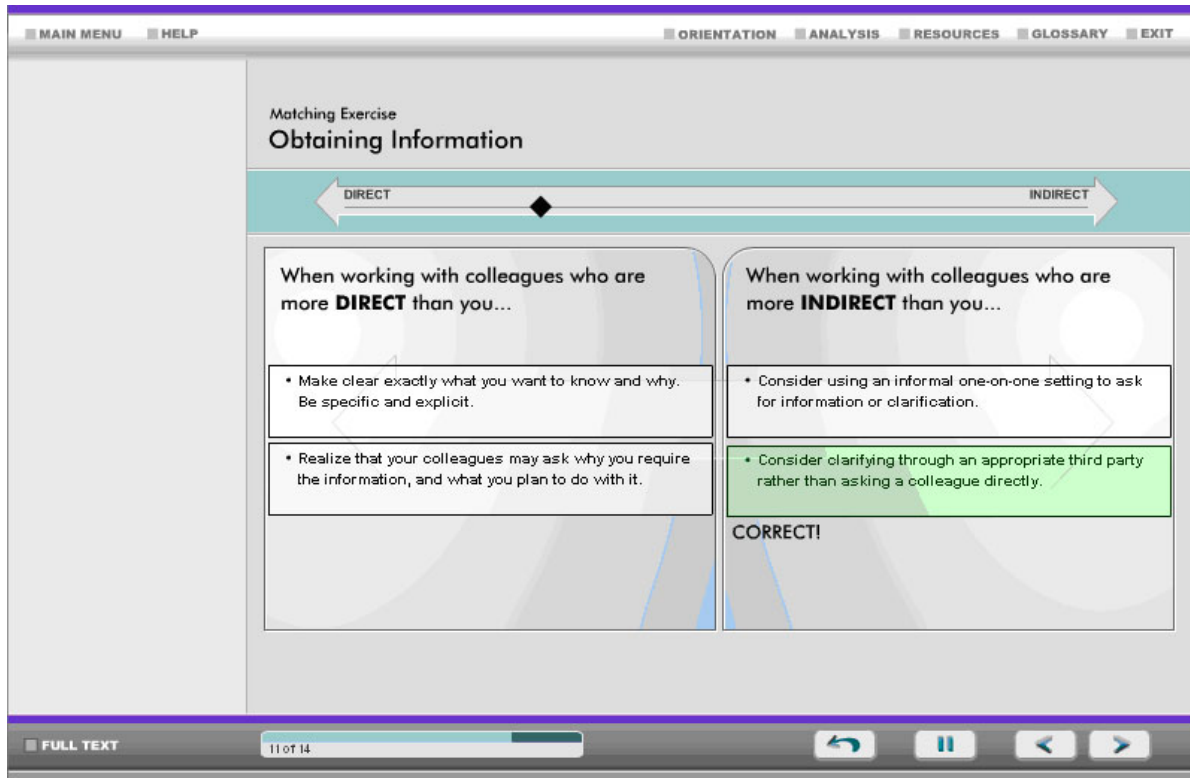


Figure 35: Working with different communications styles.

## 4.0 BENEFITS

### 4.1 Technology Solution

Whether implemented as an intranet (internal to military firewalls) or as an internet tool (accessible on the worldwide web), a web-based tool offers many advantages: for example, ease of administration and data capture, and the ability to reach a larger training audience than would be available through the traditional classroom venue. The embedded self-assessment profile is unique in its ability to provide immediate feedback to users as well as its ability to access a data base of country profiles for comparison purposes.

Further, a web-based solution means that the user data can be collected and analyzed quickly, knowledge gaps across branches of service, rank, gender, and other demographics can be easily identified, and supplemental targeted information can be accessed to address those gaps. With the data capture feature of *GS Commander*, instructors, researchers, and leaders of multicultural staffs will be able to objectively assess the ability of individuals and teams to culturally adapt. Finally, the tool includes a user-friendly backend administration system that allows ongoing maintenance, modifications, and development.

#### 4.1.1 Military Payoff

Little is known about how to rapidly form and support multinational headquarters staff over extended deployment because research and development has primarily focused on fighting and winning wars. However, ARL HRED research at HQ SFOR and at HQ DJTF during AW04 provided a rich source of information on issues associated with the impact of cultural diversity on teamwork that had not been addressed in national or NATO training venues. In-depth interviews conducted by MeridianEaton Global with officers experienced in multinational staff assignments around the world have provided, and continue to provide, realistic, relevant content designed specifically for officers preparing for short-term or extended deployment in a multicultural environment. Thus, *GS Commander* can facilitate a shortened learning curve for working at the Joint Task Force level. Additionally, unique to *GS Commander* is its application for Commanders and principal staff to assess, and possibly predict, behavior of team members. When potential problems in team composition are identified through analysis of the individual and team profiles created by the embedded survey, steps can be taken to minimize, avoid, or address issues before they negatively impact the mission.

## **5.0 FUTURE CONSIDERATIONS**

### **5.1 Science and Technology Gaps**

We have identified three science and technology gaps associated with *GS Commander*:

- *GS Commander* can be leveraged to provide recommendations for system requirements that address unmet or, as yet, unidentified needs of multicultural teams at the Joint Task Force level,
- *GS Commander* functionality can be expanded to address threats to information sharing and decision making performance on interagency task forces, and
- *GS Commander* embedded survey tool can be used to identify cultural profiles for the purpose of populating cultural variables in a multitude of existing decision making models, where assigned weights are currently based on educated guess rather than real data from real people.

### **5.11 The GLOBESMART® SOLDIER**

Experience with *GS Commander* can be leveraged to create a tool that bridges gaps in cultural differences between coalition forces and Iraqis that they encounter on a daily basis. MeridianEaton Global proposes a training/decision aid that will, upon implementation, immediately benefit troops in Iraq.

Pre-deployment training has generally been limited to raising cultural awareness about Iraqi customs, religion, and history and understanding the physicality of cultural differences (e.g., time, space, and gestures). What is lacking is a means to prepare (and to provide ongoing support for) leaders and Soldiers by helping them to understand culturally based cognitive biases that influence not only Iraqi behaviour, but their own behaviour as well (e.g., risk-taking, activity orientation, or perceptions of inter-relationship power). These biases, when not understood, can impede progress toward mission goals. Proposed is a 24/7 online reference tool, "GLOBESMART® SOLDIER (*GS Soldier*)," with information on critical topics identified by "boots-on-the-ground" Soldiers that would provide military personnel with quick and easy access to extensive knowledge on how to interact effectively with Iraqis. This tool could be developed and fielded within nine months with appropriate funding.

*GS Soldier* design would contribute significantly to:

- Faster and more effective training of Iraqi military personnel,
- Avoidance of unnecessary misunderstandings with Iraqi counterparts in the government, clerical, or civilian areas, and

- More rapid transition to Iraqi autonomy and self-government.

A further advantage of this tool is that the groundwork would be laid so that *GS Soldier* could be rapidly scaleable to other countries. In the longer term, military personnel could also have access to a similar set of benefits for other strategic locations such as Afghanistan, Kuwait and Sudan (assuming access to appropriate information and interviewees).

## 6.0 RELEVANCE

The need exists to leverage what is known about culture, teams, training, and leadership in order to provide a model of coalition teamwork. First, the NATO Strategic Concept provides an integrated military structure necessary to sustain the NATO Alliance based on cooperation and coordination agreements, including collective force planning, common operational planning, and multinational formations [126] [127]. These agreements depend on the ability of leaders and teams to adapt to uncertain and complex conditions. Multinational staffs increase uncertainty and introduce complexity into performance of command and control functions. Second, the Combined Joint Task Force (CJTF) Concept was established for a multinational, multi-service deployable task force generated primarily for humanitarian relief and peacekeeping. The demands on leaders and teams within CJTF are recognized as considerable, resulting in a nucleus of core staffs established within the NATO military command structure. The CJTF Concept implies the existence of adaptable leaders and teams. Third, the Prague Summit Declaration [128] began the process of accession to join the Alliance, with Bulgaria, Estonia, Latvia, Lithuania, Romania, Slovakia, and Slovenia to begin accession talks. The introduction of new cultures and militaries to the NATO family requires leaders and teams to accommodate to the new entrants. Fourth, the NATO Response Force (NRF), consisting of a technologically advanced, flexible, deployable, interoperable and sustainable force, was created. This force will be a catalyst in improving the Alliance's peacekeeping capabilities, but again, will challenge leaders and teams to recognize the effect of cultural diversity on teamwork.

## 7.0 SUMMARY

Significant cultural differences have been found to interfere with mission success when cultural knowledge is lacking [129]. The inability to adapt, as necessary, to the influences of culture on thoughts and behaviour can result in imperfect situational awareness, which can lead to inaccurate situation assessment, and flawed or delayed decision making. We propose that cultural adaptability is critical to mission success in multicultural military environments, particularly at the operations level. Cultural adaptability includes the ability to recognize the influences of culture on teamwork, understand how best to act and react to those influences, and most importantly, take action by choosing to adapt. Mere exposure to other cultures over a long-duration deployment does not guarantee performance improvement.

The performance of multicultural teams on extended deployment can be enhanced through understanding common cultural differences between team members from different NATO countries and exposure to practical strategies for adapting to those differences. *GS Commander* will enable users to learn rapidly and immediately apply the knowledge acquired to their daily work.

## 5.3 GLOBESMART<sup>®</sup> COMMANDER TOOL

GlobeSmart<sup>®</sup> Commander is an instructional tool designed to provide operational level military teams with the information and skills they need to adapt to cultural influences on teamwork. Military officers preparing for or working on multinational teams access the tool through individual user accounts (see Figure 37).



**Figure 36: GlobeSmart® Commander login.**

For new users, the login is followed by a welcome screen that briefly introduces the tool and a module that defines culture and explains the importance of culture in influencing behaviour and team interactions. The next segment of the tool is a self-assessment survey that provides users a better understanding of how culture influences their interaction and decision-making styles as well as the impact on culturally diverse team members by comparison of their profile on six dimensions to the profiles of national averages for many other nations (see Figure 38). The six dimensions reflect basic culturally-based values or orientations identified in the culture literature (see Figure 38).

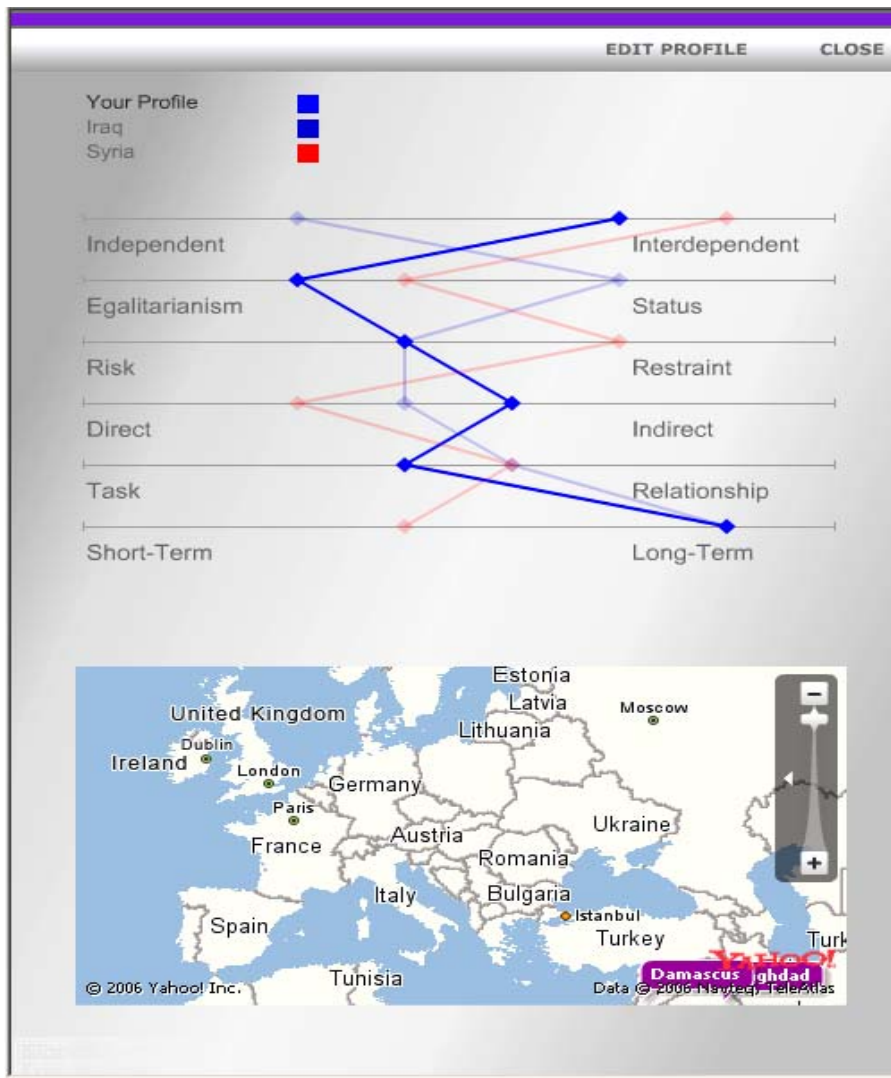
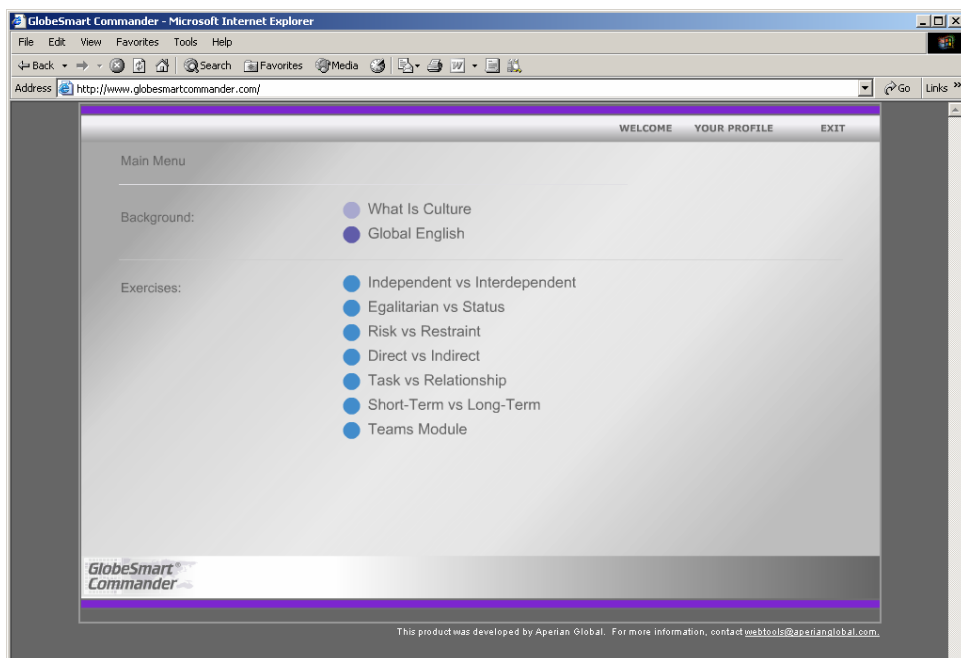


Figure 37: Self Assessment Profile.

Once new users have completed the self assessment survey and received their profile, they are ready to proceed through the modules listed on the Main Menu screen. Returning users are taken directly to the Main Menu screen following login. GlobeSmart® Commander is a course comprised of various modules, with each module listed on the Main Menu screen (see Figure 39). The goal of the course is to raise awareness about the existence of cultural differences among multinational team members and the impact those differences have on teamwork.



**Figure 38: GlobeSmart® Commander main menu.**

In addition to the module on culture, GlobeSmart® Commander has a module on global English, a module on each of the six dimensions, and a teams module. Each module contains a series of pages which are developed using a pre-created template and populated with specific content, including video, images, audio and text. Each instructional module is introduced by a video scene in which cultural differences are having a negative impact on team performance (see Figure 40). For example in the Task vs. Relationship module, two strangers, Officers from different nations, now working within the same Multinational Headquarters, try to coordinate an action. One Officer takes a very task-oriented stance, asking for what he needs, while the other Officer, representing the relationship orientation, attempts to get to know the other Officer before discussing business. The interaction ends unsuccessfully. At the conclusion of the video, a narrator explains the key differences between the two styles of the dimension represented in the situation. This is followed by a presentation by the two actors representing the opposite extremes of the dimension and a discussion by the narrator on the importance of people with differing styles being able to work together. This allows the user to see the situation from both perspectives. The final component of the dimension modules is a series of interactive exercises to insure the user understands and can apply the lessons learned about cultural differences. Screen shots demonstrating each of these components is included below.





Figure 39: Video scene.

The first page provides an overview of the dimension. It describes aspects of each end of the dimension continuum (see Figure 41).

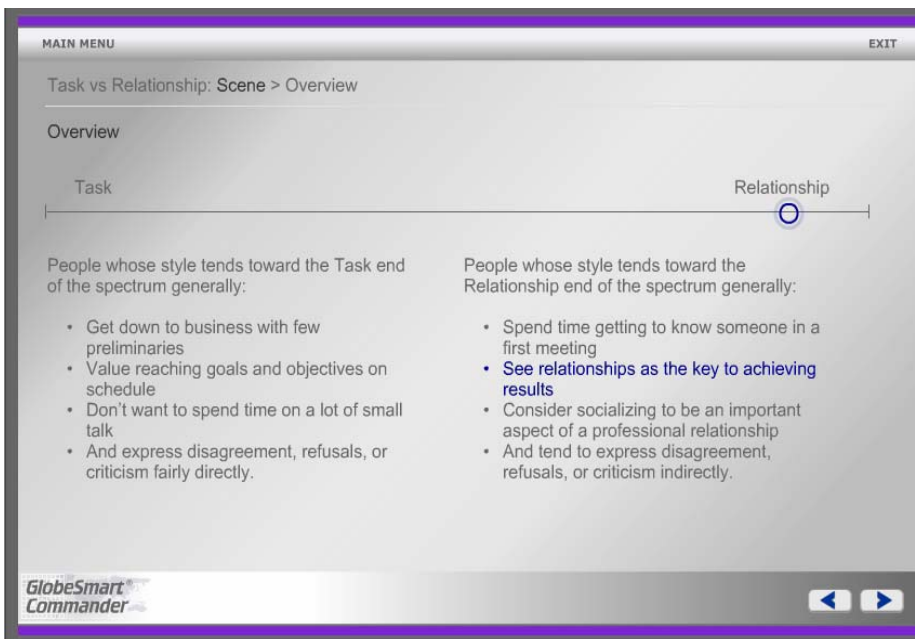


Figure 40: Dimension overview.

## TRAINING CULTURAL ADAPTABILITY

The overview page is followed by an explanation of each perspective (see Figures 42, 43) presented by the scene actors.

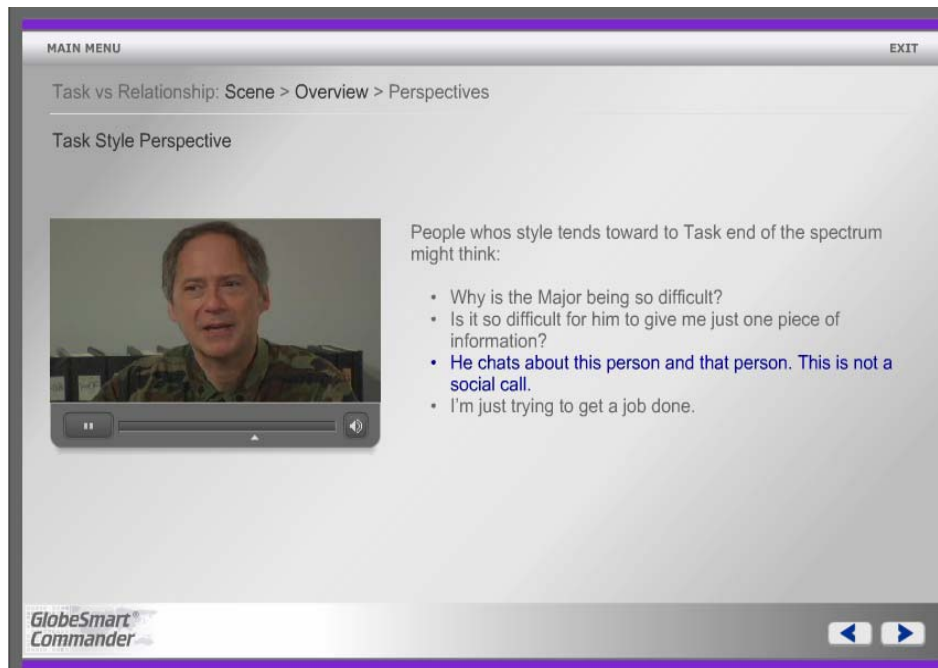


Figure 41: Task perspective.

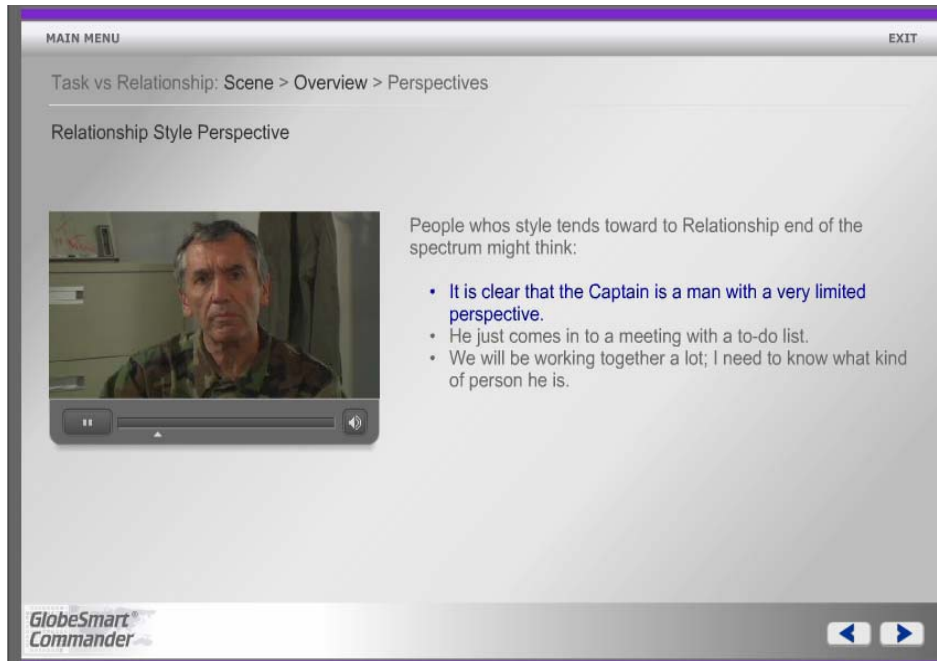
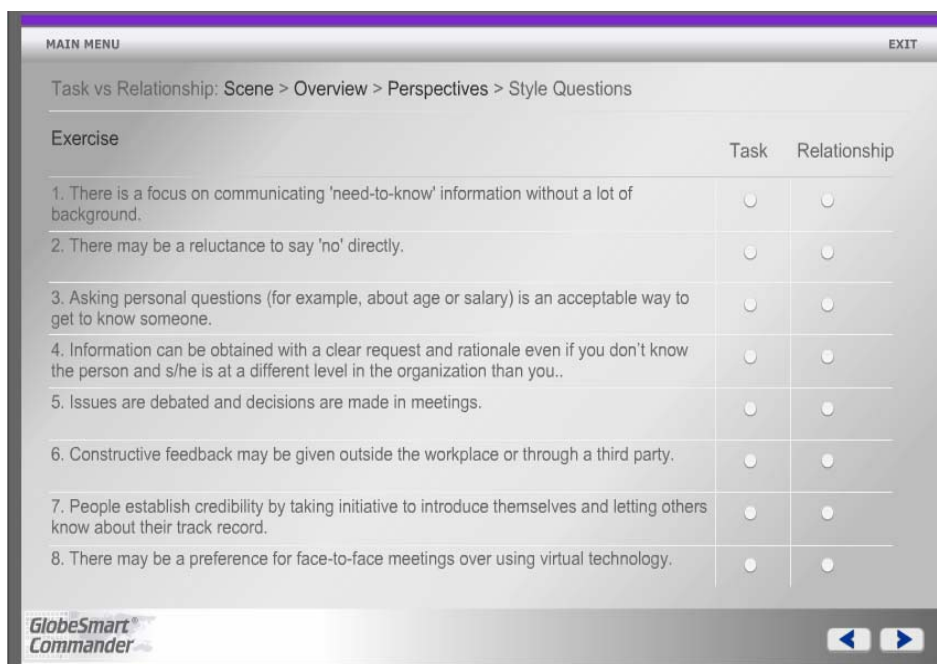
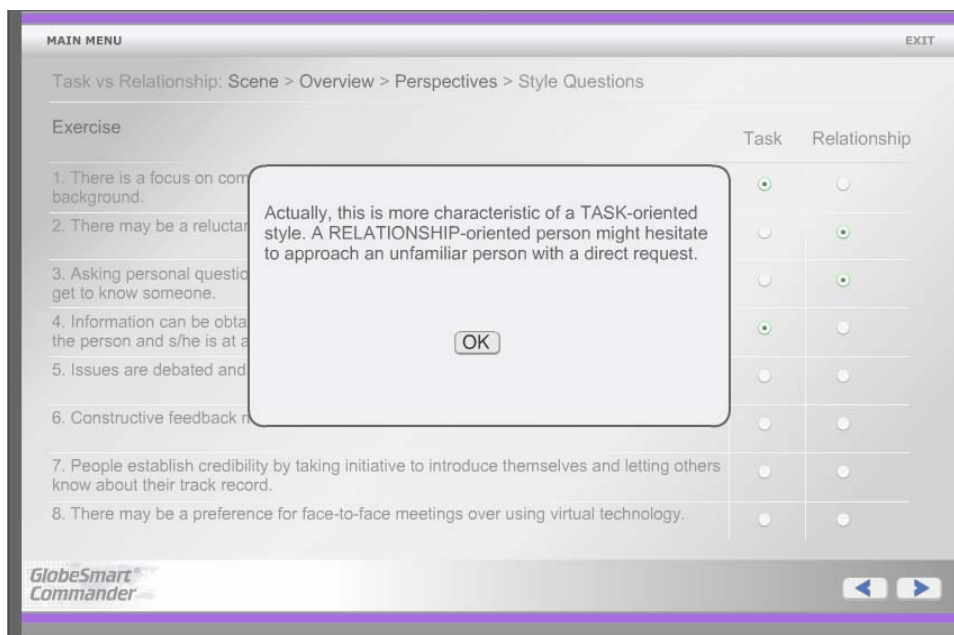


Figure 42: Relationship perspective.

Interactive exercises are presented next to evaluate the users understanding of the dimension (see Figure 43) and provide feedback on concepts that are not understood (see Figure 44).



**Figure 43: Checkbox exercise.**

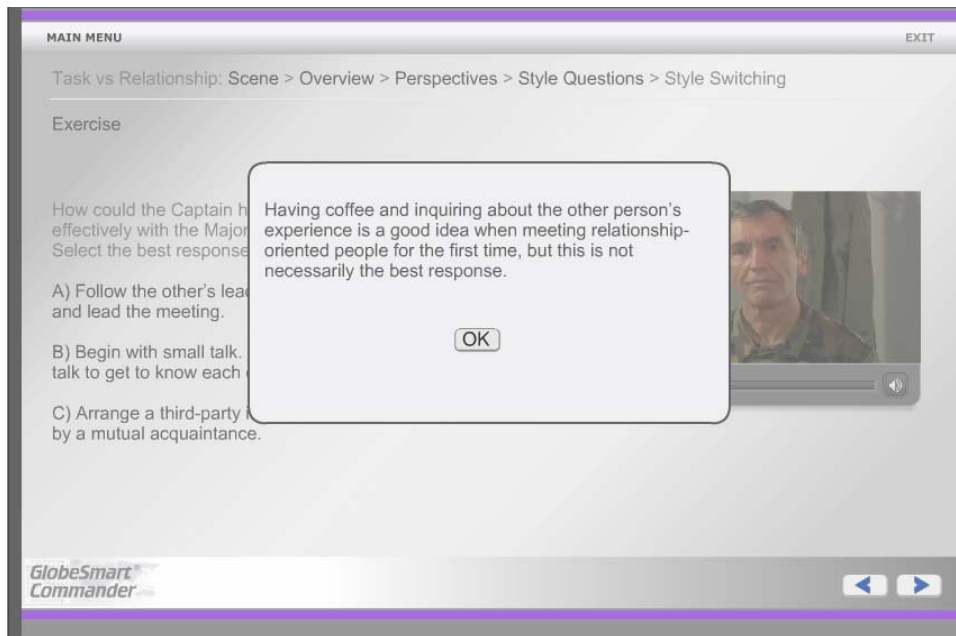


**Figure 44: Feedback on checkbox exercise.**

In the next section, users are given an opportunity to select approaches that would have led to a more positive interaction between the Officers. The selected approach is demonstrated in a video clip (see Figure 46) and feedback is given based on the approach selected (see Figure 47).

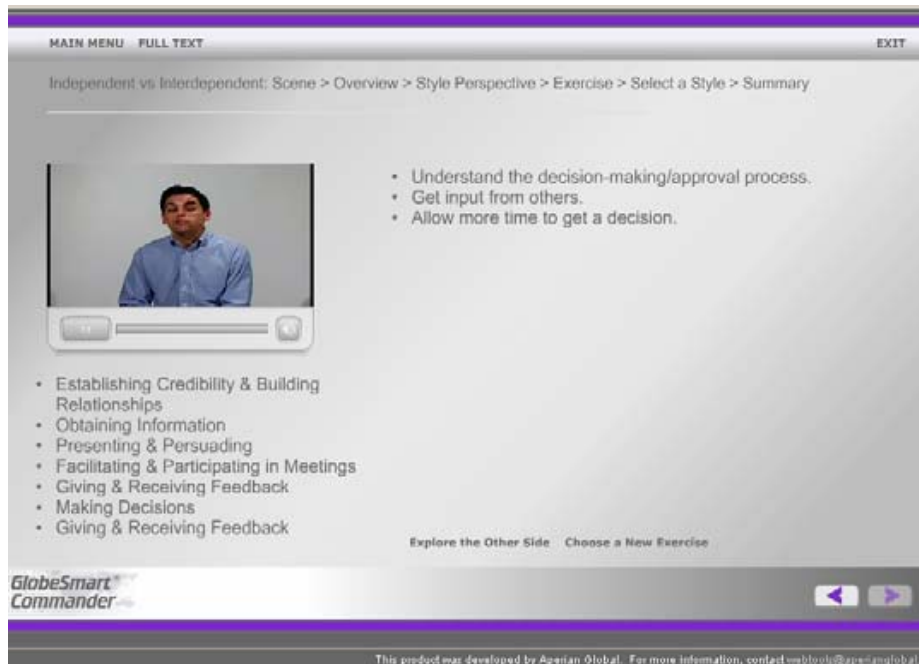


**Figure 45: Style switching exercise.**



**Figure 46: Feedback on style switching.**

The final component of the dimension module is a summary that includes advice on how to interact with others holding either perspective, in this case a task or relationship orientation (see Figure 48).



**Figure 47: Summary of the dimension.**

## 5.4 TECHNOLOGY TRANSITION

The GlobeSmart® Commander Cultural Awareness Training tool was transitioned to NATO HQ SACT with a letter addressed to Brigadier General Ernst Otto Berk, Joint Experimentation Exercises & Assessment. Software and supporting documentation, including installation instructions, accompanied the technology transition letter. A copy of the letter can be found in Appendix 3.





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## **Chapter 6 – 'Adaptability in Coalition Teamwork' International Research Symposium**

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Dr. Janet Sutton, U.S. Air Force Research Laboratory, 711 Human Performance Wing, USA

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Mme Danielle Pelat, RTA, Paris, France

**See Annex A for HFM RSY 142 Program**

**HFM-142 Symposium  
ADAPTABILITY IN COALITION TEAMWORK  
Team Track Out-Brief**

**Peter Essens, TNO, Soesterberg, The Netherlands**

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## **1.0 INTRODUCTION**

Coalition operations require multinational teamwork at increasingly lower levels of command. Collaboration and interaction between people from different backgrounds and cultures has proven to be an extra complexity in the handling the complexities of stabilisation and reconstruction operations. The HFM-142 Symposium on ADAPTABILITY IN COALITION TEAMWORK reviewed results of current, militarily relevant research in the domains of national culture and teamwork. In this out-brief an overview is given of the presentations on teamwork. In addition, we will review the discussion of pertinent issues in the research on coalition teams with some conclusion on the direction of research in this area.

## **2.0 OVERVIEW OF TEAM TRACK PRESENTATIONS**

In the team track there were twelve papers and three poster presentations. They covered assessments and interviews of operational experiences and laboratory studies with micro-world experimentations. Their central theme was how cultural diversity affects team factors and team performance.

- Anne Lise Bjørnstad presented studies on the interrelationship between organizational structure, process and flexibility, culture and trust (field studies - questionnaires, lab experiment) in particular related to power distance and uncertainty avoidance. There was some support to the hypothesis that high uncertainty avoidance predisposed people perceive organizational changes less positively. Support was found that culturally homogenous ad-hoc teams developed higher trust than culturally heterogeneous ad-hoc teams.

- Shawn Burke presented the results on the relationship between cultural orientation profiles and teamwork behaviours from twenty-two interviews with officers in a NATO Joint Exercise. (The profiles were Egalitarian – Status; Risk – Restraint; Interdependent – Independent; Short Term – Long Term; Direct – Indirect; Relationship – Task). Although these were unstructured interviews trends were identified supporting some of the proposed cultural orientation profiles. An egalitarian, interdependent, and direct orientation was found in descriptions of effective supporting behaviours. In addition, a direct orientation was found in descriptions of effective leadership/initiative behaviours.

- Rik Warren presented data analyses of effects of age, computer game experience & English proficiency in the NATO RTO HFM-138/RTG computer game (SABRE) experiment. He concluded that these are real effects which may present confounding effects in culture studies. If you take these effects out (with regression and ANCOVA) you find that the hypothesis that homogeneous-culture teams perform better than mixed-culture teams is not confirmed, the mixed performed better. Important is to realise that when comparing between nations there may be considerable variability within national teams.

- Peter Berggren compared methods for assessing team's shared situational awareness in dynamic situations (C3Fire). He found confirmation that shared situational awareness contributes to team performance, that individual situational awareness and shared situational awareness are correlated, and that shared situational awareness as degree of agreement is tapping into different aspects of shared situational awareness than when subjectively assessed.
- Fred Lichacz presented results from a study in a simulated multinational C2 headquarters 156 participants from eight countries on the impact of cultural differences on situation awareness and confidence. It was confidence rather than situation awareness that was correlated with the various dimensions of national culture and cognitive bias. All groups were overconfident, but the non-native English speaking participants were observed to be more confident in their responses than the native English speaking participants.
- Brian Prue presented a study on how to keep distributed teams synchronised. Distributed teams may have clear projection of command in terms of high level goals and the higher commander's plans. The question is how to avoid that these become disjointed for the teams. Common grounding is essential to keep these distributed parties aligned in interacting with the changing situations of the world.
- Shawn Burke presented a PC-based simulation study with two hundred thirty-four students in a realistic intelligence gathering and decision making task. They compared the effects of culturally homogeneous vs. heterogeneous teams (team composition) on team process and team adaptability related to tolerance for ambiguity (related to uncertainty avoidance); teamwork; meta-cognition; openness to experience. Main findings were that culturally homogeneous teams high in TOA made quicker decisions than heterogeneous teams. The commonly held assumption that diversity adds to quality was not confirmed in this task context - heterogeneous teams did not deliver higher quality decisions. Also, team composition did not significantly impact backing-up behaviour.
- Katia Sycara presented a development towards modeling human teamwork for automated decision support in distributed collaborative decision making in time-pressured, high-stakes situations, such as agent-assisted search operations. Based on behaviour of actual search and rescue teams and simulation experiments it was found that best opportunities for support were coverage of accidental holes in the search pattern due to poor execution of the search plan, and poor priority assignments.
- Fred van Ettinger presented initial results from the operational assessment of the NATO Response Force focussed on the level of networked collaboration. One conclusion was that despite a far from optimal technical environment this does not cause mission failure and a Command or Headquarter can still operate successfully due to the social and the knowledge network of the military. The social network, including leadership and positive culture, has to be explored for quick wins, momentum and future success.
- Matthieu Branlat talked about collaboration support in coordinating intelligence analysis perspectives. Lack of common ground between agents hampers coordination, especially in unpredictable and ambiguous situations. A concept was proposed for an analytic support tool designed to foster exploration, and preventing individual analysts from overly narrow and reductive analysis.
- Peter Essens presented a study on measuring command team effectiveness (CTEF), performed in the context of the NATO RTO Task Groups (HFM-087 and HFM-127). The theory-based model and instrument were developed to help commanders and teams to assess and maintain the team's potential for success during operations. In an operational application the assessment tool was filled out by the Netherlands amphibious planning staff on three successive occasions during an international joint exercise. The model and the instrument as means for feedback on their own performance were considered valuable and covering a relevant set of items. Negative was the perceived complexity of reflecting on own behaviour. A relevant observation was that in this lean-manned staff most participants were member of multiple teams which made the definition of team complex.

### **3.0 MAIN ISSUES ARISING FROM TEAM TRACK DISCUSSIONS**

Several issues that require specific attention in the study of cultural factors and teamwork were brought forward by the participants in the team track. The main issues were: Maturity of the concepts and theory; Ecological validity; Analysis of real life operations methodologies.

Whereas team theory has developed to maturity with a rich knowledge base the culture factor and team performance seems to be an undeveloped area. In one paper (#18, Burke cs.) this was clearly recognised: “The results reported herein just begin to scratch the surface of the interplay of cultural orientation, team composition, and the processes that lead to effective team performance.” This weakness of theory played clearly a role in the discussions on team and culture. Terminology was used in diverse meanings, e.g. people from different national cultures, from different organisations, culture as different values and beliefs, or habits, or ways of working. Despite the maturity of team research the precision in defining the level of the team was not always clear either, team as established closed group, student teams formed in two hours, initially ad hoc teams in multinational coalition exercises working together for some weeks, semi-permanent for 6 months, multi-team staffs, alliances. Also the level of command showed to be factor of confusion: tactical execution teams action oriented, command problem solving teams exchanging knowledge, and so on. A reference framework that addresses these dimensions is clearly needed in order to progress in this area.

In his key note address MG Van Loon referred to diversity of the coalition forces as one of the major complexities of coalition operations. He regarded diversity as a difficult reality, but also as an essential one to capture the diverse perspectives for making better, and well-supported operational decisions. In this he did not want to focus on the differences and caveats, but on the binding factors and opportunities. If we look from that perspective to the studies presented we see two main related issues: operational relevance and ecological validity. Operational relevance was the trigger that started the NATO Task Group HFM138. For continued relevance it seems to be important to maintain and renew an operational view and continue to observe and analyse the operational realities, these are continuously developing. In particular the idea of binding or positive factors might be a way to overcome the potentially dozens of variations of cultural obstacles that can be thought of. Ecological validity was discussed in relation to the use of microworlds or PC games that are being used in the reported studies. Concerns were there about the generalization and relevance of these experiments for addressing the “new complexities” of stabilisation and reconstruction operations. Although these research platforms are powerful tools and highly valuable for developing theoretical concepts and insights, equally important remains continued, systematic operational observation (case studies) as drivers, and application of theory in practice as test and evaluation of the concepts and behavioural insights.

In the line of understanding the complexities and operational practice there was discussion on: How can we measure in the field? Do we have sufficient (naturalistic) insight in the realities of the new complexities? What are the best methods for systematic and safe, and military supported, approaches of operational practice? Experiments in reality are rare, but not impossible. Case studies are a more common approach to social science of operational situations, however, too scarcely done for this problem area.

### **4.0 CONCLUSION**

The papers, presentations and discussions show that there is still substantial work to be done in theory building and understanding of operational realities. HFM-138 and the Symposium on Cultural Adaptability of Coalition Teamwork provide a strong milestone in this development. The sense is that the operational realities need to be analysed in further detail. This requires strong military support. That support can only be gained if the research is addressing actual operational issues including the commitment for participatory research – not bringing the military to the lab but the researcher to the field. Where HFM-138 started off with an operational issue identified in the field, in particular for the operational effectiveness of teamwork and collaboration in broader sense, the research community (and NATO RTO) should follow-up on that line and deepen their operational involvement and understanding and provide the field with practical directions, based on sound theory.

## **NATO HFM-142 Research Symposium on Adaptability in Coalition Teamwork CULTURE Track Summary**

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11 May 2008

The NATO Human Factors and Medicine HFM-142 Research Symposium on Adaptability in Coalition Teamwork was held in central Copenhagen, Denmark, on 21-23 April 2008, at the meeting facilities of the Ministry of Foreign Affairs at the Eigtveds Pakhus. The symposium included opening remarks on the afternoon of 21 April 2008, and then broke into two tracks of presentations, one labeled the CULTURE track, the other labeled the TEAMS track.

The CULTURE track presentations occurred all day Tuesday, 22 April 2008, and in the morning of Wednesday, 23 April 2008. A total of twelve papers were presented orally, as well as one poster. The presenters came from France, Malaysia, the Netherlands, Sweden, the United Kingdom, the United States, and all dealt with NATO-relevant issues. Broadly speaking, the papers and poster presented spanned three major types of topics:

- Presentations that highlighted the need for cultural awareness in the field.
  - A French Clinical Director for the German Hospital to Kabul: A Multinational Experience
  - Linguistic Sources of Coalition Miscommunication
  - Designing User Culturally Fit Interface for Globally Distributed Collaboration in Virtual Communities [poster]
- Presentations highlighting issues concerning cultural training.
  - Simulations Based Approach to Cross-Cultural Training for Higher Order Cultural Awareness
  - Bridging the Cultural Gap: A Cultural Framework as a Basis for Cultural Awareness Training
  - Predictive Modelling of Personality Traits – Implications for Selection of Operational Personnel
  - Multicultural Perspective-taking Competencies: A Conceptual Model and Training Tool
  - US/UK Cultural Differences in Mental Models of Planning
  - Culture, Politeness and Directive Compliance: Does Saying "Please" Make a Difference?
  - Can You Work With Me? The Effects of In-Group vs. Out-Group in Developing Swift Trust for Global Virtual Teams
  - Empirical Studies and an Explanatory Model of Cultural Differences in Goal Setting, Task Allocation, and Communication.
- Presentations concerning the psychometrics of various aspects of measuring culturally-relevant constructs.
  - Applying Unfolding Item Response Theory to Enhance Measurement of Cultural Norms
  - Measuring Cultural Cognitive Biases in Multi-national Research

The issues raised during the discussions and question/answer sessions in the CULTURE track revolved around the following:

1. How can we deal with the nested nature of behavior, in which behaviors are nested in contexts, which are nested in people with individual differences, who are nested in teams (oftentimes ad hoc in nature), who are nested in organizational cultures, which are nested in national cultures?

2. What is the different between adaptation and adjustment, and which is primary for our work?
3. What is cultural about cultural adaptability? Are we talking about general adaptational skills that we all have that are applied in cross-cultural contexts? If so, what are those culture-general skills, and what are the culture-specific knowledge, skills, and attributes that accompany and complement the culture-general adaptational skills?
4. What is the goal of cultural adaptation? Is it integration or assimilation? What are the minimal ingredients for ad hoc coalition teams coming together to work together effectively? And what is cultural about these ingredients?
5. What level of analysis is appropriate for the study of culture and its influence on adaptation? Are we studying cultural topographies or individual competencies? Is studying cultural level constructs appropriate? Or is it better to study individual level competencies, regardless of culture? And is any difference between any two or more people from different cultures a “cultural” difference?
6. What are the best ways to train cultural adaptability: (1) Do we raise awareness about cultures? If so, what aspects of them? Dimensions? Which ones? Norms? Values? Beliefs? Religions? or (2) Do we train competencies and, if so, which ones?
7. What are the goals of cultural adaptability? Does accomplishing missions equate to winning the hearts and minds of the local population? Do we want coalition teams to like each other? Accept each other? Are we talking about assimilation or integration?
8. How can cultural (and individual) differences in ad hoc coalition teams be leveraged in order to increase team effectiveness?

The questions that arose from the presentations and subsequent discussions are interesting because they highlight important questions that exist today that basic research on culture and its relationship with behavior has just begun to explore. It was impressive that these questions were generated from almost entirely field-based, applied studies that can be used to inform a tangible goal, either in the form of a training tool to aid in improving cross-cultural adaptability, or the changing of doctrine or standard operating procedures to achieve the same result. Some questions, such as those that concern the best way to model and analyze nested behavior, can be informed by recent developments in the modeling and statistical procedures literatures, such as the use of Multi-Level Random Coefficient Modeling (AKA Hierarchical Linear Modeling). Other questions can certainly be addressed by more basic research, such as those concerning the identification of individual knowledge, skills, attributes, and competencies that enable people to be, or become, more adaptive across cultures. Yet, there are some topics that can only be addressed in applied work in the field, especially those addressing the efficacy of models of cultural adaptation in high-stakes, ambiguous, and ad hoc situations. The presentations and discussion, therefore, make it clear that a multi-pronged approach to research involving combinations of basic and applied science is necessary to generate knowledge that will be utilizable in applied settings, either in the form of training or changes in operating procedures.

In summary, the CULTURE track of the HFM-142 Research Symposium on Adaptability in Coalition Teamwork raised many issues concerning contemporary operations and the operational environment that highlighted the need for continued, focused research on the areas described above. Moreover, it was clear that many of the answers needed to address the above issues did not exist in basic science research either; thus future research endeavors must include both a basic as well as applied perspective in addressing how to best improve the adaptability of coalition team members from different cultural backgrounds.





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## **Appendix 1 – Concept Whitepaper, March 2003**

### **Submitted to ACT CD&E Bi-Strategic Command Working Group**

#### **Leader and Team Adaptability in Multinational Coalitions: Cultural diversity in cognition and teamwork**

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#### ***Preface***

Battle command of military operations requires leaders and teams who are able to make decisions and respond in an appropriate, timely manner even in highly uncertain situations. The degree of situational uncertainty has continued to increase as military requirements have evolved in response to changing conditions around the world and advances in information systems that have made more information available, faster than ever before. The superior warfighting capabilities of the U.S. military forces have encouraged our adversaries to adapt their tactics, to operate as terrorists undermining the safety and security of the people in the U.S and the world. To respond to the terrorist threat, military forces must anticipate the unexpected and be prepared for the unimaginable. The people and organizations of the military must be adaptable and technology must enable their adaptability. Adaptability is both a proactive and reactive process and can be seen in what military forces do and how they operate. Information systems are a critical component of adaptable performance—especially of distributed, decentralized, yet highly interdependent military forces required to deftly transition from peacekeeping to warfighting to peacekeeping in collaboration with joint, interagency, and Alliance forces. Countering worldwide terrorism, keeping the peace, and responding to humanitarian crises are operations for coalitions. Experimentation is required to define the training requirements, organizational design, and information system requirements for adaptable performance of military coalitions.

In 2001, the U. S. Army Research Lab (ARL), specifically Dr. Linda Pierce, Dr. Janet Sutton, and Dr. Liz Bowman, engaged in a multidimensional research effort to improve adaptive military performance, both in U.S. and Allied coalition forces. They developed a theory of adaptive performance, an adaptive learning model, and tools to overcome identified barriers to adaptability. Their work initially focused on U. S. forces transitioning from warfighting to peacekeeping operations. They then expanded the adaptive performance spectrum to investigate cultural differences in cognition and teamwork in a multinational operation. Successful validation studies of adaptive performance tools and positive evaluations from leaders of the allied coalition in Bosnia-Herzegovina firmly supported the continuation and expansion of their research program.

ARL researchers identified barriers to adaptability in the training and knowledge components of military units preparing to transition to stability and support operations (SASO). In pre-deployment training exercises, a warfighting mindset interfered with learning how to conduct steady state operations in a peacekeeping environment. Other barriers to learning included the lack of meaningful participation by critical team

members from civil affairs, the international community, and multinational forces and an inability to control the training events to insure that there were consequences for mistakes and to provide opportunities for the participants to correct errors and practice “what right feels like.” Without a grasp of the basics, SASO expertise was slow to develop. Adaptable performance in SASO requires expertise in the art of influence, persuasion, and negotiation with international and national publics. Leaders and teams did not have the opportunity to experience expert decision making based on an accurate situational understanding. These vulnerabilities affected the individuals’ ability to work as members of multifunctional teams (for example, joint U. S., multinational forces, international community groups).

ARL used their model of adaptive learning to develop scenario-based computer training tools. These tools, known as *Simulations for Adaptability (Sfor Adapt)*, allow individuals and teams to make decisions and work together to solve problems they are likely to encounter in conducting peacekeeping operations.

The adaptive learning model was based on the notion that advanced cognitive learning is best served by the opportunity to solve problems while immersed in realistic challenging situations using an iterative process of practice and feedback, both individually and as part of a group. Learning environments were constructed that allowed problem solving in a group, in order to negotiate different viewpoints and gain equilibrium as a group. Learning that occurs in this context helped the learner(s) (both individuals and the team) remember and apply information in later novel situations.

The successful development of the Sfor Adapt tools spurred the investigation into cultural differences in cognition and teamwork in the coalition headquarters in Bosnia-Herzegovina, or Headquarters, Sustainment Force (HQ SFOR). Researchers concluded that cultural differences did exist, and a prototype cultural adaptability-training tool for use by multinational teams was developed, initially named “Training Adaptable Coalition Teamwork (TACT).” Research continued in Bosnia to more clearly link cultural cognitive dimensions and team performance functions. These efforts provide a valuable opportunity for the international research community to synchronize efforts to develop adaptive leaders and teams, an essential component in the development of the NATO Response Force (NRF).

The following topics are presented as the framework of the adaptive performance effort:

- **Cultural Adaptability:** The effects of cultural diversity in cognition and teamwork in multinational coalitions.
- **Measurement:** The development of team performance metrics suited to multinational coalitions.
- **Training:** The development of scenario-based computer SASO training tools for adaptive learning and enhanced team performance.

### *Executive Summary*

Multinational coalitions are a complicated assembly of leaders, teams, cultures, networks and systems. Not only must leaders and teams adapt in a rapid fashion to the military requirements of operations other than war, but they must also contend with many government and civilian agencies charged with non-military actions, such as diplomatic, information, and economic measures. This complex environment makes adaptive performance more critical than ever, yet the presence of adaptable leaders and teams continues to be elusive.

The development of adaptive performance in multinational coalitions can be rapidly advanced by the collaboration of researchers from the NATO alliance.. The U.S. research methodology, used as a foundation, can be refined, evaluated, and developed for multinational use. The following efforts are proposed as the building blocks of this program.

- Host a NATO alliance working conference to define research relevant to the adaptive performance effort.
- Develop research agenda and core research partnerships among NATO coalition partners.

Once the research group has been established, the following research objectives will support the development of a multinational adaptive performance program:

- **CULTURAL ADAPTABILITY.**
  - Refine framework that links cultural differences to teamwork dimensions to study performance in NATO alliance teams and guide development of methods and tools for adaptive performance
  - Identify, through research partner collaboration:
    - common understanding of cultural implications for teamwork
    - barriers, and underlying causes, to adaptive team performance through the investigation of alliance coalition exercises and test beds
    - current national processes in place to prepare leaders and teams for SASO deployments
    - adaptability potential provided by current national practices
  - Conduct team cognitive task analysis to assess extent to which social cognitive differences due to culture may be limiting team effectiveness
  - Further develop a cultural adaptability scale
- **MEASUREMENT.**
  - Reach common understanding of adaptive team performance
  - Develop a model of team performance applicable to coalition teamwork in coordination with U. S. and international researchers
  - Expand concept development of tools for measuring and predicting team performance
  - Develop adaptable performance metrics for application to multinational teams
- **TRAINING.**
  - Modify Sfor Adapt training tools for coalition use.
  - Enhance the TACT cultural adaptability tool for Alliance use
  - Formulate design recommendations for adaptable leader and team performance
  - Evaluate and refine methods to identify, measure, and train cultural adaptability in multinational teams.

## Concept Development and Experimentation Proposal

### *Cultural Adaptability*

Research on culture and individuals can be used as a point-of-departure to understanding the impact of culture on team processes. In a seminal research study, Hofstede (1980) identified cultural dimensions that he used to characterize national differences. The following cultural dimensions describe individual behaviour and cognition along a continuum: Power distance (the degree of inequality in power among members of a community), tolerance of ambiguity (how people deal with unpredictable situations), and individualism (how people define themselves by groups). Additional

Models, methods, and tools to promote development and maintenance of multinational and interagency teams for military operations will advance the state of the art in international cooperation regardless of mission (Klein, Klein, & Mumaw, 2001).

cultural dimensions relate to cognitive differences, for example, whether individuals think hypothetically or concretely, dialectically, and their ability to assess a variety of solutions to a problem.

Theoretical frameworks and models integrating culture to multinational teams and team leadership are limited, but growing. The need exists to leverage what is known about culture, teams, training, and leadership in order to provide a model of coalition teamwork and develop methods and information systems that recognize the importance of political, economic, social, and environmental factors in addition to military strategy. Additionally, knowledge on team adaptation should be expanded to maximize the effectiveness of multinational teams in the NATO Combined Joint Task Force (CJTF) and future NATO Reaction Force (NRF).

Proposed is an expansion of an on-going investigation into the impact of cultural differences on cognition and behaviour relative to team performance in a multinational military environment. Team models and theories to identify team process or organizational barriers unique to a military system will highlight the impact of several possible variables on team performance. These variables may include, but are not limited to, the presence of a military culture that transcends national cultural boundaries, organizational issues that arise from distributed teams and collaborative information technology, and cognitive differences in teamwork that can be attributed to culture. This program of research will also address training design requirements for adaptable leaders and teams.

### ***Measurement***

A team's performance will depend on many factors, such as team members' knowledge, skills, and abilities relative to a task or the team (Cannon-Bowers & Salas, 1997) and the team situational awareness, or understanding of a particular situation (Cooke, Stout, & Salas, 1997). Thus, team knowledge and methods to define and measure this concept have gained attention. Team knowledge can be characterized along several dimensions, to include mental versus situational models, homogenous versus heterogeneous knowledge distribution, the form of knowledge (declarative, procedural, strategic) or the content of knowledge (task work or teamwork) (Cooke, Salas, Cannon-Bowers & Stout, 2000).

One promising avenue of research for the elicitation of knowledge among team members is linguistic analysis (Cooke, 1994; Foltz & Wells, 1999; Foltz, Kintsch, & Landauer, 1998; Foltz, 1996; Rowe, Cooke, Hall, & Halgren, 1996). One variant of linguistic analysis, Latent Semantic Analysis (LSA), is a method of understanding the contextual meaning of words used in team communications using statistical analysis (Foltz & Wells, 1999). A successful and ongoing research project by New Mexico State University (NMSU) Psychology Department promises additional support for this effort. NMSU researchers are engaged in using PRONET as a method for identifying, describing, and representing sequences of complex behavior (Cooke & Gillan, 1999). This method uses the Pathfinder algorithm to analyze and represent behavioral sequences in a network and has been shown to be predictive of knowledge and performance (Gillan & Cooke, 2001). The improved understanding of multinational team knowledge structures and related team performance metrics are a critical component of improving adaptable performance within the NATO community.

## *Training*

U.S. researchers have developed two PC, web-based scenario driven training programs to build expertise among teams preparing to deploy to SASO environments. These tools enhance team performance through improved decision making, appropriate use of resources, and an accurate understanding of roles and responsibilities of key team members in peacekeeping environments. These programs, developed for U.S. forces, could be easily adapted for a NATO Alliance staff as a training program. Experimentation with U.S. forces pre- and post- deployment to Bosnia-Herzegovina showed conclusively that the transition from warfighting to peacekeeping was a very difficult process unsupported by adequate and realistic training (Klein & Pierce, 2002; Pierce & Klein, 2002; Pierce & Pomranky, 2001). The experience in Bosnia clearly showed that as the threat level changes, leaders and teams must be adaptable. These tools have been validated with U.S. officers and were shown to have good face validity and to improve the ability of officers to learn adaptive responses to SASO. Adapting these tools for multinational use will increase the adaptive learning potential for the NATO alliance.

## **PART ONE**

### **Operational Context**

#### 1.0 NATO desired operational capabilities

Multinational formations are a critical component of the NATO Strategic Concept. In an environment of continuous change, achieving leader and team adaptability improves the CJTF capacity to attain transparency between forces and achieve effective joint action (NATO 1991; NATO 1999b).

This program of research addresses cultural barriers to teamwork in a multinational coalition, team performance metrics based on the concept of team knowledge and situation awareness, and training issues. Each of these areas is mutually supportive and offers NATO opportunities to make significant advances toward adaptable and efficient CJTF and NRF leadership and teamwork. The theory, models, and training tools that result from this project will promote the development of adaptable systems, leaders and teams.

#### 1.1 Type of capability

The products resulting from this research project will include models and measures of team performance (to address cultural and organizational barriers), and training methods and tools to rapidly develop knowledge, skills, and abilities required for adaptable leaders and teams in the NATO alliance.

#### 1.2 Scope

Adaptive performance for leaders and teams will develop through identification of how cultural dimensions impact multinational teamwork, experimentation and testing of adaptive learning theory, models of teamwork, and computer assisted training aids. The timeframe for this experiment is envisioned as a multi-year effort, which will leverage ongoing research currently supported in ARL through the Science Technology Objective (ARL-1) and the Collaborative Technology Alliance (CTA), a research consortium comprised of government, university, and industry cognitive scientists. Efforts to expand this research effort to the NATO alliance will require additional funding.

#### 1.3 Status

The NATO Defense Capabilities Initiative (1999a; 2000a) and Lord Robertson's address to the Brookings Institution (Aviation Week & Space Technology, 2002) clearly indicate that the CJTF concept, though structurally sound, lacks the necessary doctrine, training, and shared system capabilities to achieve the

required level of interoperability for joint action by a highly integrated NATO coalition. This research program will provide the tools to develop these necessary leader and team adaptable performance capabilities, through the development of a multinational adaptive performance model, a clear understanding of collaborative team actions and techniques for measuring performance, and a comprehensive set of recommendations and tools for training adaptive leaders and teams.

## ***PART TWO***

### ***Operational Concept***

#### 2.0 Hypotheses

2.0.1 Cultural Adaptation. Cultural dimensions (power distance, uncertainty avoidance, and activity orientation) linked to team functions (situation assessment, coordination, roles and responsibilities, and supporting behavior) cluster to predict patterns of leader and team adaptability.

2.0.2 Measurement. The possibility exists to measure adaptable multinational team performance.

2.0.3 Training. Scenario-based training tools enhance leader and team adaptable performance.

#### 2.1 General Description

Developing adaptable leaders and teams for a multinational CJTF as described in this research proposal will be an iterative, knowledge building process. Central to the research effort is an improved understanding of multinational team cognition, including, but not limited to, cultural and organizational barriers to adaptation. Knowledge gained in this initial stage will allow the development of training tools to rapidly build expertise needed for adaptable leaders and teams operating in the CJTF or the future NRF.

#### 2.2 Relationship to other operational capabilities

Developing adaptive tools for leaders and teams in the CJTF or NRF poses no additional requirements on new or existing systems. These advancements would have significant impact on the NRF concept development, mandated at the Prague Summit (NATO 2002).

## ***PART THREE***

### **Assessment of military worth and R&D potential**

#### 3.0 Relevance to key capability needs

The need to improve leader and team adaptability in the CJTF is expressed within a number of NATO documents and initiatives.

##### The Combined Joint Task Forces Concept

- Establishes the concept of a CJTF for a multinational, multi-service deployable task force generated primarily for humanitarian relief and peacekeeping.
- The demands on leaders and teams within CJTF are recognized as considerable, resulting in a nuclei of core staffs established within the NATO military command structure



- Initial experimentation demonstrated the value of the CJTF concept. Current efforts are underway for full implementation, including the acquisition of command and control and communications equipment. These efforts imply the existence of adaptable leaders and teams.

#### Defence Capabilities Initiative

- Command and control and information systems must be better matched to requirements. A greater volume of information flowing to lower echelons of command and control create challenges to adaptability and interoperability, including doctrine, training and operational procedures, and the increased pace of technological change.

#### NATO Strategic Concept

- The integrated military structure necessary to sustain the NATO alliance is based on cooperation and coordination agreements, including collective force planning, common operational planning, and multinational formations. These agreements depend on the ability of leaders and teams to adapt to uncertain and complex conditions.
- The challenge of interoperability depends on increased transparency between national systems, mutual confidence and the capacity for joint action.

#### Prague Summit Declaration

- On 21 November 2002 NATO invited Bulgaria, Estonia, Latvia, Lithuania, Romania, Slovakia, and Slovenia to begin accession talks to join the Alliance. The introduction of new cultures and militaries to the NATO family will require leaders and teams to accommodate to the new entrants.
- An announcement was made of the creation of a NATO Response Force (NRF) consisting of a technologically advanced, flexible, deployable, interoperable and sustainable force. This force will be a catalyst in improving the Alliance's peacekeeping capabilities, but again, will challenge leaders and teams to recognize the effect of cultural diversity on teamwork.

#### 3.1 Exploits emerging technology

This proposal exploits the development of scenario-based computer training tools to rapidly develop SASO expertise among leaders and teams, while not new, is continuing to expand with the use of web-based technology to improve the conditions, settings, and application of the training.

#### 3.2 Likely impact on capability

Developing adaptive leaders and teams will enhance the ability of NATO alliance to operate the CJTF, NRF, or other military and non-military actions. Participating nations in this research effort will contribute to the NATO products and will also benefit their own nations' leader and team adaptable performance.

#### 3.3 Utility across several capabilities, missions, tasks

The attainment of adaptable leaders and teams will increase the capability of NATO to plan and conduct full spectrum operations. In the case of multinational peacekeeping operations, capability will also be generated in the ability to integrate political, military, economic, social, infrastructure, and information elements to contribute to stabilization of the local area.

### 3.4 Potential for collaboration

This project has great potential for collaboration. From the U.S., collaboration is possible from government, university, and industry researchers. Within the U.S. military, collaboration is possible with Joint Forces Command. Several countries are currently engaged in JFCOM research, and would likely contribute to research of this type. Those include Australia, Canada, Germany, the United Kingdom, and the U.S. This research effort should be expanded to include all NATO nations, if interested in participating.

### 3.5 Affordable (R&D, procurement, support costs)

Research costs are estimated at \$70K provided in yearly increments for three years to cover purchase of materials needed for experimentation, meeting facilities, and travel and allowances for scientists. This is a multi-year cost estimate, and anticipates a cost-sharing relationship among participating Alliance and Partnership for Peace members.

### 3.6 Implications for doctrine, training, personnel, organization, and materiel

Improving multinational team performance and developing training solutions for multinational team challenges offer opportunities for more adaptable leaders and teams in a CJTF. Recommendations would be forthcoming for training, selection of personnel, and organization of the CJTF.

### 3.7 Presence of other competing solutions

None.

### 3.8 Operational, practical limitations

Adaptive leader and team training programs resulting from this program of research must be low cost, easily modifiable, and usable with co-located or distributed teams.

### 3.9 Technical risk

No technical risk has been identified.

### 3.10 RED Team Vulnerability assessment

No RED Team vulnerability has been identified, nor is it required.

### 3.11 SUMMARY

The ability to predict adaptable performance in leaders and teams and the promise of improving alliance adaptability provide an opportunity for NATO to optimize the CJTF and NRF concepts. These goals, supported by a multinational research effort, will ensure that cultural and organizational requirements of participating countries are well represented in final models, metrics, and training tools.

## ***PART FOUR***

### **Preliminary Project Plan**

#### 4.1 Lead agency (POC) & Potential Supporting National and NATO bodies, POCs

ARL is the agency proposing the project and is willing to be the leading agency in the Feasibility Study Phase. This study phase would build a plan for future development and experimentation, to include invitations to nations and NATO commands and agencies to build a project team. The lead agency point of contact is Dr. Janet Sutton who will remain the project POC regardless of her agency affiliation. Victor Edelmann, NATO CDE Analyst, Allied Command Atlantic Headquarters, will act as Allied Command

Transformation point of contact. Participation is expected from military and civilian scientists who currently support military leadership in their own nations.

#### 4.2 Concept packages to be assessed

##### *Package 1: Cultural Adaptability.*

A theoretical framework for understanding the relationship between national cultural dimensions and team performance developed by ARL based on research conducted at HQ SFOR and MND (N) in Bosnia-Herzegovina. The framework would form the basis and define the scope of future collaborative research.

##### *Package 2: Measurement.*

Team performance metrics suited to a military multinational coalition. The initial plan is to use linguistic analysis techniques, though other techniques may also be considered.

##### *Package 3: Training.*

The Sfor Adapt toolkit and cultural adaptability scenario-based training tools.

#### 4.3 Tasks and responsibilities

Under Dr. Sutton's leadership, a team of human factors cognitive scientists from participating nations will

- Define cognitive requirements to work within multinational peacekeeping coalitions at the tactical and strategic levels
- Develop team performance metrics suitable to the multinational component of the CJTF and NRF
- Build on the theoretical understanding to develop training programs to prepare NATO nations to participate as members of cross-cultural, multifunctional, non-hierarchical teams

#### 4.4 Timelines

Timelines will have to be established by the Lead Agency when determining tasks and responsibilities. Current activities that will contribute to the proposed research effort. This research effort is anticipated as a multi-year effort, with anticipated conclusion in 2007.

#### 4.5 General outline of type and level of support for each contributor

Dr. Sutton, supported by Mr. Edelmann (HQ SACT), would manage the collaborative research process between U.S. and non-U.S. scientists. Initially, current observations of multinational teamwork at the sustainment force headquarters in Sarajevo, Bosnia-Herzegovina and theoretical research would be made available to multinational partners, including identified team, organizational, and cultural barriers to adaptable performance. Multinational research partners would contribute access to leaders and teams for research purposes, as relevant. Once research partners are identified, a discussion of resources and research venues would lead to a prioritized plan of research. This plan may have to be limited initially if fiscal resources are limited. During the first year, it is hoped that each participating nation will actively pursue national funding sources to support the research effort. Once research partners are identified, a division of labor will be proposed that will leverage existing research or national strengths presented by the ally. Possible activities include theory development, measurement tools and methods, model and simulation development, and concept development of specific tools for application to the CJTF and NRF.

#### 4.6 Contingent fallback if support reduced

The contingent fallback is to continue the program of research with Support and Stability Operations (SASO) within the U. S. frame of reference.

4.7 General outline of cost

This multi-year research project, as proposed, is expected to cost \$1,475,000 USD. This can be broken down into annual costs of \$70,000 each year from 2004 – 2006 and \$50,000 in 2007. Travel and allowances for the overall research effort and semi-annual working group meetings to plan and evaluate research efforts. These figures anticipate a cost-sharing arrangement among participating nations to cover concepts development, model development, metric and training tool development, and validation studies of research products. The activities will have to be scaled back if CD&E funds are not available. However, interested nations will be encouraged to pursue national funding sources during the first year in order to continue the program as scheduled in the 2004-2007 timeframe.

4.8 Summary of related CDE efforts in nations, NATO that can be tapped. To be determined at the exploratory meeting once concept is approved as a NATO CDE project.

**Appendix A – Project Plan Specifics**

<u>Research Task</u>	<u>Anticipated Work Activities</u>
Concept Development	<ul style="list-style-type: none"> <li>Refine framework of national cultural dimensions and impact on teamwork</li> <li>Develop a common understanding of cultural implications for teamwork</li> <li>Conduct inventory of national processes for leader and team development, assess adaptability potential</li> <li>Develop cultural adaptability scale</li> <li>Expand concept development of tools for measuring and predicting team performance</li> </ul>
Model Development	<ul style="list-style-type: none"> <li>Develop a model of leader and team adaptability based on the adaptive learning model that is relevant to multinational coalitions</li> </ul>
Metrics Development	<ul style="list-style-type: none"> <li>Develop metrics of adaptable performance for application to multinational teams</li> </ul>
Data Collection	<ul style="list-style-type: none"> <li>Identify common understanding of cultural implications for teamwork</li> <li>Identify barriers and causes of adaptive team performance through the investigation of multinational coalition exercises and test beds</li> <li>Identify current national processes in place to prepare leaders and teams for SASO deployments</li> <li>Identify adaptability potential provided by current national practices</li> <li>Conduct multinational experimentation to assess the extent to which social cognitive differences due to culture may be limiting team effectiveness</li> </ul>
Project Team Meetings	<ul style="list-style-type: none"> <li>Semi-annual working group meetings to set the research agenda and track progress toward achieving goals. Also to collaborate on research findings and share information among partners</li> </ul>
Validation Studies	<ul style="list-style-type: none"> <li>Studies to validate the usability and usefulness of</li> </ul>

cognitive tools to increase adaptability among leaders and teams

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### Appendix B – Resource Implications

It is highly likely that nations will be interested in contributing key research personnel to participate in this project due to its high degree of military relevance. However, without CD&E funding, it is unlikely that nations will be able to fund the level of financial support needed to effectively complete the project as proposed.

### Appendix C – Vulnerability Assessment

None

### Appendix D – Reference material

Aviation Week & Space Technology. (2002). What to expect at NATO's Prague Summit Heads of NATO nations. *Volume 157, 20*.

Cannon-Bowers, J. A. & Salas, E. (1997). Teamwork competencies: The interaction of team member knowledge, skills and attitudes. In O. F. O'Neil (Ed.), *Workforce readiness: Competencies and assessment* (pp. 151-174). Mahwah, NJ: Erlbaum.

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Klein, H.A., Klein, G., & Mumaw, R.J. (2001). *A review of cultural dimensions relevant to aviation safety*. Wright State University, General Consultant Services Agreement 6-1111-10A-0112.

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NATO. (1999a) Defense Capabilities Initiative. Press Release. Available on the web: <http://www.nato.int/docu/pr/1999/p99s069e.htm>.

NATO. (1999b) The Alliance's Strategic Concept. Press Release. Available on the web: <http://www.nato.int/docu/pr/1999/p99-065e.htm>.

NATO. (2000a). NATO's Defense Capabilities Initiative. NATO Fact Sheet. Available on the web: <http://www.nato.int/docu/facts/2000/nato-dci.htm>.

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Pierce, L. & Pomranky, R. (2001). The Chameleon Project for adaptable commanders and teams. *Proceedings of the Human Factors and Ergonomics Society 45<sup>th</sup> Annual Meeting, 513-517.*

Rowe, A. L., Cooke, N. J., Hall, E. P., & Halgren, T. L. (1996). Toward an On-line knowledge assessment methodology: Building on the relationship between knowledge and doing. *Journal of Experimental Psychology: Applied*. Vol 2,1 (pp. 31-47).

## Appendix 2 – RTO HFM RTG 138 Terms of Reference

### References:

- A. The Leader and Team Adaptability in Multinational Coalitions: Cultural Diversity in Cognition and Teamwork white paper dated 5 March 2003
  - B. NATO CDE Report #4 to the NATO Military Committee dated 2 September 2003
  - C. MCM-201-03 Bi-SC Report on Concept Development and Experimentation dated 4 December 2003
  - D. Exploratory Meeting held 23-25 February 2004 at NATO Headquarters
  - E. NATO CD&E project on Leader and Team Adaptability in Multinational Coalitions: Cultural Diversity in Cognition and Teamwork (LTAMC) dated 25 February 2004 (Revised Dec 2004).
  - F. HFM ET-049 Technical Activity Proposal
1. **Background.** In March 2003, the US Army Research Laboratory (ARL) Human Research and Engineering Directorate (HRED) wrote and submitted the concept at reference (A) for consideration as a potential NATO CD&E project. Its aim is to improve the ability of NATO Response Force Headquarters personnel to better perform command and control functions through the understanding of culturally based cognitive differences that impact multicultural teamwork. This concept was forwarded to the Military Committee via reference (B) and was subsequently approved as a NATO CD&E project on 4 December 2003 in reference (C). The ARL HRED multicultural program of research was presented to Dr. Robert Foster, OSD, in September 2003 resulting in a Technical Activity Proposal (F) submitted for consideration as a HFM Exploratory Team in October 2003. Reference (D) was planned for and then convened by the Headquarters, Supreme Allied Commander Transformation and the US Army Research Laboratory. Eight nations and NATO Headquarters, Supreme Allied Command Transformation sent representatives to this meeting. The nations were Canada, Germany, Greece, Norway, Sweden, Turkey, the United Kingdom and the United States. During the exploratory meeting, reference (E) was drafted. In accordance with reference (E), the nations notified the NATO CD&E Project Lead Analyst of their desire to participate or not to participate as a member of the team for this NATO CD&E project. The nations that decided to formally join the project team are Canada, Norway, Sweden and the United States. Greece and the United Kingdom are observers. Should other nations decide to join the project team, their project team composition and responsibilities will be annotated in an appendix to this document. All the aforementioned nations are members of the combined CD&E - HFM ET-049 project team.
  2. **Project Objectives.** To conduct multinational, collaborative experiments designed to capture knowledge about cultural factors for use in military modelling and simulation, system design, personnel selection, and officer training for the full range of Alliance military operations.
    - (1) **Area of research and scope:**
      - Teamwork adaptability
      - Social and cognitive cultural factors
    - (2) **Specific goals and topics**
      - Define cultural adaptability.
      - Generate research questions

## APPENDIX 2 – RTO HFM RTG 138 TERMS OF REFERENCE

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- Make a recommendation for a conceptual model of cultural adaptability for Alliance military operations
- Develop methods for experimentation
  - Design experiments
  - Generate reference scenarios
  - Develop process and outcome measures
    - Consider processes, organizations and technologies for study of cultural adaptability
- Establish testbeds for conducting collaborative experiments
  - National
  - NATO
- Recommend system design requirements
- Identify potential products that would enable cultural adaptability

**(3) Deliverables**

- ACT: Published report; GlobeSmart<sup>®</sup> Commander cultural awareness training tool
- RTO: Research Symposium

**(4) Duration**

- ACT: 3 years (Feb 2004 until Sept 2007)
- RTO: 3 years (May 2005 until April 2008)

3. **Purpose.** The aim of these Terms of Reference is to establish the project team, its responsibilities and contributions within the NATO RTO HFM project on “Adaptability in Coalition Teamwork,” which operates in tandem with the NATO CD&E LTAMC project. A timeline for these responsibilities and contributions will be governed by reference (E).

4. **General Agreements.**

a. Information Sharing.

- i. Research and experimentation information will be shared with all project team members and any NATO and PfP nations.
- ii. Although the project is currently unclassified, it may be necessary during concept development and experimentation to classify information. If this is the case, a NATO security classification will be assigned to the data/information to protect it from unauthorized access. In all cases when contemplating the classification of project information, the entire project team will be consulted to try to preclude members from potentially being excluded from viewing certain project information or data.

b. Resource Responsibilities. Each nation on the project team is responsible for financing its own personnel contributions, administrative costs, research facilities, and travel and per diem. Specific responsibilities in paragraph 5 of this document are the sole financial responsibility of the nation under which they are listed.

5. **Project Team Composition.** The project team will consist of:

a. United States

- i. Air Force Research Laboratory (AFRL): Dr. Janet Sutton, Chair; Dr. Rik Warren
- ii. Army Research Laboratory (ARL): Dr. Linda Pierce; Mr. Frank Morelli
- iii. Army Research Institute (ARI): Dr. Sharon Riedel



- iv. NAVAIR Orlando Training Systems Division (NAVAIR-ORL TSD): Dr. Joan Johnston; Dr. Phil Mangos
  - b. Canada
    - i. Canadian Forces Experimentation Centre (CFEC): Dr. Fred Lichacz
  - c. Norway
    - i. Norwegian Defence Research Establishment (FFI): Ms. Anne Lise Bjornstad
  - d. Sweden
    - i. Swedish Defence Research Agency (FOI): Dr. Erland Svensson; Ms. Jenny Lindoff; Lt Col Arne Worm, M. Sc. PhD
  - e. NATO
    - i. Supreme Allied Commander Transformation (HQ SACT): Mr. Van Edelmann; Mr. Pierre Marc; Mr. Bill Piersol; Dr. Nancy Hughes
    - ii. Research and Technology Organization (RTO) Human Factors and Medicine Panel: Dr. Robert Foster; Dr. Paul Chatelier
- 6. **Project Team Responsibilities.** Each of the following nations and the NATO organization agreed to contribute time, expertise and/or resources to this project. These contributions are:
  - a. United States
    - i. Dr. Sutton will manage the overall project plan
    - ii. Dr. Sutton will lead the development of and maintain the concept development and experimentation plan
      - 1. Oversee its execution
    - iii. Dr. Sutton will provide required scientific information to the NATO CD & E advisor to assist him in writing any requisite reports
    - iv. Dr. Sutton will act as the repository for all information on this project.
    - v. Other US team members will contribute to planning, execution and documentation of research.
  - b. All other project team nations
    - i. Will contribute to planning, execution and documentation of research.
  - c. NATO
    - i. Provide concept development and experimentation advise to the project team leader
    - ii. Secure funding
    - iii. Provide support for relationship development and research venues with international scientists interested in cultural based aspects of team development
    - iv. Facilities and meeting rooms as needed.
- 7. **Dissolution.** The terms of reference will be reviewed and if necessary, updated annually by the project team. The project team can be dissolved based on one of the following reasons:
  - a. The project team unanimously recommends dissolution due to lack of progress, material and/or funding.
    - i. A recommendation for dissolution would subsequently be made to the both the RTO HFM panel and HQ SACT.
  - b. The concept no longer appears to be feasible.
    - i. A recommendation for dissolution would subsequently be made to both the RTO HFM panel and HQ SACT.
  - c. On completion of the three year effort for ACT and RTO and delivery of a final report and research symposium, respectively.



## Appendix 3 – **GlobeSmart<sup>®</sup> Commander** **Technology Transmission Letter** (copy)

07 May 2007\*

Brigadier General Ernst Otto Berk  
Joint Experimentation Exercises & Assessment  
HQ, Supreme Allied Command Transformation  
North Atlantic Treaty Organization  
7857 Blandy Road, Suite 100  
Norfolk, VA 23551-2490

Dear General Berk,

The U.S. Army Research Laboratory (ARL) hereby extends use rights for the **GlobeSmart<sup>®</sup> Commander** cultural awareness training software to North Atlantic Treaty Organization Supreme Allied Commander Transformation headquarters (NATO HQ SACT). These rights are provided for NATO training purposes only, under the auspices of the Terms of Reference for the NATO Concept Development and Experimentation (CD&E) Project entitled Leader and Team Adaptability in Multinational Coalitions (LTAMC): Cultural Diversity in Cognition and Teamwork. Transfer of this product will facilitate the project's stated aim of improving the ability of NATO Response Force Headquarters personnel to better perform command and control functions through the understanding of culturally based cognitive differences that impact multicultural teamwork.

**GlobeSmart<sup>®</sup> Commander** was developed under a Small Business Innovative Research contract between the U.S. Army Research Laboratory (ARL) and Aperian Global, an international consulting company. This training tool is the primary deliverable for the "Leader and Team Adaptability in Multinational Coalitions" or **LTAMC** Concept Development and Experimentation (CD&E) project.

No training or support other than the documentation and training materials transmitted with this letter will be provided by either ARL or Aperian Global, with one exception. Aperian Global will provide original software which includes detailed documentation and on-line technical assistance to HQ SACT for 10 days after the effective date of transfer to ensure that the product is successfully installed on a NATO School host server. This date will be established by NATO and Aperian upon receipt of **GlobeSmart<sup>®</sup> Commander** at NATO HQ SACT. Any changes made to the hardware, software or content that adversely impact the functionality and use of **GlobeSmart<sup>®</sup> Commander** are not the responsibility of ARL or Aperian Global. Further, there are no licensing fees due to ARL or to Aperian Global.

Questions regarding **GlobeSmart<sup>®</sup> Commander** should be directed to Dr. Linda Pierce, **GlobeSmart<sup>®</sup> Commander** Project Manager ([lpierce@arl.army.mil](mailto:lpierce@arl.army.mil)), Ms. Debbie Patton, Learning with Adaptive Simulation Technologies Army Technology Objective (**LAST ATO**) Manager for the ARL Human Research and Engineering Directorate (HRED, [dpatton@arl.army.mil](mailto:dpatton@arl.army.mil)), or Dr. Janet Sutton, NATO **LTAMC** Project Manager ([janet.sutton@wpafb.af.mil](mailto:janet.sutton@wpafb.af.mil)).

I ask that you acknowledge receipt of this letter and your acceptance of its terms by signing as NATO representative on the endorsement below, and by faxing a signed and dated copy of this letter to "Mr. Frank

**APPENDIX 3 – GLOBESMART®  
COMMANDER TECHNOLOGY TRANSMISSION LETTER**

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Morelli (ARL-HRED)” (FAX #: 410.278.9523). These actions will constitute acknowledgement of acceptance of *GlobeSmart® Commander* by NATO HQ SACT.

Sincerely –

\_\_\_\_\_ Date \_\_\_\_\_  
Frank Morelli  
Research Psychologist | NATO LTAMC Member  
U.S. Army Research Laboratory, HRED

The undersigned NATO representative acknowledges receipt of this transition letter from the US Army Research Laboratory dated 7 May 2007 regarding the transfer of use rights for *GlobeSmart® Commander* to NATO HQ SACT for NATO training purposes and agrees to terms contained therein.

\_\_\_\_\_ Date \_\_\_\_\_  
FOR NATO:  
Brigadier General Ernst Otto Berk  
Joint Experimentation Exercises & Assessment  
HQ, Supreme Allied Command Transformation  
North Atlantic Treaty Organization  
7857 Blandy Road, Suite 100  
Norfolk, VA 23551-2490

\*The *GlobeSmart® Commander* software package, including all documentation, was delivered to Supreme Allied Commander HQ on 31 May 07, receipt signed by Ms. Melanie Whitney.

## Appendix 4 – Project Team Biographies

Listed alphabetically by last name are abbreviated biographies for the NATO ACT CD&E – RTO HFM-138 project team. Included are representative relevant publications. The intent is to give the reader insight as the scientific qualifications of the researchers.

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**Anne Lise Bjørnstad**, Research Psychologist

Norwegian Defence Research Establishment (FFI)

P O Box 25, 2027 Kjeller, Norway

[Tel] +47 63807746 [Fax] +47 63807212

[anne-lise.bjornstad@ffi.no](mailto:anne-lise.bjornstad@ffi.no)

Anne Lise Bjørnstad is a research psychologist in the Division for Information Management at the Norwegian Defence Research Establishment (FFI). She has been with FFI for 6 years and is currently working on two projects, LTAMC and FFI project 108401 *Network Collaboration – Experimentation* (SINETT). SINETT aims to study the new possibilities for collaboration allowed by current technological trends in both military and civilian sectors and advice the Norwegian Defence. SINETT started in 2007, continuing the work of project 879 *NEC in Operations*. This project conducted theoretical and empirical examinations of the NEC concept, linked to both technological and organizational developments. Bjørnstad has had an organizational focus in these projects, including the analyses of consequences for cooperation in military operations nationally and internationally. This overlaps with some of the aims of LTAMC where her work has focused on cross-cultural organizational issues linked to cooperation in international NATO headquarters.

Bjørnstad holds a *Cand.Polit.*<sup>50</sup> degree in psychology from the University of Trondheim (NTNU), Norway, where she specialized in cross-cultural organizational psychology. Her main research interests are within the areas of cross-cultural psychology, organizational psychology, decision-making and group psychology. At FFI, this expertise has mainly been directed at command and control (C2) and organizational issues related to the transformation of the Norwegian Armed Forces. She has focused on future military organizational designs enabled through technological advancements, including a focus on NEC and C2 issues, and has been involved in a number of activities and forums related to the development and analyses of the NEC-concept in Norway. She maintains a close cooperation with the technological research environment at FFI, into which she provides a human factor perspective.

Bjørnstad A L (2005). *Part I: Allied Warrior 2004 - Pilot study and analysis of cross-cultural organizational issues*. FFI/RAPPORT-2005/01709.

Bjørnstad A L (2006). *Part II: Allied Warrior 2004 - Pilot study and analysis of cross-cultural organizational issues*. FFI/RAPPORT-2006/00112.

Bjørnstad A L (2006b). *Battle Griffin 2005 – analysis of organizational processes*. FFI/NOTAT-2006/00211.

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<sup>50</sup> Cand Polit. is a Norwegian degree ranging between a Masters degree and a Ph.D

## APPENDIX 4 – PROJECT TEAM BIOGRAPHIES

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**Frederick M. J. Lichacz, PhD**, Experimental Psychologist

Canadian Forces Experimentation Centre

National Defence Headquarters

101 Colonel By Dr.

Ottawa, Ontario, Canada, K1A 0K2

Tel: +1 613-990-7626 Fax: 613-991-5819

[Lichacz.FMJ@forces.gc.ca](mailto:Lichacz.FMJ@forces.gc.ca)

Dr. Lichacz received his doctoral degree in Cognitive Psychology in 1998 from Carleton University in Ottawa, Canada and began his career as an Experimental Psychologist at Defence Research and Development Canada (Toronto) (nee Defence and Civil Institute of Environmental Medicine, Toronto) in 1998. His primary research interests focus on decision-making in both individual and team settings. Since 2002, Dr. Lichacz has been a member of the Science and Technology Team at the Canadian Forces Experimentation Centre (CFEC) in Ottawa, Canada, where he provides human factors support to CFEC's mission of leading the exploration of emerging joint operational concepts and the experimentation of capabilities supporting Canadian Forces transformation. In this position, Dr. Lichacz has developed and maintained a research program that focuses on the relationship between situation awareness and confidence within complex, distributed information-sharing environments. This work has been applied to the effects of sleep loss on performance, visual search, Uninhabited Aerial Vehicle operations, and distributed command and control settings. Currently, Dr Lichacz is the Canadian representative for NATO's HFM-138 LTAMC project and is also the Canadian Lead Analyst for Multinational Experiment 5.

**Lichacz, F. M. J.** (in press). Augmenting our understanding of the relationship between situation awareness and confidence using calibration and resolution techniques. *Ergonomics*.

Baranski, J. V., Thompson, M.M., **Lichacz, F. M. J.**, Pasto, L., McCann, C., Gil, V., & Pigeau, R. (in press). Effects of sleep loss on team decision making: Motivational loss or motivation gain? *Human Factors*.

**Lichacz, F. M. J.** & Farrell, P. S. E. (2005). The calibration of situation awareness and confidence within a multinational operational net assessment. *Military Psychology*, *17*, 247-268.

**Jenny Lindoff, Researcher**

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Jenny Lindoff currently works as a researcher at the Swedish Defence Research Agency (FOI) where she conducts research and development in the command and control domain. Miss Lindoff holds a Bachelors degree in Cognitive Science. She has worked at FOI for five years and has conducted research in several different domains and environments. Miss Lindoff has conducted studies with military personnel in operational settings, during large international command and control exercises as well as during controlled game based simulations. Miss Lindoff has also conducted research where military exercises have been combined with controlled experiments, which has proved to be very successful.

Miss Lindoff has worked with a wide range of research issue like dynamic decision-making in military command and control, performance assessment in complex environments, as well as studying the impact on team structures on decision-making and performance. Miss Lindoff has worked closely with the Swedish Armed Forces conducting studies to support the transformation towards a Network Based Defence. This year Miss Lindoff has been in charge of a large scale experimentation exercise at the Swedish Armed Forces Development Centre in Enköping. The exercise turned out to be very successful.

Miss Lindoff has also conducted several studies with the Swedish Air Force. Last year a comprehensive study was conducted in an Air Command Operations Centre in Uppsala, Sweden. The purpose of the study was to test and develop a repeated measurement technique to assess performance in complex environments. Third generation statistics were used to analyze the data from which a causal model was derived showing the relations between mental workload, individual performance and team performance. The Swedish Air Force was very pleased with this study and Miss Lindoff was personally invited to conduct a second study this year during real, rapid readiness ‘high alert’ operations.

Miss Lindoff is an active member of the NATO Allied Command Transformation Concept Development & Experimentation (CD&E) project, “Leader and Team Adaptability in Multinational Coalitions (LTAMC): Cultural diversity in cognition and teamwork”. Miss Lindoff has been in charge of conducting experiments with Swedish officers which is part of a large study that the LTAMC is conducting in six different countries. Miss Lindoff has also helped analyzing data from Allied Warrior 04 and Allied Warrior 05 which generated the Cultural Adaptability Model which is described in the proposal.

## APPENDIX 4 – PROJECT TEAM BIOGRAPHIES

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Dr. Mangos has performed applied research in personnel selection, measurement, training, and assessment. His basic and applied research efforts within the Naval Air Systems Command have focused on the development of adaptive, simulation-based training and skill assessment methodologies useful for customizing instructional content to the unique needs of the learner. His current program of work focuses on the application of psychometric theory to the development of scenarios in simulation-based training, focusing on data reduction methods and other techniques useful for scaling scenario content. His research is also addressing the measurement of team cognition within naval aviation and Command and Control teams, methods to explore, assess, and model patterns of shared cognition among team members (with particular emphasis on congruence with respect to procedural knowledge), and influences of these patterns on individual and team performance outcomes.

Highlights of his applied research and development efforts in the U.S. Navy include an analysis and revision of all Naval Flight Officer training curricula, training task analyses spanning all Naval Aviator and Naval Flight Officer training pipelines, and the development of assessment content for the primary Naval aviation training personnel selection battery. For this effort, Dr. Mangos led item development for 2500+ new assessment items and designed and executed a psychometric analysis and validation plan for the items. Dr. Mangos has also engaged in a number of large-scale efforts to develop personnel selection systems spanning multiple jobs and training domains, serving employees within the aviation, manufacturing, public safety, and intelligence domains. His research has been published within applied psychology journals (*Human Performance*) and presented at national conferences. He holds a Ph.D. in Industrial/Organizational and Human Factors Psychology from Wright State University.

Kozarcycki, M. P., Mangos, P. M., Johnston, J. H., Isaacson, J., McCoy, C., & Ogreten, S. (April, 2007). What will they be thinking? Developing cultural situational judgment tests. Paper presented at the 22<sup>nd</sup> Annual Conference of the Society for Industrial and Organizational Psychology, New York, NY.

Mangos, P. M., Johnston, J. H., & Littrell, L. (Forthcoming). Performance measurement issues and guidelines for adaptive, simulation-based training. To appear in D. A. Vincenzi & J. A. Wise (Eds.), *Human Factors in Simulation*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Mangos, P. M., Steele-Johnson, D., LaHuis, D., & White, E. D. (In Press). A multiple-task measurement framework for assessing maximum-typical performance. *Human Performance*.



**Linda Pierce, Ph.D.**

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Linda Pierce is Chief of the U.S. Army Research Institute-Aberdeen Proving Ground field unit. She leads a program of research to improve performance of networked teams and organizations. She has almost 20 years of experience conducting research on collaboration and decision making in battle command teams. In a previous position at the U.S. Army Research Laboratory she initiated ground-breaking research on coalition operations working in Bosnia-Herzegovina with NATO forces at combined force headquarters and the Singapore Center for Military Experimentation. This work has resulted in methods and tools to support and evaluate multinational teamwork in peacekeeping operations and is influencing the direction of socio-cultural research in military operations. Her current research focus areas include the design, training, and support of joint, interagency, and multinational teams; understanding the dynamics of multi-team systems; and developing and evaluating a framework of automation reliance in networked teams. She is the ARI lead for the multi-agency Tactical Human Integration of Networked Knowledge Army Technology Objective. She earned her PhD from Texas Tech University in 1987 and has authored or coauthored more than 50 journal articles, book chapters, and conference proceedings.

Burke, S., Pierce, L., & Salas, E., Eds. (2006). *Advances in human performance and cognitive engineering: Vol. 6. A prerequisite for effective performance within complex environments*, Amsterdam: Elsevier.

Dzindolet, M.T., Pierce, L.G., & Dixon, M.W. (in press) *Augmenting Multi-Cultural Collaboration*. In P.A. Hancock & J.L. Szalma (Eds.). *Stress and Performance*. Ashgate.

Pierce, L., & Dixon, M. (2006). *Improving multi-cultural teamwork to combat terrorism*. NATO RTO-MP-SCI Panel Workshop-174, *Tactical Decision Making and Situational Awareness for Defence Against Terrorism*, <http://www.rta.nato.int/>.

## APPENDIX 4 – PROJECT TEAM BIOGRAPHIES

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As a defense scientist for the U.S. Army Research Laboratory, Mr. Morelli has conducted empirical research supporting system design and development for the U.S. Department of Defense Future Force Warrior (FFW) and Future Combat Systems (FCS) programs. He has also conducted basic research using immersive simulation to evaluate human visual tracking and identification capabilities under stress. A primary research focus has been the systematic exploration of the relationship between stress response and measures of attention and perception. Using paradigms that test the human visual ability to track and identify multiple moving items at once, his ongoing research attempts to address the impact of stress upon basic cognitive and attentional processes characteristic to tasks commonly encountered during peacekeeping, force protection and combat operations. Given the disproportionate distractor-to-target ratio intentionally employed within his multi-element tracking paradigms, this work holds special relevance to operations that take place in urban settings, where potential for non-combatant interference is elevated. The research has design implications for advanced C4I systems, where the limits of situational awareness may be taxed by processing multiple inputs while concurrently distributing information to relevant parties within the operational landscape.

Related work also focuses upon the relationship between stress and perceptual learning effects, multimodal processing (e.g., visual, auditory and haptic), and the impact of crossmodal processing upon cognitive and psychomotor performance. Ongoing efforts include research on the detection of human behavioral threat signatures based on biological motion cues (e.g., complex and purposeful human motor activity such as gait, posture, and gestures), and the development of a social network analysis capability for the Army Research Laboratory.

Morelli, F. & Burton, P.A. (2006). The Impact of Induced Stress upon Selective Attention in Multiple Object Tracking. *Military Psychology* (in press).

Morelli, F. & Burton, P.A. (2006). Visuomotor processing, induced stress and perceptual learning. *Proceedings of the 25th Army Science Conference*, Orlando, FL.

Burton, P.A. & Morelli, F. (2006). The effect of stress on crossmodal interference during visual search. *Proceedings of the 25th Army Science Conference*, Orlando, FL.

**Sharon L. Riedel, PhD**, Research Psychologist

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One of Dr. Riedel's major research interests is in developing training in critical thinking for military leaders and teams. Her critical thinking projects developed a conceptual model for critical thinking, identified eight high payoff critical thinking skills for Army officers, and developed and evaluated web based training for the critical thinking skills. The conceptual model and eight critical thinking skills have been taught in the major blocks of instruction at the U.S. Army's Command and General Staff Officers' Course. Another area of research interest is facilitating the effective performance of multinational teams and team leaders. In the area of multinational team communication, she has developed and tested training in communication skills for SFOR multinational teams at Camp Butmir, Sarajevo. In addition to membership on HFM -138/LTAMC, Dr. Riedel also has an appointment to the HFM-120 research task group, titled 'Exploration of the Areas of Multinational Operations and Inter-Cultural Factors.' The purpose of this group is to increase awareness and understanding of the impact of inter-cultural factors on multinational military operations. One of the group's projects is a literature review that examines the applied and theoretical knowledge on diversity in the areas of human culture, organizations and technologies relevant to effectiveness in multinational military missions.

Adelman, L. & Riedel, S.L. (1997). *Handbook for the evaluation of knowledge-based systems: Conceptual framework and compendium of methods*. Boston, MA: Kluwer Academic Publishers.

## **APPENDIX 4 – PROJECT TEAM BIOGRAPHIES**

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Dr. Sutton's research focus is on development of methods and systems to promote rapid formation of effective leaders and teams at the operational level. A major component of the research is the investigation of individual differences (for example, personality, leadership characteristics, cognitive styles) and of group differences (for example national, organizational, and military culture) for the purpose of identifying the knowledge, skills, aptitudes, and abilities required for one to adapt, as necessary, to ensure mission success. She conducts research in the laboratory and in field settings to advance the development and evaluation of military concepts and technology. For HQ Supreme Allied Command Transformation, Dr. Sutton is the project lead for the 2004 – 2007 Concept Development and Experimentation experiment titled 'Leader and Team Adaptability in Multinational Coalitions' or LTAMC. The associated body of research is a collaborative effort with the NATO Research and Technology Organization Human Factors and Medicine Panel, where Dr. Sutton is the Chairperson for the HFM-138 Research Task Group titled 'Adaptability in Coalition Teamwork.' Dr. Sutton is a charter member of the RTO Human Factors and Medicine Exploratory Team #067, 'Improving the Effectiveness of Coalition Headquarters for Multinational Operations,' where she continues to advance the concept of Adaptability, and specifically Cultural Adaptability, as a core competency for military operations.

For the U.S. Air Force Research Laboratory, she co-manages development of the Situation Authorable Behavior Research Environment (SABRE), a game-based testbed designed to evaluate the impact of individual and group differences at the individual, dyad, and team level. In addition, she works with the U.S. Army Research Laboratory (ARL) on development of a tactical for managing social interactions between U.S. military and non-Western civilians. She has, also, worked with ARL to provide Human Factors support to the Field Artillery Center & School and the Depth & Simultaneous Attack Battle Lab.

Sutton, J.L., Cosenzo, K.A., Pierce, L.G. (2004). Influence of culture and personality on determinants of cognitive processes under conditions of uncertainty. *Proceedings of the 9th International Command and Control Research and Technology Symposium*. Copenhagen, Denmark.

Sutton, J.L., & Gundling, E. (2005). Enabling Cultural Adaptability. In C.A. Rodriguez & R. Poisson (Chairs), *Strategies to maintain combat readiness during extended deployments – A human systems approach*. Symposium conducted at the HFM-124/RSY, Prague, Czech Republic.

Sutton, J.L., Pierce, L.G., Burke, C.S., & Salas, E. (2006). Cultural Adaptability. In *Advances in Human Performance and Cognitive Engineering Research, Vol 6: Understanding Adaptability: A Prerequisite for Effective Performance within Complex Environments*. ISBN 0-7623-1248-3

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Erland Svensson, Ph.D., is director of research at the Swedish Defence Research Agency (FOI), and professor at the University of Linköping. He has been head of the department of Man-System-Interaction (MSI) at Swedish Defence Research Agency, and deputy director of institute of Aviation Medicine at FOA. He is responsible for, and active in research programs directed towards human factors aspects within NCW in laboratory and operational settings. As a clinical- and military psychologist, Dr. Svensson has worked with functional psychometric principles, and he has experience in personality- and vocational testing for military selection. Dr. Svensson is Swedish PFP-representative and observer of NATO RTO Human Factors and Medicine Panel. He is PO for co-operative activities between USAF/RL and FOI/FMV on operator functional status assessment and adaptive aiding implementation. He is POC, and member of the theme group on Human-Cognitive-Social-Sciences in tri-lateral co-operative activities between the Netherlands, Canada, and Sweden, and POC in bi-lateral co-operations on Human Factors between United Kingdom and Sweden. Dr. Svensson is appointed by EC as an expert for examination of research applications on human factors within the EC research programs. Dr. Svensson is governmental expert in European Defence Agency (EDA). He has been project leader within GARTEUR, and in EC-projects.

Dr. Svensson is a member of the Royal Aeronautical Society, London, and member of the Swedish Society for M.P.s and Scientists. He is member of the board of the Swedish Society for Human Factors (HFN). He is secretary of the board of the Swedish Aviation and Naval Medical Association, and member of the Aerospace Medical Association. He is member of the Human Factors and Ergonomics Society. He is member of the committee for the Swedish-American Workshop on Modelling and Simulation. Dr. Svensson has been faculty opponent at doctoral dissertations at four universities. He has been tutor for three doctors, and is tutor for three candidates for the doctorate at the University of Linköping.

Svensson, E., Angelborg-Thanderz, M., Sjöberg, L., & Olsson, S. (1997). Information complexity –Mental workload and performance in combat aircraft. *Ergonomics*, 40, 362-380.

Svensson, E., Angelborg-Thanderz, M., & Sjöberg, L. (1993). Mission challenge, mental workload, and performance in military aviation. *Aviation, Space, and Environmental Medicine*, 64:985-991.

Svensson, E. (1997). Pilot mental workload and situational awareness - psychological models of the pilot. In Flin,R., Salas,E., Strub, M., & Martin, L. (Eds.) *Decision Making under Stress. Emerging Themes and Applications*. Aldershot, Hampshire, England: Ashgate.

## APPENDIX 4 – PROJECT TEAM BIOGRAPHIES

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Dr. Warren's current duties are to develop, manage, and serve as a Technical Advisor to programs on the effects of societies, crowds, culture, and personality on cognition and individual and group decision making. He develops mathematical models of cultural effects on cognition; models of culturally influenced communication effects, and models of cultural conflict and cooperation. He is the Program Manager for (1) the Rosetta Project which is developing a low-technology test-bed for multicultural research on cognition and features data collection in China, India, Japan, Korea, Malaysia, as well as America; (2) SABRE: A game-based testbed for culture and personality research (with Dr. Janet Sutton); and (3) A mathematical model of dyadic-based cultural conflict & cooperation. His NATO Activities include being a member of HFM-138/LTAMC.

Previously, Dr Warren was the Associate to the Chief Scientist for Human Effectiveness of the Air Force Research Laboratory (1998 - 2004). He serves on the editorial boards of the International Journal of Ecological Psychology and the International Journal of Aviation Psychology. He is a member of the Psychonomic Society, the International Association for Cross-Cultural Psychology, and the International Society for Ecological Psychology.

He holds a PhD in Experimental Psychology from Cornell University. In Addition to culture, his interests include perception and language. He edited (with Alex Wertheim) *Perception & Control of Self-Motion* which was published by Erlbaum Associates in 1990.

*Perception & control of self-motion* (1990). Edited by Rik Warren and Alex H. Wertheim. Hillsdale, NJ: Erlbaum Associates.

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Capt (Bul-N) Yanakiev has a PhD in Sociology from the Institute of Sociology, Bulgarian Academy of Sciences, Sofia (*Thesis: 'Quantification of Categorical Survey's Data: Application of Optimal Scaling Methods'*). He works in the area of Sociology of the Military, which is the changing patterns of military organization, new military missions and the challenges of the military professionalism, public opinion and security policy; cultural challenges in multinational coalitions; and diversity issues in the military. He has expertise in methodology of qualitative and quantitative sociological surveys such as data processing and analysis, social science measurement, scales and indexes construction, social science data archiving and implementation of comparative analyses.

Position held include (1) National representative for Bulgaria on the NATO RTO Human Factors and Medicine Panel (2007); (2) Chair of the HFM Exploratory Team #067, titled 'Educating Adaptable Military Leaders and Training Teams for Improved Coalition Operations' (2006); (3) Senior Research Associate (Sociology), High Commission of Attestation, Council of Ministers of the Republic of Bulgaria (2001); (4) Research Fellow, University of Cologne, Central Archive for Empirical Social Sciences, Germany (*Thesis: 'European Public Opinion and the Development of the Common European Security and Defence Policy: Comparative Analysis of West and East European Public Perceptions'* (1990-2000)); and (5) International Partnership for Peace Research Fellow, NATO Defence College, Rome, Italy (*Thesis: 'Military Co-operation in South Eastern Europe and the Future of Multinational Peace Support Operations'* (1999)).

Yanakiev, Yantsislav (2000). *Military Co-operation in South Eastern Europe and the Future of Multinational Peace-support Operations*. NATO Defence College Monograph Series, Rome, Spring 2000. Available also in INTERNET: <http://www.ndc.nato.int/publications>, p. 178

Rachev, Valeri and Yanakiev, Yantsislav (2003). *Warriors in Peacekeeping: Points of Conflict in Complex Cultural Encounters: The Case of Bulgaria/ In: Warriors in Peacekeeping: Points of Conflict in Complex Cultural Encounters*, Jean Callaghan and Mathias Scheoenborn (Eds.), Muenster, Hamburg and Berlin: LIT VERLAG, Piscataway, New Jersey: Transaction Publishers, Published also in Russian "*Солдаты в миротворческих операциях*", The Diplomatic Academy of the Russian Federation.

## APPENDIX 4 – PROJECT TEAM BIOGRAPHIES

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## Appendix 5 – Annual Reports

### A5.1 2005 ANNUAL REPORT (REVISED FEB 2005)

#### Short Annual report:

This annual report presents the work completed in 2005 by the HFM-138 “Adaptability in Coalition Teamwork” research task group and the ACT CD&E “Leader and Team Adaptability in Coalition Teamwork (LTAMC)” research group. Membership in these groups is mutually inclusive. The combined HFM-138/ACT CD&E program of research follows the CD&E process and is reported as a project for both the RTO and ACT. A glossary of acronyms is included at the end of this report.

#### HFM-138/LTAMC Achievements:

- The utility of a web-based venue for cultural adaptability training at the operational level was assessed to be viable.
- Baseline data, collected at a NATO CPX, contributed significantly to the development of a web-based training tool.
- A three-factor causal model was developed that identified critical aspects of cultural adaptability, cognitive readiness, and personality affecting teamwork at the operational level.
- A collaborative relationship was established with RTO SAS-053.
- An organizational questionnaire that utilized data collected at a NATO CPX was developed by the Norwegian Defence Research Establishment (FFI). The questionnaire addresses group roles and processes, organization, decision-making, information sharing, language, identity, and culture and will be used by HFM-138/LTAMC team members in future research.

#### HFM-138/LTAMC 2005 Products:

1. A draft paper titled “Data reduction and modelling by means of factor analysis (FA), multidimensional scaling (MDS) and structural equation modelling (LISREL)” was written that explained the statistical methods used to analyze data collected at the DJTF for AW04.
2. A paper titled “Leader and Team Adaptability in Multinational Coalitions (LTAMC)” introduced the HFM-138/ACT CD&E program of research at the 10<sup>th</sup> International Command and Control Research and Technology Symposium.
3. A paper titled “Enabling Cultural Adaptability” introduced a technology solution, GLOBESMART<sup>®</sup> COMMANDER, to the difficulties inherent in multicultural teamwork staffs at the HFM-124 Symposium on Strategies to Maintain Combat Readiness on Extended Deployments: A Human Systems Approach.

#### HFM-138/LTAMC 2005 Activity:

- January:
  - A revised TAP and TOR was submitted for consideration of transitioning HFM ET-49 to a RTG.
  - Dr. Sutton and Mr. Edelmann attended a meeting in San Francisco, CA USA to provide oversight for the GLOBESMART<sup>®</sup> COMMANDER tool underdevelopment by ARL HRED and MeridianEaton Global, an international consulting company. GLOBESMART<sup>®</sup> COMMANDER is a web-based tool designed to train cultural adaptability at the operational level.
  - Dr. Sutton attended a meeting with BBN Technologies in Boston, MA USA to discuss the feasibility of using SABRE, a game-based tool designed to study teamwork in co-located or distributed teams, for HFM-138/ACT CD&E national experimentation.
  - A teleconference using a web-based meeting tool (WebEx) was attended by members and guests from Canada, Norway, Sweden, and the United States. At that meeting, Dr. Paul Chatelier briefed on the role of the RTO in supporting the core research program and on the respective roles of the RTO HFM Panel and ACT in

## APPENDIX 5 – ANNUAL REPORTS

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regard to EBO experimentation. Dr. Erland Svensson presented preliminary results from data collected at the DJTF for AW04.

- February
  - Dr. Sutton and Mr. Edelmann held a budget review meeting in Lawton, OK USA to establish the 2005 calendar year expense plan for \$55K in financial support from the ACT CD&E program.
  - Dr. Sutton attended a SAS-053 meeting in Orlando, FL USA as a newly appointed member and presented the HFM-138/ACT CD&E program of research. SAS-053 was created to define and develop a prototype Virtual Institute (VI) for the purpose of supporting model development and multinational collaborative experimentation on military-related groups and organizations.
- April
  - A face-to-face meeting to be held at the Swedish Defence Research Agency, Linkoping, Sweden was cancelled due funding issues. These issues were later resolved, though a meeting in Sweden was not held in 2005.
  - Scientists at the Swedish Defence Research Agency completed analysis of data collected at AW04 and wrote a draft paper (*see Achievement #1*) presenting preliminary results.
- May
  - Dr. Sutton and Mr. Edelmann attended a meeting in San Francisco, CA USA to provide oversight for the GLOBESMART<sup>®</sup> COMMANDER tool.
- June
  - Dr. Sutton presented a paper (*see Achievement #2*) in McClean, VA USA at the 10<sup>th</sup> ICCRTS.
  - A planning meeting, attended by members and guests from Canada, Norway, Sweden, the United Kingdom, and the United States, was held at ACT headquarters in Norfolk, VA USA. At that meeting, representatives from Meridian Eaton Global discussed design and content GLOBESMART<sup>®</sup> COMMANDER and BBN Technologies demonstrated the utility of SABRE for HFM-138/ACT CD&E research. RTG members brainstormed potential research questions and hypotheses for national experimentation, ultimately deciding that the project's research question should remain broad (i.e., What is the impact of culture on teamwork?), whereas hypotheses should be specific to the interaction of cultural variables and team task functions such as information sharing, coordination, assignment of roles and responsibilities, and support behaviour. Additional areas of interest are the exploration of the relationship between culture and teamwork with regard to confidence in decision making, trust, situation awareness, language, and organizational structure. Results of organizational data collected at the DJTF for AW04 were presented by our Norwegian member who plans to utilize the information in development of an organizational questionnaire.
- July
  - The FPC for AW05 was held in Carcavalas, Portugal. Dr. Sutton and Mr. Edelmann participated in planning meetings there, led by JWC, for the purpose of defining requirements for HFM-138/ACT CD&E experimentation to be embedded in the CPX.
- September
  - HFM ET-49 officially transitioned to HFM-138.
  - Dr. Sutton and Mr. Edelmann attended a meeting in San Francisco, CA USA to provide oversight for the GLOBESMART<sup>®</sup> COMMANDER tool.
- October:
  - Dr. Sutton presented a paper (*see Achievement #3*) in Prague, CZE at the HFM-124 Symposium.
  - Survey data was collected at Joint Command-Lisbon as Phase 1 of the AW05 experimentation plan. These data will be used to validate the causal model of cultural adaptability developed from AW04 data. Results of analysis should be available by May 06.
  - Dr. Sutton attended a SAS-053 meeting in The Hague, NE to discuss HFM-138/ACT CD&E experimentation progress and results-to-date with team members. Discussions at this meeting resulted in the decision to test the VI concept with an experiment based on HFM-138/ACT CD&E research using the SABRE tool. It was further discussed that findings from the experiment can potentially provide input to the SAS-050, "Conceptual Model of Command and Control," HBR model component titled "Team Characteristics and Behaviours."

[Note: SAS-050 is a follow-on study to SAS-023 which developed the Code of Best Practices for assessment of C2. A series of experiments is planned to test some of the hypotheses their model.]

- November
  - Limited cultural training was provided to a target group of officers at the DJTF for AW05 in Montijo, Portugal as Phase 2 of the experimentation plan.
- December
  - Observation and interview data was collected from a target group of officers at the DJTF for AW05 in Montijo, Portugal as Phase 3 of the experimentation plan. Anecdotal evidence of culturally based behaviour associated with information sharing, coordination, and support behaviour of individuals from multiple cultures who must work together to achieve specific goals in a stressful environment was obtained. Insights obtained have direct applicability to content development of the GLOBESMART<sup>®</sup> COMMANDER tool.
  - ACT CD&E project management responsibility transferred from Mr. Van Edelmann to Mr. Pierre Marc. A conference call with Dr. Sutton, Mr. Marc, and ACT analysts was held to discuss HFM-138/ACT CD&E participation in MNE4.

Way Ahead In 2006, research supporting the HFM-138/ACT CD&E project is currently scheduled to occur at MNE4 (Feb Mar) and Steadfast Jaw (Nov – Dec). Additionally, national experimentation using the SABRE research tool will be conducted in Canada at the Canadian Forces Experimentation Centre, in Norway at Norwegian Defense Staff College, and in the United States at the Air Force Research Laboratory. Of critical importance will be to determine how to transition, and begin the process of transitioning, the GLOBESMART<sup>®</sup> COMMANDER tool to NATO training venues. //END OF REPORT

## **A5.2 2006 ANNUAL REPORT**

### **I. INTRODUCTION**

Dates and places of meetings: 17-19 May 2006, Stockholm, Sweden  
12-14 October 2006, San Francisco, California USA

Changes [from 2005 Annual Report] in team composition:

Level of participation by Partner nations in open events: 100% (Full participation)

General useful information:

1. HFM-138 operates concurrently as a Concept Development and Experimentation (CD&E) program with Allied Command Transformation headquarters (ACT). Whereas the title for the RTO effort is “Adaptability in Coalition Teamwork,” the title for the ACT program is “Leader and Team Adaptability in Multinational Coalitions” or LTAMC. The combined effort, often referred to as HFM-138/LTAMC, follows the CD&E process and is reported as a project for both NATO entities.
2. In this report, reference is made to the GlobeSmart<sup>®</sup> Commander cultural awareness training tool. This is a web-based, self-paced training designed for officers who will, at some point in their career, take a NATO assignment. The tool was developed under a U.S. Army Small Business Innovative Research contract for the Army Research Laboratory with considerable content input from the HFM-138 effort. GlobeSmart<sup>®</sup> Commander is the primary deliverable to ACT.
3. In this report, reference is made to the Leader and Team Adaptability in Multinational Coalitions or LTAMC multinational experiment. This experiment investigates the relationships among culture, information sharing,

## APPENDIX 5 – ANNUAL REPORTS

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situation awareness, and team performance using a game-based testbed called SABRE (Situation Authorable Behavior Research Environment). There are two parts to the experiment: Part 1 is conducted with culturally homogeneous 4-person teams of military officers and Part 2 is conducted with culturally heterogeneous 4-person teams of military officers. HFM-138 nations participating in this large scale experiment are Bulgaria, Canada, The Netherlands, Norway, Sweden, and the United States.

### II. STATUS OF ACTIVITIES

Major achievements for 2006 and assessment of the work plan:

1. Norway developed a questionnaire to enquire about organizational issues relevant to the HFM-138 focus. This questionnaire was used to collect data during the NATO Allied Warrior 04 exercise from the NATO Response Force (NRF) Deployable Joint Task Force (DJTF) and during a NATO winter exercise, Battle Griffin 2005.
  - Finalized reports on the analyses of organizational and cultural factors related to the cooperation at an operational level
    - Bjørnstad A L (2005): *Part I: Allied Warrior 2004 - Pilot study and analysis of cross-cultural organizational issues*. FFI/RAPPORT-2005/01709
    - Bjørnstad A L (2006): *Part II: Allied Warrior 2004 - Pilot study and analysis of cross-cultural organizational issues*. FFI/RAPPORT-00112
  - Finalized report on the analysis of organizational data collected at a tactical level
    - Bjørnstad A L (2006): *Battle Griffin 2005: analysis of organizational processes*. FFI/NOTAT-2006/00211
2. The GlobeSmart<sup>®</sup> Commander cultural awareness training tool was transitioned to Allied Command Transformation on effort was completed. This cultural awareness training tool will be transitioned to ACT in 2007. A demonstration of the training is available for viewing until June 2007.
3. The conceptual Cultural Adaptability model was empirically validated. A proposal to develop the predictive validity of this model as a joint venture between the U.S. and Sweden has been submitted and is under review by the funding source.
4. A collaborative relationship with HFM-127 and HFM-ET067 was established.

Expectations of future progress: It is expected that HFM-138 will complete all research activity by September 2007, at which time effort will be directed to planning and execution of the final deliverable, a research symposium.

Schedule for submission of the deliverable or end product:

- HFM-142 RSY “Adaptability in Coalition Teamwork” is scheduled April 2008 in Copenhagen, Denmark

### III. LIAISON WITH OTHER BODIES

Coordinated activities with other RTO bodies:

- Dr. Sutton, Chair, represented HFM-138 as a charter member of HFM-ET067 “Educating Adaptable Military Leaders and Training Teams for Improved Coalition Operations” at the initial planning meeting held 11-12 June 2006 in Sofia, Bulgaria.

- Collaboration with HFM-127 “Operational Validation of Command Team Effectiveness (CTEF) Instrument” was provided 7-11 August 2006 for the purpose of assisting in validation of the CTEF with a representative sample of NATO staff officers at Supreme Allied Command Transformation headquarters (HQ SACT) in Norfolk, Virginia USA

Technical advice or support to ONSTs (Outline NATO Staff Targets), NSTs (NATO Staff Targets), STANAGs, Armament Review, LTCR development, etc.: None

Presentations to or from other NATO bodies:

- Dr. Sutton, Chair, presented the HFM-138 program of research at the 3<sup>rd</sup> Allied Command Transformation NATO Network Enabled Capability (NNEC) Conference 28-30 March 2006.
- Dr. Warren and Dr. Mangos attended the Allied Command Transformation NATO SPRINT meeting 24-27 October 2006 to look for opportunities to synergize with other organizations doing culture/HIS research and for opportunities to match research products with transition opportunities.

List of Technical Team Members serving as liaison officers to other NATO bodies:

- Capt (N) Yantsislav Yanakiev is Chair of HFM-ET-067
- Dr. Peter Essens is Chair of HFM-127
- Dr. Erland Svensson represents Sweden on the HFM panel

#### IV. RECOMMENDATIONS TO THE PANEL OR RTB

- HFM-142 Programme Committee nominations and Call for Papers is submitted for HFM Panel approval
- Assistance is requested for activities associated with planning and executing the HFM-142 RSY to include (but not limited to):
  - Coordination with HFM Panel Member from Denmark
  - Identifying and soliciting keynote speaker(s)
  - Identifying and soliciting Technical Evaluator
  - Identifying funding sources
  - Administrative support of media development for knowledge distribution (e.g., handbook)

#### V. FUTURE MEETINGS

- 22-24 May 2007, HFM-138 Working Meeting, Ottawa, Ontario, Canada
- TBD 1Q08, HFM-142 Programme Committee Meeting, Copenhagen, Denmark

Attachments:

- A Technical Team Work Schedule

## APPENDIX 5 – ANNUAL REPORTS

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### Attachment A to 2006 Annual Report Technical Team Work Schedule

#### Major Milestones

1. Initiation of the six-nation (Bulgaria, Canada, The Netherlands, Norway, Sweden, and United States) Leader and Team Adaptability in Multinational Coalitions (LTAMC) distributed team study. Start April 2006 – Estimated Completion September 2007.
2. Development of a conceptual model of Cultural Adaptability model based on data collected at two NATO Command Post Exercises, Allied Warrior 04 and Allied Warrior 05. Start January 2005 – Completed May 2006.
3. Development of a marketing brochure describing the HFM-138/LTAMC project. Start August 2006 – Completed October 2006.

#### HFM-138 2006 Activity

January	Dr. Sutton and Mr. Pierre Marc, representing Allied Command Transformation, held a budget review meeting at HQ SACT to establish the 2006 calendar year expense plan for financial support from ACT Concept Development and Experimentation funds
February	The U.S. hosted The Netherlands and Sweden at the U.S. Air Force Research Laboratory, Wright-Patterson Air Force Base, for a demonstration of the Situation Authorable Behavior Research Environment (SABRE) tool that is used for data collection in the LTAMC multinational experiment
March	Dr. Sutton presented the HFM-138 program of research at the NATO Network Enabled Capability Conference (NNEC) in Portsmouth VA. USA
April	Norway began LTAMC Part 1 data collection for 8 teams. Sweden participated as an observer in several of those sessions. BBN Technologies provided on-site technical support in Norway.
May	A working meeting was hosted by the Swedish Defence Research Agency and ACT in Stockholm Sweden. Discussed were: lessons learned from the first 8 teams conducted in Norway, which was also later communicated in writing to the group; results from analysis of data collected at Allied Warrior 05 and Multinational Experiment 4 (MNE4); planning and execution of Part 1 the LTAMC experiment; and collaboration with HFM-127. (Minutes of this meeting are available upon request.)
June	Team members collaborated on development of situational judgment tests to be used in August to validate the efficacy of the GlobeSmart <sup>®</sup> Commander cultural awareness training tool at HQ SACT.
August	<ul style="list-style-type: none"><li>• The Netherlands began LTAMC Part 1 data collection. BBN Technologies provided on-site technical support.</li><li>• Sweden began LTAMC Part 1 data collection. BBN Technologies provided on-site technical support.</li><li>• The GlobeSmart<sup>®</sup> Commander cultural awareness training tool was demonstrated at HQ Supreme Allied Command Transformation in Norfolk VA USA.</li><li>• The Command Team Effectiveness (CTEF) instrument, developed by HFM-127, was presented to a sample of NATO officers at HQ SACT.</li></ul>
October	

- A working meeting was hosted by the U.S. and ACT in San Francisco, CA USA. Discussed were: use of the SABRE tool for experimentation in general and for the LTAMC experiment specifically; planning and execution of Part 2 the LTAMC experiment; planning and execution of HFM-138 deliverables; results of analysis of the GlobeSmart<sup>®</sup> Commander and CTEF validation data collected in August; collaboration with HFM-ET067 and SAS-065; and ideas for follow-on work. (Minutes of this meeting are available upon request.)
- Dr. Warren and Dr. Mangos attended the Allied Command Transformation NATO SPRINT meeting at the invitation of Dr. Nancy Houston, Chief, Cognitive Sciences Branch, ACT.
- Dr. Sutton presented the HFM-138 program of research at the Advanced Research Workshop, sponsored by the G.S. Ravoski Defense and Staff College, Sofia Bulgaria and hosted by Capt (N) Yanakiev.
- Norway began LTAMC Part 1 data collection for an additional 8 teams.
- Development of an HFM-138/LTAMC marketing brochure was completed.

**November**

- Norway completed LTAMC Part 1 data collection (16 teams total).
- Bulgaria began LTAMC Part 1 data collection. BBN Technologies provided on-site technical support.

**December**

- Bulgaria completed LTAMC Part 1 data collection (8 teams total).
- Ms. Bjornstad presented preliminary analyses of LTAMC data for Norway's initial 8 teams to the steering committee of FFI project 879 "Network Based Defense in Operations," which provides national support for the HFM-138 effort.
- The GlobeSmart<sup>®</sup> Commander cultural awareness training tool was delivered by the developer to the U.S. Army Research Laboratory (Dr. Pierce). Technology transition paperwork was initiated to transition the tool to the Joint Education and Training (JET) branch of NATO Supreme Allied Command Transformation headquarters. The intent is for JET to host the training on a NATO server, thus making the training available universally to Alliance and PfP nations and NATO schools.

//END OF REPORT//

**A5.3 2007 ANNUAL REPORT**

Reporting period: January 2007 – December 2007

This document is the full and complete Final Annual Report for the combined NATO ACT CD&E 'Leader and Team Adaptability in Multinational Coalitions (LTAMC)' project and NATO RTO HFM RTG 138 'Adaptability in Coalition Teamwork' project.

**I. INTRODUCTION**

Dates and places of meetings: 17-19 May 2007, Ottawa, Ontario CA  
13-15 Oct 2007, Edinburgh Scotland

Changes [from 2006 Annual Report] in team composition: None

Level of participation by Partner nations in open events: 100% (Full participation)

## APPENDIX 5 – ANNUAL REPORTS

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General useful information:

1. HFM RTG 138, titled ‘Adaptability in Coalition Teamwork,’ operates concurrently as an Allied Command Transformation headquarters (ACT) Concept Development and Experimentation (CD&E) program titled “Leader and Team Adaptability in Multinational Coalitions” or LTAMC. The combined effort the CD&E process and is reported as a project for both NATO entities.
2. In this report, reference is made to the GlobeSmart<sup>®</sup> Commander cultural awareness training tool. This is a web-based, self-paced training designed for officers who will, at some point in their career, take a NATO assignment. The tool was developed under a U.S. Army Small Business Innovative Research contract for the Army Research Laboratory with considerable content input from the combined NATO ACT CD&E – RTO HFM RTG 138 effort.
3. In this report, reference is made to the Leader and Team Adaptability in Multinational Coalitions or LTAMC multinational experiment. This experiment investigates the relationships among culture, information sharing, situation awareness, and team performance using a game-based testbed called SABRE (Situation Authorable Behavior Research Environment). Nations participating in this large scale experiment are Bulgaria, The Netherlands, Norway, Sweden, and the United States.

## II. STATUS OF ACTIVITIES

Major achievements for 2007 and assessment of the work plan:

1. Data collection and analysis was completed for the five-nation, distributed team laboratory experiment titled ‘Leader and Team Adaptability in Multinational Coalitions (LTAMC)’.
2. The GlobeSmart<sup>®</sup> Commander cultural awareness training tool was transitioned to in May 2007. Delivery of all software and supporting documentation constitutes the final deliverable to ACT the CD&E LTAMC project (2004-2007).
3. A contract was let August 30 2007 by the U.S. Air Force Office of Scientific Research (AFOSR) European Office of Aerospace Research and Development (EOARD) to support follow-on research of the Cultural Adaptability model developed in the course of this program. The new research effort, titled ‘Cognitive and Personality Determinants of Cultural Adaptability,’ will be managed by Dr. Erland Svensson, ACT CD&E LTAMC – RTO HFM RTG 138 team member and director of research at the Swedish Defence Research Laboratory (FOI).
4. Dr. Sutton, HFM RTG 138 Chair, participated in a meeting of HFM RTG 067 on January 15-17 in Paris, FR. Based on that meeting a new RTG will be recommended to continue and expand on the findings from HFM RTG 138, 120, 127, and 139. Pending HFM Panel approval, the new RTG will be RTG 163 ‘Improving the Organizational Effectiveness of Coalition Operations’ and will be chaired by Capt (BUL-N) Dr. Yantsislav Yanakiev, an active member of HFM-138. Tentatively, the first meeting of HFM RTG 163 is scheduled for January 2008 in Paris, FR..

Expectations of future progress: Some aspects of the work completed with this project will continue through HFM RTG 163. Scientists will utilize findings to inform national research in the domains of culture and teamwork.

Schedule for submission of the deliverable or end product: The NATO ACT CD&E - RTO HFM RTG 138 project has concluded within the TOR parameters, provided early delivery of the ACT CD&E primary deliverable, a cultural awareness training tool, in May 2007, and is on-schedule to deliver the RTO HFM final deliverable, an international research symposium in



April 2008. HFM RSY 142 RSY “Adaptability in Coalition Teamwork” is scheduled 21-23 April 2008 in Copenhagen, Denmark

### III. LIAISON WITH OTHER BODIES

Coordinated activities with other RTO bodies:

- Dr. Sutton represented HFM RTG 138 at the January 2007 HFM ET 067 “Educating Adaptable Military Leaders and Training Teams for Improved Coalition Operations” planning meeting in Paris FR.

Technical advice or support to ONSTs (Outline NATO Staff Targets), NSTs (NATO Staff Targets), STANAGs, Armament Review, LTCR development, etc.: None

Presentations to or from other NATO bodies:

- Dr. Sutton presented the NATO ACT CD&E - HFM RTG 138 GlobeSmart® Commander cultural awareness training tool, final deliverable product to ACT, at the 4<sup>th</sup> Allied Command Transformation NATO Network Enabled Capability (NNEC) Conference 26-29 March 2007.

List of Technical Team Members serving as liaison officers to other NATO bodies:

- Capt (N) Yantsislav Yanakiev is Chair of HFM ET 067 and HFM Panel member
- Dr. Peter Essens is Chair of HFM RTG 127 and HFM Panel member
- Dr. Erland Svensson represents Sweden on the HFM panel

### IV. RECOMMENDATIONS TO THE PANEL OR RTB

- Continued support for planning and execution of HFM RSY 142 event

### V. FUTURE MEETINGS

- The NATO ACT CD&E – RTO HFM RTG 138 project has concluded. There will be no future meetings.



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## **ANNEX A**

- I. ‘Adaptability in Coalition Teamwork’  
NATO RTO HFM RSY 142 Program**
- II. HFM RSY 142 Technical Activity Proposal**
- III. HFM RSY 142 Terms of Reference**
- IV. Research Papers generated by the NATO ACT CD&E  
LTAMC / NATO RTO HFM RTG 138 project team**



## NORTH ATLANTIC TREATY ORGANISATION



## RESEARCH & TECHNOLOGY ORGANISATION

### HFM-142 SYMPOSIUM

#### ADAPTABILITY IN COALITION TEAMWORK

*Faculté d'adaptation au travail en équipe  
au sein d'une coalition*

**A Symposium Organised by the  
Human Factors and Medicine Panel**

To be held in

**Copenhagen (Denmark)**

**21-23 April 2008**

This Symposium is open to citizens from NATO, Partnership for Peace (PfP) and Mediterranean Dialogue (MD) Nations

**NO Conference Fee due for this event**

**Latest enrolment dates:**

**21 March 2008**

ENROL ONLINE AT: <http://www.rta.nato.int>

#### Background

The mission of RTO is to conduct and promote co-operative research and information exchange. RTO consists of a three level organisation: the Research and Technology Board (RTB), the Panels and the Technical Teams. The Human Factors and Medicine Panel (HFM) is one of the seven Panels under the RTB which encompasses four Area Committees: (1) Operational medicine (OM) encompasses aerospace, hyperbaric, and military medicine necessary to ensure sustenance, physical and mental health, safety and survival of military personnel, (2) Human protection in adverse environments (HP) encompasses human-centred research for optimising human physiological tolerance, protection and survivability in adverse mission environments, (3) Human effectiveness (HE) optimizes individual readiness and organizational effectiveness by addressing psycho-social, organizational, cultural and cognitive aspects in military action, (4) Human system integration (HSI) optimizes the performance of human operated technical systems by addressing the human machine interactions, processes, tools and measures of effectiveness.

#### Theme

Multinational coalitions are a complicated assembly of individuals, networks, and organizations required to perform as teams, often ad hoc or in a distributed environment. The cultural diversity inherent in coalition teams challenges leaders and team members to recognize the cultural biases of their own and others' thoughts and their manifested predisposition to behaviour. Diversity can either enhance or hinder team performance along the full spectrum of military operations. Models, methods, and tools that support rapid development of effective multicultural teams are needed to ensure mission success that is dependent on a high degree of interoperability and collaboration among team members. NATO leaders and the international research community must leverage what is known about individual differences, organizational structure and processes, national/organizational/military cultures, teams, and training in order to provide a model of coalition teamwork that can be used to guide doctrine, training, personnel, and organization. This symposium will review results of current, militarily relevant research in the domains of national culture and teamwork. Direction for a future international research agenda will be discussed.

#### Topics

- Individual Differences
- Team Cognition and Performance
- Organizational Processes
- Measures, Metrics, and Models

#### Enrollment

Citizens from NATO, Partnership for Peace (PfP), and Mediterranean Dialogue (MD) may enroll for this Symposium via <http://www.rta.nato.int>. When your enrollment is accepted you will receive a general information package with the latest information on travel, accommodations, and other local arrangements. PfP and MD participations need to take special note of any VISA requirements. Please note that all participants are to make their own travel arrangements and hotel bookings.

#### Important date

We recommend you to register as soon as possible and well **before 21 March 2008**.

#### Programme Committee

##### Chairperson

Dr. Janet Sutton  
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## HFM-142 Symposium on "Adaptability in Coalition Teamwork"

### Programme

#### Monday 21 April 2008

11:30	Registration
12:30	Briefing for Speakers
13:00	Administrative Announcements, Opening Ceremony and Welcoming Address
13:15	<b>1</b> Strategic Perspectives on Developing Language, Regional and Cultural Capabilities Ms. Gail McGinn, US Deputy under Secretary of Defense for Plans, Dr. Daniel McDonald, Dr. Marinus van Driel, DEOMI, Dr Peter Hancock, University of Central Florida, USA
13:45	<b>KN1</b> Cultural Challenges in Joint and Combined Command Major General Ton van Loon (NLD), Chief of Staff, Allied Land Component Command HQ Heidelberg
14:30	<b>KN2</b> Individual Difference Theory and Research: Applications to Multinational Coalition Teamwork Dr. Megan Thompson, Defence Scientist, Defence Research and Development, CAN
15:15	Break
15:45	Introduction to CULTURE Track Dr. David Matsumoto, Professor, San Francisco State University, Director and CEO, The Ekman Group Research Division, USA
16:00	Introduction to TEAMS Track Dr. Peter Essens, Chief Scientist Human in Command, TNO Defence, Security and Safety, NLD
16:15	Q & A about Focus Sessions Chair: Dr. Joan Johnston, Naval Air Warfare Center Training Systems Division, USA
16:30	Adjourn for the day
18:00	Harbor Tour Boat Departs from Nyhavn Canal to Reception
19:15	Hosted Cocktail

#### Tuesday 22 April 2008

#### POSTERS TO BE EXHIBITED on Tuesday 22 April from 08:30 to 17:15

- P-01** Decision Processes in a Spatio-Temporal System  
Mrs. Birgitta Kylesten, Swedish Defence Research Agency (FOI), SWE

- P-02** Modeling of Cooperative Processes of Networked Teams in Surveillance and Situation Assessment  
Ms. Margarete Piori, FGAN Research Institute for Communication, Information Processing and Ergonomics, DEU
- P-03** Decision Support Systems  
Mr. Peter Berggren, Ms. Birgitta Kylesten, Swedish Defence Research Agency (FOI), SWE
- P-04** Designing User Culturally Fit Interface for Globally Distributed Collaboration in Virtual Communities  
Dr. Shafiz Affendi Mohd Yusof, Dr. Norhayati Zakaria, Faculty of International Studies, Universiti Utara, MALAYSIA

#### Tuesday 22 April 2008

##### CULTURE Track - Room A

Chair - Dr. David Matsumoto, San Francisco State University, The Ekman Group Research Division and Dr. Linda Pierce, Army Research Institute, USA

- 09:00** Administrative Announcements and Agenda
- 09:15** **2** A French Clinical Director for the German Hospital in Kabul: A Multinational Experience  
Dr. Evelyne Lambert, Dr. Sylvain Ausset, Dr. Guillaume Pelee de Saint Maurice, Prof. Bernard Lenoir, Military Teaching Hospital Percy, FRA
- 09:45** **3** Simulation Based Approach to Cross-Cultural Training for Higher Order Cultural Awareness  
Mr. Preetam Maloor, Dr. Kevin Ruess, Dr. Jacqueline Haynes, Intelligent Automation Inc., Dr. Stephen Zaccaro, George Mason University, Dr. R.S. Zaharna, American University, USA
- 10:15** **4** Applying Unfolding Item Response Theory to Enhance Measurement of Cultural Norms  
Dr. Phillip Mangos, Dr. Joan H. Johnston, Naval Air Warfare Center Training Systems Division, USA
- 10:45** Break
- 11:15** **5** Bridging the Culture Gap: A Cultural Framework as a Basis for Cultural Awareness Training  
MSc Josephine van Meer, MSc Gerard Veldhuis, TNO Defence, Security and Safety, NLD
- 11:45** **6** Predictive Modelling of Personality Traits - Implications for Selection of Operational Personnel  
Dr. Erland Svensson, Ms. Jenny Lindoff, Swedish Defence Research, SWE, Dr. Janet Sutton, Air Force Research Laboratory, USA
- 12:15** **7** Measuring Cultural Cognitive Biases in Multi-National Research  
Dr. Joan Johnston, Dr. Phillip Mangos, Naval Air Warfare Center Training Systems Division, USA
- 12:45** Lunch
- 14:15** **8** Multicultural Perspective-Taking Competencies: A Conceptual Model and Training Tool  
Dr. Joan Rentsch, University of Tennessee-Knoxville, Dr. Allison Abbe, Army Research Institute, USA
- 14:45** **9** US/UK Cultural Differences in Mental Models of Planning  
Dr. Louise Rasmussen, Dr. Winston Sieck, Klein Associates Division of ARA, USA, Dr. Paul Smart, University of Southampton, GBR

- 15:15** **10** Linguistic Sources of Coalition Miscommunication  
Dr. Yya Whiteley, Systems Engineering & Assessment Ltd, GBR, Mr. Stephen Poteet, Dr. Ping Xue, Dr. Anne Kao, The Boeing Company, USA, Dr. Jitu Patel, Defense Science and Technology Lab, GBR, Dr. Cheryl Giammanco, Army Research Laboratory, USA,
- 15:45** Break
- 16:15** **11** Culture, Politeness and Directive Compliance: Does Saying "Please" Make a Difference?  
Dr. Christopher Miller, Dr. Kip Smith, Smart Information Flow Technologies, USA
- 17:15** Adjourn for the Day
- 16:45** Facilitated Discussion of CULTURE Perspectives

##### TEAMS Track - Room B

Chair - Dr. Peter Essens, Chief Scientist Human in Command, TNO Defence, Security & Safety, NLD, and Ms. Anne Lise Bjornstad, Researcher, Norwegian Defence Research Establishment (FFI), NOR

- 09:00** Administrative Announcements and Agenda
- 09:15** **12** Organization, Culture and Group Processes in Operational and Simulated Environments  
Ms. Anne Lise Bjornstad, Norwegian Defence Research Establishment (FFI), NOR
- 09:45** **13** Examining Teamwork Dimensions Within a Coalition Environment: Perspectives from a NATO Joint Task Force Perspective  
Dr. C. Shawn Burke, Mr. Cameron Klein, Ms. Christin Upshaw, Dr. Eduardo Salas, Institute for Simulation and Training, University of Central Florida, Dr. Joan Hall Johnston, NAVAIR, Dr. Janet L. Sutton, Air Force Research Laboratory, Dr. Linda Pierce, Army Research Institute, Ms. Diane Ungvarski, Army Research Laboratory, USA
- 10:15** **14** Mixed- & Homogeneous-Culture Military Team Performance on a Simulated Mission: Effects of Age and Computer-Game Experience & English Proficiency  
Dr. Rik Warren, Air Force Research Laboratory, USA
- 10:45** Break
- 11:15** **15** Assessing Shared Situational Awareness in Dynamic Situations  
Mr. Peter Berggren, Dr. Jan Andersson, Swedish Defence Research Agency, Dr. Jens Alfredson, SAAB Aerosystems, SWE
- 11:45** **16** A Preliminary Examination of the Impact of Cultural Differences on Situation Awareness and Confidence in a Simulated Multinational Headquarters  
Dr. Frederick Lichacz, Canadian Forces Experimentation Centre, CAN
- 12:15** **17** Synchronization Loops: A Model for Assessing Distributed Teamwork  
Mr. Brian Prue, Mr. Martin Voshell, Mr. David Woods, Mr. James Tittle, Mr. Jay Pepper, Mr. William Elm, Resilient Cognitive Solutions, Ohio State University, USA
- 12:45** Lunch

- 14:15 18** Varying Team Composition to Examine the Effect of Cultural Diversity on Team Process and Cultural Adaptive Team Performance  
Dr. C. Shawn Burke, Dr. Eduardo Salas, Institute for Simulation and Training, University of Central Florida, Dr. Katherine Wilson, University of Miami, USA
- 14:45 19** Predicting Adaptable Performance in Multicultural Teams: A Causal Model  
Ms. Charlene Stokes, Dr. Tamera Schneider, Wright State University, Dr. Joseph Lyons, Wright-Patterson AFB, USA
- 15:15 20** A Model of Human Teamwork for Agent-Assisted Search Operations  
Dr. Katia Sycara, Carnegie Mellon University, Dr. Gita Sukthankar, University of Central Florida, Mr. Joseph A. Giampapa, Carnegie Mellon University, Mr. Chris Burnett, University of Aberdeen, USA
- 15:45** Break
- 16:15 21** Operational Assessment of a NATO Response Force  
Cdr Fred van Ettinger, LCol Ruud Tegenbosch, NATO Command and Control Center of Excellence (C2COE), NLD
- 16:45** Facilitated Discussion on TEAM Perspectives
- 17:15** Adjourn for the Day

### Wednesday 23 April 2008

#### CULTURE Track - Room B

Chair - Dr. David Matsumoto, San Francisco State University / The Ekman Group, USA  
and Dr. Linda Pierce, Army Research Institute USA

- 09:00** Administrative Announcements and Agenda
- 09:15 22** Can You Work with Me? The Effects of In-Group vs. Out-Group in Developing Swift Trust for Global Virtual Teams  
Dr. Norhayati Zakaria, Dr. Shafiz Affendi Mohd Yusof, Faculty of International Studies, Universiti Utara, MALAYSIA
- 09:45 23** Empirical Studies and an Explanatory Model of Cultural Differences in Goal Setting, Task Allocation, and Communication  
Prof. Kip Smith (USA), University of Linköping, SWE
- 10:15 24** Using a Computer-Game for Research on Culture and Team Adaptability: Lessons Learned from a NATO Experiment  
Dr. Rik Warren, Dr. Janet Sutton, Air Force Research Laboratory, USA
- 10:45** Break

#### TEAMS Track - Room A

Chair - Dr. Peter Essens, Chief Scientist Human in Command, TNO Defence, Security and Safety, NLD  
and Ms. Anne Lise Bjørnstad, Researcher, Norwegian Defence Research Establishment (FFI), NOR

- 09:00** Administrative Announcements and Agenda
- 09:15 25** Collaboration Support via Analysis of Factions  
Mr. Michael Smith, Mr. Matthieu Branlat, Mr. Robert Stephens, Dr. David Woods, The Ohio State University, USA

- 09:45 26** Application of the Command Team Effectiveness (CTEF) Instrument in the Multinational Exercise "Joint Caribbean Lion"  
Dr. Ad Vogelaar, TNO Defence, Security and Safety, NLD
- 10:15** Break
- 11:00** CULTURE Track Out-Brief  
Dr. David Matsumoto, Track Chair
- 11:30** TEAMS Track Out-Brief  
Dr. Peter Essens, Track Chair, HFM-142 PC Member
- 12:00** EXPERTS Discussion: Cultural Adaptability  
Dr. Fred Lichacz, HFM-142 PC Member  
Ms. Anne Lise Bjørnstad, Researcher, Norwegian Defence Research Institute, NOR,  
Dr. Mansour Javidan, Professor and Director The Garvin Center for Cultures & Languages of Int. Management, USA  
Dr. David Matsumoto, Professor, San Francisco State University, USA  
Dr. Linda Pierce, Chief, Organizational Performance Research Unit, Army Research Institute, HFM-142 PC Member, USA  
Dr. Winston Sieck, Principal Scientist, Applied Research Associates, USA
- 13:00** Lunch
- 14:15** Technical Evaluator Report  
Prof. Dr. Joseph Soeters, Chair Management and Organization Studies, Netherlands Defense Academy and Tilburg University, NLD
- 15:00** Developing an International Research Agenda  
Chair: Dr. Janet Sutton, HFM-142 Chair and Dr. Joan Johnston, HFM-142 PC Member
- 16:00** Closing Remarks  
Dr. Robert Foster (USA), Chair, NATO/RTO Human Factors and Medicine Panel
- 16:15** Symposium Adjourned
- 18:45** Depart for Dinner from the Hotel Strand
- 19:00** Gala Dinner at Tivoli Gardens

For more information,  
Please visit the following web sites:

<http://www.nato.int>



<http://www.rta.nato.int>



***Reference:***

***HFM-142/RSY***

***Acknowledgement***

***The Human Factors and Medicine Panel  
expresses its thanks to the RTB Members from  
Denmark for the invitation  
to hold this meeting in Copenhagen, and  
for the facilities and personnel,  
which make this meeting possible.***





North Atlantic Treaty Organization  
*Research and Technology Agency*

HFM-142/RSY  
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12 November 2007

## HUMAN FACTORS & MEDICINE PANEL

HFM-142 Symposium on

“Adaptability in Coalition Teamwork”  
21<sup>st</sup> – 23<sup>rd</sup> April 2008

To be held at the

**EIGTVEDS PAKHUS  
COPENHAGEN, DENMARK**

and the 21<sup>st</sup> HFM Panel Business Meeting  
(for HFM Panel Members only)  
21<sup>st</sup> -25<sup>th</sup> April 2008



1. **INTRODUCTION**

By invitation of the Danish delegation, the NATO/RTO HFM Panel will organise a **Symposium on "Adaptability in Coalition Teamwork"** from 21<sup>st</sup> to 23<sup>rd</sup> of April 2008 at Eigtveds Pakhus in Copenhagen, Denmark.

In conjunction with its Symposium, the 21<sup>st</sup> HFM Panel Business Meeting of the NATO/RTO Human Factors and Medicine Panel will be held from the 21<sup>st</sup> to the 25<sup>th</sup> of April 2008 at Eigtveds Pakhus in Copenhagen, Denmark. The HFM Business Meeting is exclusively for HFM Panel Members and invited technical briefers.

This package, prepared with the help of our Hosts from Denmark, contains information to assist you with the planning of your visit. For your convenience, the package is organised as follows:

1. Introduction
2. Useful information
3. Meeting site
4. Accommodation
5. Meals and refreshments
6. Social Activities and partner program
7. City and country information
8. Climate
9. Currency
10. Miscellaneous

**IMPORTANT**

**Please note that hotel bookings for all participants should be made before *19<sup>th</sup> February 2008* to be sure to have a room with special negotiated rates.**

*Note: Booking is only possible via the following Web-site :*

**<http://www.protocol5.dk>**

**2. USEFUL INFORMATION****Local Host Co-ordinator**

LtCol Steffen Lydich  
Aviation and Naval Medicine Branch  
Armed Forces Health Services  
P.O. Box 240  
DK-4000 Roskilde  
Denmark

Tel: +45 39 77 15 00  
Fax: +45 39 77 12 40  
E-mail: [slydoc@aerodoctors.com](mailto:slydoc@aerodoctors.com)

**Local Administrative Centre**

Warrant Officer-I Flemming Wrist-Knudsen  
Protocol Branch, Executive Office  
Defence Command Denmark  
Danneskjold-Samsøes Alle 1  
P.O. Box 2153  
DK-1034 Copenhagen K  
Denmark

Tel: +45 45 67 30 21  
Cell.: +45 21 25 81 03  
Fax: +45 45 89 08 30  
Email: [protocol1@mail.dk](mailto:protocol1@mail.dk)

**RTA/HFM Office**

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[pelatd@rta.nato.int](mailto:pelatd@rta.nato.int)



## HFM-142 SYMPOSIUM

### 3. MEETING SITE

The NATO-RTO HFM-142 Symposium on “*Adaptability in Coalition Teamwork*” and the 21<sup>st</sup> HFM Panel Business Meeting (PBM open to HFM Panel Members only) will be held the same week at :

**Eigtveds Pakhus**  
**Asiatisk Plads 2 G**  
**DK-1448 København K**  
**Phone: +45 33921601/02**



The Conference will take place in the **Meeting Facilities of the Ministry of Foreign Affairs at Eigtveds Pakhus** in central Copenhagen. The building is a renovated old historic ware house, located in the old harbour, next to the Ministry of Foreign Affairs.

No transport will be provided between the hotels and Eigtveds Pakhus, as they are all in easy walking distance. The nearest hotel (Strand) is about 700 m, the furthest hotel (71 Nyhavn) is about 1100 m away from the meeting site.

#### **Registration**

Registration will take place at Eigtveds Pakhus on **Monday 21<sup>st</sup> April 2008**

- **at 08h00** prior to the starting of the 21<sup>st</sup> HFM Panel Meeting
- **at 11h30** prior to the opening of the Symposium and throughout the day.

All participants are kindly reminded to bring a passport or ID card with them in order to obtain a security badge to gain access to the Conference Area. A badge will be issued to each registered participant. You are requested to wear your Meeting badge at all times whilst in the Conference Area, at the reception and at the dinners.

*We always recommend to not wear NATO/HFM badges outside the conference and social evenings.*

### 4. ACCOMMODATION

Arrangements have been made with three hotels in the centre of Copenhagen, all within walking distance from the meeting site. All hotels are in classical buildings in the old part of central Copenhagen. There is plenty of atmosphere, and you are right in the city centre as soon as you leave the hotel. The prices that have been negotiated for our meeting are government rates, and are valid for the period from Saturday the 19<sup>th</sup> of April to Friday the 25<sup>th</sup> of April.

**Booking is administered by a civilian agency NHG A/S.**

**You must book your hotel room via the meeting website, in order to get the room rate which has been negotiated. The website is : <http://www.protocol5.dk>**

**NOTE: The prices and availability of the pre-booked rooms are only guaranteed until 19<sup>th</sup> February 2008. After this date the website will remain open, and NHG a/s will try to obtain a room for you at the conference rate, but you are encouraged to book before 19<sup>th</sup> February.**

**If you wish to arrive before the 19<sup>th</sup> April or leave after the 25<sup>th</sup> April the agency will try to arrange this with the hotel, based on room availability. The website might not let you enter arrival dates before the 19<sup>th</sup> and departure dates after the 25<sup>th</sup>, so if you require**

extra nights you must enter that as a special request in the relevant box on the website. The agency will let you know if your request can be met, and at what price. We expect that the hotels will accept the government rates for extra nights as well.

Hotel name and address:	Number of rooms booked	Price for single room <u>Includes taxes &amp; Breakfast</u>	Price for double room <u>Includes taxes &amp; Breakfast</u>	Hotel website for info only as you must book your room on the meeting web-site to get negotiated prices: <a href="http://www.protocol5.dk">http://www.protocol5.dk</a>
<b>Hotel Strand</b> Havnegade 37 (3 star)	117 rooms	955 DKK	1160 DKK	<a href="http://www.copenhagenstrand.dk">www.copenhagenstrand.dk</a>
<b>Hotel 71 Nyhavn</b> Nyhavn 71 (4-star)	50 rooms	945 DKK		<a href="http://www.71nyhavnhotel.dk">www.71nyhavnhotel.dk</a>
<b>Hotel Opera</b> Tordenskjoldsgade 15 (3-star)	70 rooms	885 DKK		<a href="http://www.hotelopera.dk">www.hotelopera.dk</a>

After the 19<sup>th</sup> February, request for changes to your booking, or request for a late reservation, can be attempted by contacting the agency directly. They will help you as best they can, but without any guarantee that all requests can be met. Point of contact will be:

**NHG A/S**

Att.: Charlotte Klostergaard

+45 70 222 130

[klostergaard@nhg.dk](mailto:klostergaard@nhg.dk)

**Payment policy for accomodation:** Will be settled directly with the hotel on check-out. Your credit card information is only a guarantee for the NHG A/S Agency and the hotel.

**Cancellation policy:** Cancellation or changes of your reservation can be made until 19<sup>th</sup> March 2008 with the charge of a handling fee of 5 € by the agency. Cancellations and changes made after 19<sup>th</sup> March 2008 will mean that you could be charged for the stay, but the agency will make the best possible solution for you with the respective hotel.

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*You are not likely to find better offers, but you are of course welcome to do so by booking on line via the internet:*

[www.booking.com](http://www.booking.com) - [www.hotelweb.dk](http://www.hotelweb.dk) - [www.expedia.dk](http://www.expedia.dk) or any other site of your choice.

**Arrival information:**

**By air:**

Metro : At the far end of the arrival terminal at Copenhagen International Airport (Kastrup) you will find a Metro station. You must walk straight ahead when you have passed through customs, all the way to the end of the terminal building, and up one flight of stairs to the Metro station. The Metro runs directly to Kongens Nytorv, which is close to all 3 hotels (see map). The journey takes 15 minutes, and Kongens Nytorv is stop number 8. The price is 28:50 DKK (3.75€) one way, valid for 3 zones. You will need to buy a ticket (by credit card/cash) at the DSB office or ticket machines inside the airport terminal building or just outside the Metro station. Some ticket types needs to be validated in the yellow machines on the platform before getting on the Metro.

Trains from Copenhagen International Airport (Kastrup) to Copenhagen Central Railway Station run six times per hour (usually from platform 2); duration 12 minutes; price 28:50 DKK (3.75€) one way. Tickets can be purchased (by credit card/cash) at the DSB office or ticket machines inside the airport terminal building. Access to the trains is direct from the Arrival terminal at the airport. Some ticket types need to be validated in the yellow machines on the platform before getting on the train. From the Central Railway station it is a short taxi trip to either one of the hotels.

**Taxis:** Duration 15 min; approximate price 250 DKK (33€). Most taxis accept credit card but this must be given at the beginning of the ride. Service is included in the price.

**By train:**

You will arrive at Copenhagen Central Railway Station, and from there it is a short taxi trip to either of the hotels.

**By car:**

Generally not a good idea. Parking in the old centre of Copenhagen is difficult, and expensive.

5. **MEALS AND REFRESHMENTS**

***Breakfast***

Breakfast and taxes are included in the room price at all the hotels.

***Refreshments during the Symposium and Panel Meeting***

Coffee and other refreshments will be available during the morning and afternoon coffee breaks, free of charge.

***Lunch***

No arrangements have been made for lunch, since the area around the meeting site has many restaurants where meeting participants can choose their own place for lunch.

***Dinner***

No arrangements have been made, except for the social events on Wednesday and Thursday.

6. **SOCIAL ACTIVITIES AND PARTNER PROGRAM**

Please indicate your intention to participate in social activities and partner tour on the same web-site where you book your hotel.

- On Monday 21<sup>st</sup> of April, at 19:15 hrs: A reception will be hosted by the Danish Armed Forces Health Services for symposium participants, HFM Panel Members and partners, at Kastellet, the old historical Citadel in Copenhagen. Transport to the reception is planned by boat, with a short tour of the harbor and canals before disembarking near Kastellet. This plan depends a little on the weather, but pickup is expected to be from Nyhavn Canal at 18:00 hrs, and the Reception will be from 19:15 to 20:15 hrs.  
*The dress code for the Reception is Casual.*

- On Wednesday 23<sup>rd</sup> of April, at 19:00 hrs: A Symposium Dinner will be held in Restaurant Perlen at TIVOLI in central Copenhagen. Transport will be by bus from Hotel Copenhagen Strand, leaving at 18:45 hrs. After the dinner you are encouraged to explore TIVOLI on your own. You may choose to walk back to the hotels, or use the bus provided at 23:00 hrs.  
We kindly ask for a contribution of 450 DKK per person.  
*The dress code for the Symposium Dinner is Jacket and Tie.*

- On Thursday 24<sup>th</sup> of April, at 19:00 hrs: A Panel Dinner will be held in the old Naval Officers Club in Copenhagen. Transport by bus will be arranged from Hotel Copenhagen Strand, leaving at 18:30 hrs. The dinner is open to HFM Panel Members, their partners and invited guests only.  
We kindly ask for a contribution of 450 DKK per person.  
*The dress code for the HFM Panel Dinner is Jacket & Tie.*

**THE FOLLOWING PROGRAM FOR ACCOMPANYING PARTNERS WILL BE AVAILABLE:**

Partners are encouraged to meet in the upstairs lobby of the meeting site on **Monday the 21<sup>st</sup> April at 10 a.m.** where payment for the partner tour will also be collected.

- On Tuesday 22<sup>nd</sup> of April, at 13:30 hrs: A guided tour of the city center will be offered, including a visit to Rosenborg Castle, where the Danish Crown Jewels are on display. Minimum number of Pre-registered participants is 15. If this number is not reached, the tour will be cancelled.

Cost per person: 250 DKK

Departure from Hotel Copenhagen Strand at 13:30 hrs (Duration approximately 4 hours)

**7. CITY & COUNTRY INFORMATION**

Denmark is located in northern Europe between the North Sea and the Baltic Sea. It is the southernmost of the Scandinavian countries and consists of a mainland peninsula, Jutland, and 406 islands. In total, Denmark covers an area of about 44.000 square km/17.000 square miles. Denmark has a population of 5.3 million people, of whom seven per cent are of foreign origins. Denmark is a constitutional monarchy, ruled by Queen Margrethe the 2<sup>nd</sup>, residing in Amalienborg Palace. The government is led by a Prime Minister, and the parliament is a one-chamber system (Folketinget), located in Christiansborg Castle, with presently 7 political parties represented. The capital, Copenhagen, is situated on the island of Zealand and is the largest city in Scandinavia. The first human settlements in the location of Copenhagen are about 6000 years old, but the city itself was established in the year 1167. Today, 1.7 million people live in the Greater Copenhagen Area. The Øresund Region, consisting of Copenhagen and southern Sweden (Skåne), has a total population of 2.8 million inhabitants. Click on [www.visitcopenhagen.dk](http://www.visitcopenhagen.dk) for more information.

**8. CLIMATE**

The weather in Denmark is not very warm in april, and spring will have only just begun. You can expect unstable weather, and rain must be anticipated. Please bring a raincoat or an umbrella.

**9. CURRENCY**

Currency in Denmark is the Danish Kroner (DKK). Bank notes are issued in denominations of 50, 100, 200, 500 and 1000 DKK. Coins come in ¼, ½, 1, 2, 5, 10 and 20 DKK.

Exchange rates : One US \$ is approx. 5,50 DDK, one Euro is approx. 7,50 DDK.

Please note that prices indicated include taxes and service. Tipping is not customary, but is at your discretion. You can add a little if you are very happy with the service.

Credit Cards: Most shops and hotels accept major international credit cards such as Visa, Diners, MasterCard and American Express.

**10. MISCELLANEOUS****Languages**

The national language is Danish, which is closely related to Norwegian and Swedish. English is widely spoken in Denmark. French and German are also commonly used. You should not have serious language difficulties in Copenhagen.

**Meeting Attire**

Meeting participants should wear business attire.

### **Electricity**

The supply in Denmark is EU standard of 230 volts/50 hertz and uses two-pin continental plugs (as in France). Please make sure you have the proper adapters for your appliances.

### **Passport and visa**

Participants from NATO-countries should be able to enter Denmark with normal Passports. If in doubt, contact the Danish Embassy in your home country.

### **Local transportation**

It is easy to get around the Copenhagen area on foot, by metro, train, bus, bike and boat. You can visit [www.visitcopenhagen.dk](http://www.visitcopenhagen.dk) for more details.

**Bikes:** Bikes are available for use free of charge from special stands located around the inner city, for use in the city centre. You deposit 20 DKK (2.60€) (20 DKK coin required) to obtain the bike but the coin is returned when the bike is returned to a bike stand.

**Taxis:** Vacant taxis carry a green sign with the word "FRI" (free) on display. Credit cards are welcomed in most taxis but this must be given at the beginning of the ride. Service is included in the price.

**Trains and buses** have a common ticket system, so you pay by a zone system to use public transport in a number of zones, for one journey (valid for one hour in the central zones). The price varies with the number of zones. In the center 2 zones it is 19 DKK for one journey, or you can buy a 10-journey card for 120 DKK. A 24 hour ticket for all zones is 110 DKK, and could be relevant if you will visit attractions outside Copenhagen itself. Tickets are validated on the platform or bus in using the yellow machines (more than one person can travel on the same card, you clip once for each person).

**Metro:** The Copenhagen metro offers a brand new and efficient way to get around in the city. All metro stations are marked with a red M. It runs from Vanløse Station to Lergravsparken in East Amager, to Ørestad in West Amager and to Frederiksberg.

**Commuter trains (S-tog):** There are a number of train lines with stations in central Copenhagen, and they can be used to get around the city.

**Buses:** All buses are yellow and entrance is at the front. Bus stops are marked with yellow signs.

### **Telephone**

International dialling country code for Denmark is + 45 followed by 8 digits. There are no area codes. Overseas enquiries are: 113. Public pay phones accept coins or prepaid Telecards but do not give back change, no matter if you get connected or not. Denmark is part of the worldwide GSM network, so compatible mobile phones should work without any problems. Main service providers are: Sonofon (tel: 80292929); TDC-mobil (tel: 80808020); and Telia (tel: 80404040).

### **Emergency**

The National Emergency Number is **112**. The call is free of charge from any telephone.

### **Time zone**

Denmark follows Central European Time (CET) which is 1 hour ahead of Greenwich Mean Time (GMT) and six hours ahead of Eastern Standard Time (EST). All clocks are moved forward one hour (summer time), usually around the last Sunday in March.



# HUMAN FACTORS & MEDICINE PANEL

HFM-142 Symposium

## COPENHAGEN CITY MAP

- 1 Restaurant Amadeus
- 2 Amalienborg Museum
- 3 The Royal Cast Collection
- 4 Museum of Decorative Arts
- 5 Nyboder Memorial Rooms
- 6 Resistance Museum
- 7 Amalienborg Palace
- 8 Marble Church
- 9 Gefion Fountain
- 10 Kastellet
- 11 Frederiks Bastion
- 12 Naval Station Copenhagen
- 13 School of Architecture
- 14 Royal Naval Museum
- 15 Scouts Museum
- 16 Christiania
- 17 Church of Our Saviour
- 18 The Royal Theatre
- 19 Charlottenborg Exhibition Centre
- 20 Burmeister & Wain Ship Museum
- 21 Lille Mølle Museum
- 22 Exhibition Center for Modern Art
- 23 Christian's Church
- 24 Christiansborg Castle
- 25 Christiansborg Castle Church
- 26 Guinness World of Records Museum
- 27 The Art Society
- 28 Louis Tussaud's Wax Museum
- 29 National Museum
- 30 Ny Carlsberg Glyptotek
- 31 Ripley's Believe It Or Not
- 32 Royal Library and The Black Diamond
- 33 Royal Stables and Coaches
- 34 Theatre History Museum
- 35 Thorvaldsens Museum
- 36 The Royal Arsenal Museum
- 37 Tivoli
- 38 Rosenborg Castle
- 39 Royal Museum of Fine Arts
- 40 The Little Mermaid
- 41 Island's Brygge's Culture-Centre



### Distances from hotels to Eigtdveds Pakhus:

Hotel 71 Nyhavn:	1100 m.
Hotel Opera:	700 m.
Hotel Copenh. Strand:	700 m.

### Distances from reception at the Citadel to hotels:

Hotel 71 Nyhavn:	1700 m.
Hotel Opera:	2000 m.
Hotel Copenh. Strand:	1900 m.

### Bus Routes

Esplanaden	1 6 9 19 29
Holmen Nord	8 72E 901 902
Kgs. Nytorv	1 6 9 10 19 29 31 32 42 43 4E 72E 73E 79E 79E 350S 650S
Knippelsbro	2 8 9 19 28 31 32 37 72E 73E 79E 901 902 350S
Christiansborg	1 2 6 8 9 10 19 28 29 31 32 37 550S 650S
Det Kgl. Bibliotek	8 901 902

901 and 902 are Harbour Busses



<b>Activity</b>	HFM-142	Adaptability in Coalition Teamwork														2007	
<b>Activity REF. Number</b>	RSY															April 2008 IS	
<b>Principal Military Requirements</b>	1	2	3	4	5										UU	December 2008	
<b>Military Functions</b>	1	2	3	4		6					10	11	12	13	14		
<b>Panel and Coordination</b>	HFM							SAS, NC3A									
<b>Location and Dates</b>	Copenhagen, Spring 2008, TBC														P-I		
<b>Publication Data</b>	MP					2008			0			UU					
<b>Keywords</b>	Culture			Adaptability			Multinational				Coalition						
Cognitive	Alliance			Team Leader													

## I. Background and Justification:

Multinational coalitions are a complicated assembly of leaders, teams, cultures, networks, and collaborative systems (Sutton & Pierce, 2003). This complicated assemblage of coalition partners will be required to perform as a team in complex environments that place high demands on the command and control (C2) of forces. This complex environment makes adaptive performance more critical than ever, yet the presence of adaptable leaders and teams continues to be elusive (Pierce, 2002). The development of adaptive performance in multinational coalitions can be rapidly advanced by the collaboration of researchers in North Atlantic Treaty Organization (NATO) and Partners for Peace (PfP) nations. Such a group has been established under NATO's Allied Command Transformation (ACT), Futures and Engagement, Concept Development and Experimentation (CD&E) led by the U.S. Army Research Laboratory (ARL) Human Research and Engineering Directorate (HRED). The CD&E project, "Leader and Team Adaptability in Multinational Coalitions (LTAMC)" was approved by the Military Committee in 2003 with the first exploratory meeting held February 2004 at NATO Headquarters in Brussels, Belgium. Simultaneously, the concept was approved by the NATO Research and Technology Organization (RTO) Human Factors and Medicine (HFM) Panel to proceed as an exploratory team (HFM/ET-049). The combined CD&E – HFM ET-049 project follows the CD&E process and is reported as a project for both CD&E and HFM.

Whether it is to combat terrorism or to keep the peace and provide disaster relief, full spectrum operations demand preparation and support of adaptable leaders and teams. A critical enabler of adaptive performance is the ability to maintain effectiveness when working on multinational teams performing command and control (C2) functions in Joint, Interagency, and Multinational (JIM) environments. Past research has found that individuals can have significantly different culturally based cognitive biases that influence their behavior. When combined with cognitive biases of others, these behaviors will either enhance or hinder the efficiency and effectiveness of multicultural staffs. Leaders and team members who recognize and understand these biases are better prepared to adapt, as needed, to ensure mission success. Previous findings also show that decision-making can be significantly influenced by individual differences such as psychological traits or cognitive styles. Psychological traits and cognitive styles are critically important in multinational military headquarters operations where decisions are time-bounded, costly in terms of resources, and where decisions may be based on incomplete or ambiguous information.

Since its inception, the CD&E – HFM international research team, led by Dr. Janet Sutton (ARL HRED), has met six times and conducted one multinational experiment with the Deployable Joint Task Force (DJTF) HQ during Allied Warrior 2004 (AW04). Transitioning HFM ET-049 to a Research Task Group is proposed. Some key drivers are the NATO Strategic Concept (1991, 1999), NATO Defence Capabilities Initiative (1999, 2001), and Prague Summit Declaration (2002). Activities initiated in HFM120/RTG-041, "Exploration of the Area of Multinational Operations and Inter-cultural Factors," compliment the proposed effort.

## II. Objective(s):

To conduct multinational, collaborative research and experiments designed to capture knowledge about cultural factors impacting multinational coalition operations. Specific objectives are: defining cultural adaptability, developing a conceptual model of cultural adaptability, identifying methods for experimentation and related measures, identifying products that could enhance cultural adaptability and recommending design requirements for future systems.

Additional objective is to initiate a dialogue with NATO and PfP nations not yet involved in the ongoing ACT's CD&E & HFM project.

## III. Topic To Be Covered:

Potential new members at the meeting will share information, discuss complementary work, discuss collaborative opportunities, determine interest, identify available resources and participate with current members in accordance with the planned agenda. Scheduled activities include: discussion of results from analysis of data collected at Battle Griffin (Norway, Feb 05) and the Knowledge Management Limited Operational Experiment (Canada, April 05), development of research plan for Multinational Experiment #4 (MNE4), and development of a protocol for collaborative national experiments using a game-based testbed.

## IV. Deliverable:

Meeting Proceedings

**V. Technical Team Leader And Lead Nation:**

Chair : Dr. Janet SUTTON United States

Lead Nation: United States

**VI. Nations Willing/Invited to Participate:**

Belgium, Bulgaria, Canada, CzechRepublic, Denmark, Estonia, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, SlovakRepublic, Slovenia, Spain, Turkey, UnitedKingdom, UnitedStates, ACT

**VII. National And/Or NATO Resources Needed:**

Participants and presenters, venue for the RSY.

**VIII. RTA Resources Needed:**

RTA support for an RSY, including funding for 2 Key Note Speakers and a Technical Evaluation Reporter.

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## **Additional Information**

**Panel Mentor:**

CAPT (N) Dr. Yantsislav YANAKIEV, Bulgaria

**Limited Participation Technical Team:**

No

**Comments:**

Output of HFM-138/RTG, no TAP available, postponed during 16th PBM until 2008. The 18th PBM decided to change the format (was RWS, is RSY) and asked for a TAP to be approved at the Spring 2007 RTB.



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**TERMS OF REFERENCE**  
**RSY On**  
**Adaptability in Coalition Teamwork**  
**HFM-142, RSY**

**I. Origin**

**A. Background**

**B. Military Benefit**

**II. Objectives**

**III. Resources**

**A. Membership**

Chair : Dr. Janet SUTTON United States

**B. Nations Willing/Invited to Participate:** Belgium, Bulgaria, Canada, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Turkey, United Kingdom, United States, ACT

**IV. Security Level**

The security level will be Unclassified/Unlimited

**V. Participation By Partner Nations And Other Nations**

This Activity is open to PfP.

**VI. Liaison**

**VII. Reference**





## PROJECT RELATED PAPERS

Bjornstad, A. L. (2005). *Part I: Allied Warrior 2004 – Pilot study and analysis of cross-cultural organizational issues*. FFI/RAPPORT-2005/01709.

Bjornstad, A. L. (2006). *Part II: Allied Warrior 2004 - Pilot study and analysis of cross-cultural organizational issues*. FFI/RAPPORT-2006/00112.

Bjørnstad, A. L. (2008, Apr). Organization, culture and group processes in operational and simulated environments (MP-HFM-142-12). In J. L. Sutton's (Chair) *Adaptability in Coalition Teamwork Symposium conducted at the NATO RTO HFM RSY 142*, Copenhagen, Denmark.

Burke, C. S., Klein, C., Christin L. Upshaw, C. L., Salas, E., Johnston, J. H., Sutton, J. L., Pierce, L. & Ungvarski, D. (2008, Apr) Examining Teamwork Dimensions in a Coalition Environment: Perspectives from a NATO Joint Task Force Exercise (MP-HFM-142-13). In J. L. Sutton's (Chair) *Adaptability in Coalition Teamwork Symposium conducted at the NATO RTO HFM RSY 142*, Copenhagen, Denmark.

Johnston, J. H., & Mangos, P. (2008, Apr). Measuring Cultural Cognitive Biases in Multi-National Research (MP-HFM-142-07). In J. L. Sutton's (Chair) *Adaptability in Coalition Teamwork. Symposium conducted at the NATO RTO HFM RSY 142*, Copenhagen, Denmark.

Mangos, P., Johnston, J.H. (2008, Apr). Applying Unfolding Item Response Theory to Enhance Measurement of Cultural Norms (MP-HFM-142-04). In J. L. Sutton's (Chair) *Adaptability in Coalition Teamwork. Symposium conducted at the NATO RTO HFM RSY 142*, Copenhagen, Denmark.

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## **FFI RAPPORT**

### **PART I: ALLIED WARRIOR 2004 - PILOT STUDY AND ANALYSIS OF CROSS- CULTURAL ORGANIZATIONAL ISSUES**

BJØRNSTAD Anne Lise

**FFI/RAPPORT-2005/01709**



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AND ANALYSIS OF CROSS-CULTURAL  
ORGANIZATIONAL ISSUES**

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FFI/RAPPORT-2005/01709

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THESAURUS REFERENCE: 8) ABSTRACT <p>FFI-project 879 Network Based Defense in Operations aims to increase the understanding of the transformation of the Norwegian Armed Forces toward NBD, including both theoretical and empirical examinations of the concept, linked to both the technological and the organizational development.</p> <p>This report presents the analysis of the organizational processes in a NATO Headquarter (HQ), based on the data collected at the NATO exercise Allied Warrior 2004 (AW04). (A part II of this report will focus more on the cross-cultural issues linked to the organization and cooperation.) Secondary to the analysis is also a methodological description of the development of the organization-focused questionnaire employed in the data collection.</p> <p>Topics covered in the analysis are, information-sharing, decision-making, language, organization, group roles and processes, social identity, and culture. There are analyses of both quantitative and qualitative data included. The results of the analysis provide some preliminary insights into the organizational processes linked to the cooperation in a multinational headquarter. The organizational questionnaire employed proved to be useful and is deemed to be of value also for further research in this area.</p>				
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## FFI RAPPORT PART I

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## PART I: ALLIED WARRIOR 2004 - PILOT STUDY AND ANALYSIS OF CROSS-CULTURAL ORGANIZATIONAL ISSUES

### 1 INTRODUCTION

FFI-project 879 *Network Based Defense in Operations* (NBD-O) aims to increase the understanding of the transformation of the Norwegian Armed Forces toward NBD<sup>1</sup>. The project focuses on theoretical and empirical examinations of the concept, linked to both the technological and the organizational development. Included in this work is also an analysis of the consequences for cooperation in military operations both nationally and internationally. This overlaps with some of the aims of the NATO Concept Development and Experimentation (CD&E) project *Leader and Team Adaptability in Multinational Coalitions: Cultural Diversity in Cognition and Teamwork* (LTAMC)<sup>2</sup>. LTAMC's general focus is on cooperation and adaptability in multinational coalitions, where the author of this report contributes with a focus on cross-cultural organizational issues linked to cooperation in international NATO headquarters.

The LTAMC team collected data for the first time at the Deployable Joint Task Force (DJTF) HQ during NATO exercise Allied Warrior 2004 (AW04)<sup>3</sup> in October/November. Data was collected on culture, cognitive readiness, personality, and organizational variables via questionnaires, observation, and semi-structured interviews.

This report presents the analysis of the data on cross-cultural organizational issues from the AW04 exercise<sup>4</sup>, aiming is to contribute both to the LTAMC and the NBD-O projects. This is considered a pilot study, as it was the first time a new organization-focused questionnaire was employed<sup>5</sup>. As such, this report also describes actions taken to revise the organization-focused questionnaire based on the data collected.

The aim is to increase the understanding of the interconnections between organizational and group processes, decision-making, information-sharing, language and culture. The intention is

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<sup>1</sup> The Norwegian term for Network Enabled Capabilities (NEC).

<sup>2</sup> LTAMC was established in 2004 under NATO Strategic Allied Command Transformation (HQ SACT, Concept Development and Experimentation (CD&E) and is led by the U.S. Army Research Laboratory (ARL). The project is also registered as a NATO Research and Technology Organization (RTO) Human Factors and Medicine (HFM) Panel exploratory team on a project titled *Adaptability in Coalition Teamwork* (ACT). The currently participating nations are Canada, Norway, Sweden and the United States (Greece and the United Kingdom participate as observers).

<sup>3</sup> AW04 was the first time experimentation was sanctioned by Strategic Allied Command Europe (SACEUR) to be integrated as part of a major NATO Command Post Exercise (CPX).

<sup>4</sup> The current "part I" of this report focuses on the organizational issues covered by the questionnaire. Due to a temporary inability to access the culture-data collected in the AW04 exercise, the interaction with culture and nationality will be analyzed in a part II of this report (which will be published shortly).

<sup>5</sup> Developed within the NBD-O project at FFI.

ultimately to provide important feedback, evaluation and input to the organizational development and training in the Norwegian Armed Forces in particular and in NATO and Pfp<sup>6</sup> nations in general. This is linked to the NATO goal of transforming its forces toward NEC (NATO HQ SACT, 2004).

### 1.1 The AW04 exercise

The exercise was designed to certify readiness of the NATO Response Force 4 (NRF 4)<sup>7</sup> from January through June 2005. The HQs for NRF 4 demonstrated this capability during the planning and conduct of a simulated Crisis Response Operations (CRO) down to the Combined Joint Force Land Component Command (CJFLCC) HQ level. Activities at the joint level included pre-mission training, practicing crisis response planning procedures, mounting the NRF CJFLCC HQ for deployment and establishing the DJTF and NRF CJFLCC HQs and C2 structure in a theatre of operations beyond NATO's Area of Responsibility.

### 1.2 The DJTF - the case

The AW04 was a command post exercise (CPX)<sup>8</sup> and in reality a rerun and a control of the readiness of the NRF 4, as they were officially approved on their former exercise in 2004. The personnel at the DJTF from HQ Naples were the focus of our study.

We were informed that the DJTF had been reorganized after the principle of Effects Based Operations (EBO)<sup>9</sup>. This was understood by one of our key informants as: a system organized around the goals set by the commander, a change from the formerly used J-structure into to a "cellular EBO structure", and a change from separate services into a joint structure. These organizational changes had been introduced in a preceding exercise in 2004, so this was the second time the personnel exercised this new organizational structure.

This study aims to go more in depth into what this reorganization meant for the personnel, in terms of their individual perceptions of organizational and group processes, decision-making, and information-sharing. The study furthermore looks into how these variables interacted with language skills and culture. Due to a temporary inability to access the culture-data collected in

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<sup>6</sup> Partnership for Peace.

<sup>7</sup> In accordance with the overall NRF Military Concept (MC 477 The NATO Response Force Military Concept, 10 April 2003), joint NRF Command and Control (C2), embedded in Strategic Command HQ, Joint Force Command (JFC) HQ, and Command Control HQs, must provide a high degree of interoperability and the capability to rapidly plan and prepare for deployment during an emerging crisis, as well as the capability to operate as a stand-alone initial entry force for up to 30 days. Thus, the NRF has a short-term perspective; they will have to be able to evacuate people, do immediate disaster relief, etc.

<sup>8</sup> I.e. run by an exercise command.

<sup>9</sup> The "NATO networked enabled capability (NNEC) foundation document" (NATO HQ SACT, 2004) states that NRF is the "catalyst for change" and that Effects based operations (EBO) is the tool in order to get there (i.e. NEC) and the goal to strive for, i.e., the "approach to operations at all levels of command" (p5, NATO HQ SACT, 2004). The document further states that EBO will require the achievement of "3 transformational goals: Decision superiority, Coherent Effects, and Joint Deployment and Sustainment".

the AW04 exercise, the interaction with culture and nationality will be analyzed in a part II of this report (which will be published shortly).

### **1.3 Purpose**

The purpose of this study was twofold; to provide some initial answers to our research questions related to organizational processes and cooperation in military multicultural settings and to develop an organization-focused questionnaire for such use. Thus, the study was exploratory in kind.

The main groups of variables that we looked at were: information-sharing, decision-making, language proficiency level, organization, group roles and processes, identity, and culture. The goal was to find out how these interact and which patterns they may produce in military multicultural organizations.

In addition to the more exploratory nature of this study, we had some hypotheses about how these variables could be interrelated.

## **2 METHOD**

This report presents the analysis of the data from the AW04 exercise focusing on cross-cultural organizational issues, using both qualitative and quantitative measures and methods of analysis. More specifically, a combination of observation, semi-structured interviews and questionnaires were employed for the data collection. This is considered the pilot work in the development of an organization-focused questionnaire.

The questionnaire endeavors to measure organization and organization-related variables anticipated to be of importance for the cooperation and decision-making in multicultural military settings like a NATO headquarter.

The work reported here is a more qualitative supplement to the other scales employed in the LTAMC project; it aims to expand the overall understanding of the interplay between the cognitive, personality and cultural factors (measured with standardized scales) with the actual organizational setting in a military headquarter.

### **2.1 Sample and execution of study**

The data-collection was carried out in the course of 6 days, November 2004. The military personnel at the DJTF from HQ Naples were the focus of our study. They counted approximately 90 persons and were from 12 different nations; the majority of whom had their daily work at the NATO HQ in Naples.

We had two key informants, who gave us an overview of the exercise and the organization. 13 people from the DJTF was interviewed and 10 filled out the questionnaire. People who volunteered to participate were offered a choice between giving an interview or filling out a questionnaire. More or less the same questions were asked in the two conditions, as the questionnaire was used as the interview-guide. However, the interview allowed for additional follow-up questions and more unstructured feed-back.

Observation played a more secondary role in this study. It was primarily carried out in the Combined Joint Operations Centre (CJOC) of the DJTF during and in connection with a “walk-through” with one of our key informants and during a brief held by the Commander.

## 2.2 Lessons learned

We found there to be some differences between the use of interviews and questionnaires. As anticipated, the interviews gave more in-depth and holistic knowledge. The opportunity to clarify questions and make sure the respondent understood it in the way it was intended proved very helpful at this initial stage of questionnaire development. Also, this allowed us to ask follow-up questions to make sure we understood what the interview subjects actually meant.

The questionnaires, on the other hand, seemed to make it easier for the respondent to answer truthfully, especially on the more sensitive questions. In other words, the more anonymous situation seemed to relieve the respondent of the pressure to conform and of the motivation for “impression management”.

There appeared to be differences in the participants’ preference for method. For instance, some people implied that they would not have bothered to fill out a questionnaire but that they would like to do an interview, whereas others found it more tedious to do the interview. This could be due to a number of reasons; possibly differences at both the national and individual levels. It could also be that there are differences between national cultures, or that the English language proficiency level plays a role. At least, there seemed to be a preference for native English speakers (mainly US) to choose to do the interview, while non-native English speakers seemed to prefer the pen-and-paper questionnaire. Is it so that non-native English speakers often prefer to read and answer questions in writing?

This actually touches upon some of the research questions that will be dealt with in the following analysis. For instance, are there any such systematic differences in personal preferences between people from different cultures<sup>10</sup> or with different levels of language proficiencies? Could this explain some of the patterns in how people cooperate?

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<sup>10</sup> As previously indicated, the analysis pertaining to the interaction with nationality and culture will primarily be presented in part II of this report.

### 3 ANALYSIS

#### 3.1 Introductory overview and analysis of the case (the DJTF) and its organization

Our key informant reports that there had been a problem of people not interacting across their organizational boundaries in the traditional J-structure (i.e. “J-1 does not communicate with J-2.”). This is his understanding of why the organization was altered in this DJTF. By breaking up the old structure, the Commander intended to create more flexibility and better knowledge-sharing and cooperation across previous barriers. According to our informants at the DJTF, the organizational structure and processes had been molded from the ideas of the Commander.

Moreover, based on what we learned from our key informant, the Commander aimed to have the DJTF organized according to his understanding of how to reach the goals set by the EBO concept. The most evident example of this for the researchers was the joint structure of the CJOC (Combined Joint Operations Centre). The CJOC is the central point of contact in and out of the DJTF. This is where information about the unfolding situations at the tactical end comes in and is distributed within the DJTF. The information from the field forms the basis from which orders and intent are formed and distributed back to the tactical end to be acted upon. We were informed that the traditional J-structure had been broken up and that people were put together across services into different “cells” (e.g., command group, current operations, sustainment cell, planning cell, etc). According to our key informant, “each cell contains the appropriate personnel”. He felt they had the right people in the right place in the new structure and that it worked “really well”. Part of this perception was based on that most of the personnel had trained together and generally knew one another since 10 months back. This, we were informed, was quite unique. In other words, there had been put quite some effort into making this CJOC a team and not just an ad-hoc decision-making group. This was also pointed out by many of the interviewees as a great advantage.<sup>11</sup>

The interviewees furthermore said that training together was a necessity since the structure was new to everyone. As they were experienced higher officers, they had many years of experience working within the traditional structure. Many expressed that they found the changes in their roles and responsibilities in this DJTF to be bewildering. Indeed, most personnel said it was chaos on the first exercise, but that it was starting to work now. They reported that it was chaotic in the beginning of this exercise as well<sup>12</sup>, as it took some time for them to remember how to work in this structure. It is important to underline that this was an organizational structure they had only been confronted with once before in this series of NRF 4 DJTF exercises.

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<sup>11</sup> This perception supports research within “natural decision-making”, which has demonstrated that teams perform better than ad-hoc groups on decision-making (e.g., Orasanu & Salas, 1993).

<sup>12</sup> Indeed, one interviewee said that, “having this NRF ready in Spring 05, is like trying to pull a rabbit out of a hat”.

In general, it is not easy for people to change over night what they have used a lifetime to learn. It seems clear to the researchers that the real benefit of a new structure may first really be demonstrated with people that are trained to work in such a structure from an earlier point in their career.

### **3.2 Analysis of the questionnaire- and interview data and revision of the questionnaire**

The analysis of the data collected with the questionnaires and interviews is organized in 7 chapters, each pertaining to the main topics covered. The topics are: Information-sharing, decision-making, language, organization, group roles and processes, social identity, and culture. The analysis is conducted topic by topic, with both quantitative and qualitative data analyses included.

Due to the explorative nature of this research and the low number in the sample, the analyses presented are primarily based on descriptive statistics. It was deemed that at this pilot stage in the research, the number of respondents was too low and the measurement tool too unfinished in order for more advanced statistical analyses to be of any value. Qualitative analyses are included alongside to give a more in depth and holistic understanding of the quantitative data.

In addition to the data analysis, there are descriptions of what has been done in terms of revising the questionnaire. This is presented in footnotes, as not to interrupt the flow in the presentation of the results and analyses.

#### **3.2.1 INFORMATION-SHARING**

##### **3.2.1.1 Information push versus pull**

There were two questions in the questionnaire measuring whether the respondents primarily pushed or pulled information; one from the point of view of information-distribution and one from the point of view of information-gathering. 100% of the respondents said they pushed information to a few or many colleagues; nobody said they waited for someone to request it. However, 39,1% said they got the information they needed by seeking it out themselves, and only 17,4% said they were provided with the information the needed from others (39,1% said they did both equally much). In other words, even though everyone claims to push information on when they have it, the majority claims to pull the information they need themselves. This discrepancy may be an indication of that even though people do push information, they can never be aware of, or able to, push it to everyone who actually will come to need it. Indeed, this finding may be an indication of a shortcoming in the traditional push-pull information-supply chain, and an argument for a change in the direction of a “post-and-pull” information-supply chain. A “post-and-pull” information-supply chain, describes a system where



information is posted on the web (or a similar medium) and made accessible to those who may need it (for more on this topic, see e.g., Albert & Hayes, 2003)<sup>13</sup>.

Qualitative data also supports this interpretation. Some interviewees explained that they at times did not know who would need the information, and that this would be an obstacle for the information-sharing process to actually work the way it was intended.

However, the questions still had a correlation of 0.45 ( $p < 0.05$ ), which means that people who indicate that they mostly push information to *many* persons, also tend to indicate that the information is pushed to them. People indicating that they only push information to *a few* persons, also indicate that they mostly pull information themselves. This shows that despite the discrepancies described above, there is a systematic relationship between how people answer these questions, indicating that they both may be valid questions to measure how information is shared in terms of a push-pull frame of understanding. Qualitative data furthermore suggest that the choice between these strategies may depend on the role/position the person is given in the exercise. There were found no difference between native English speakers and non-native English speakers.

77,3 % of the respondents say that the type of information influence how they distribute it. However, there were found no relationship between this question and the one referred to above, pertaining to how the respondents distributed information. Thus, feeling that different information needs different distribution did not influence the degree to which they generally distributed information.

### 3.2.1.2 Information-flow/communication in the hierarchy

Three questions pertaining to information-sharing behaviors, related to how much the respondents comparatively did share, receive requests from, or seek out information from a superior, subordinate or equal. Descriptive statistics indicate that the respondents share information most often with an equal and the least often with a subordinate. They receive information requests most often from a superior and the least often from a subordinate. And they report to seek information most often from equals, and the least often from a superior. The differences are depicted in Figure 1.1. The only significant difference in mean score was found between information seeking from superior versus equal ( $t = -3.51$ ,  $p = .002$ ); i.e. they seek more information from equals.

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<sup>13</sup> Networked information flow concepts, like posting and pulling information, enables organizations (such as supply units) that would not normally have the ability to task intelligence resources, to have the ability to search databases (e.g., previous reconnaissance imagery) to locate information no one ever thought to send them because no one ever anticipated their need for that information (for an exemplification of a post & pull information-supply chain, see Hafnor et al., 2005).

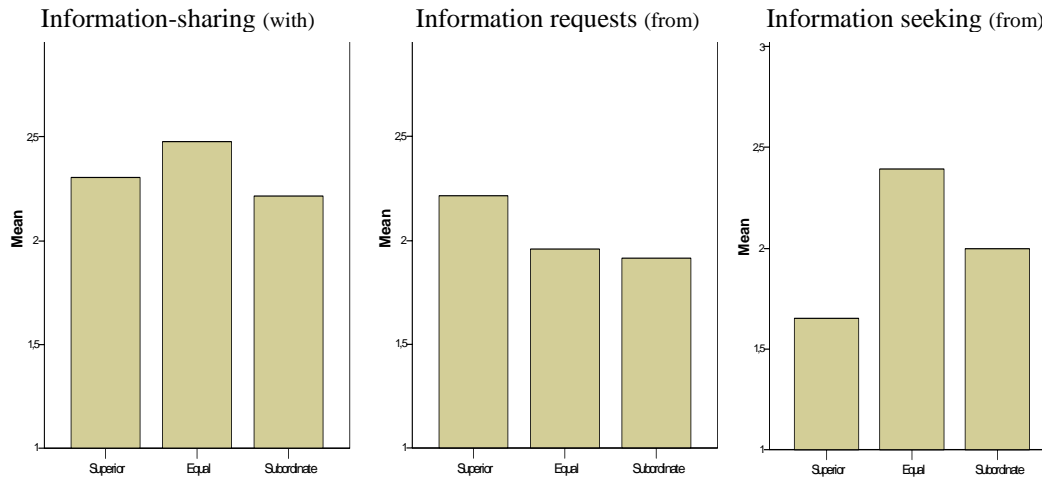


Figure 1.1. Differences in information- sharing, requests and seeking, between superior, equal and subordinate (1=min.score, 3=max.score).

The lack of significant results in who people share information with and receive requests from (depicted in the two first bar-charts in Figure 1.1), indicate that differences in these types of communication patterns were not great. Factor analysis demonstrates a pattern of reported sharing, receiving requests for, and seeking information, which indicate that the respondents may not have differentiated much between the types of communication they were rating. Rather, it could be that the answers to these questions to a large degree reflect the same variable; the general pattern of communication (see table 1.1 below).

Table 1.1. Factor analysis of questions pertaining to communication and information-flow. Principal Component Analysis with Varimax rotation. Factor loadings presented.

	1	2	3
<b>1. Communication with subordinate</b>			
Info-sharing with subordinate	.936		
Info-seeking from subordinate	.871		
Info-requests from subordinate	.763	.214	-.102
<b>2. Communication with equal</b>			
Info-seeking from equal		.889	
Info-sharing with equal		.880	
Info-requests from equal	.263	.774	.167
<b>3. Communication with superior</b>			
Info-requests from superior		-.390	.791
Info-seeking from superior		.281	.738
Info-sharing with superior	-.496	.234	.679

### Qualitative

Qualitative questions on what the interviewees thought was the general policy of information-distribution in the organization under the exercise, added to the understanding of why the quantitative results presented above seemed somewhat mixed. There were some who reported that information was shared in a traditional form, i.e. upwards in the hierarchy. Informants said for instance that, information went “mainly upwards (component-console-commander)”, and that “only some general information goes downwards”, and that “the purpose here and elsewhere is to provide the Chief with information so that he can make decisions”. This explains why the descriptive statistics show that information is most rarely shared with subordinates, most rarely requested from superiors, but most often requested *by* superiors.

At the same time, there were people who said that information was shared radically different from the norm in this organization. For instance, one interviewee said that it was “very different from usual here – all information is shared on all levels, with few exceptions”. Another one said that: “Because the organization of the CJOC is relatively flat and consists of a great number of subject matter experts, it makes horizontal information-sharing very important”. This would explain why descriptive statistics indicate that the respondents most of the time both share information with, and seek information from, equals.

Finally, some explained it like this: “one does not always follow procedure, as there are always unpredicted situations and things that do not work” and that there was “no real policy - just do it”. This adds to the understanding of why there does not seem to be a very systematic way of how people perceive the sharing, receiving and seeking of information.

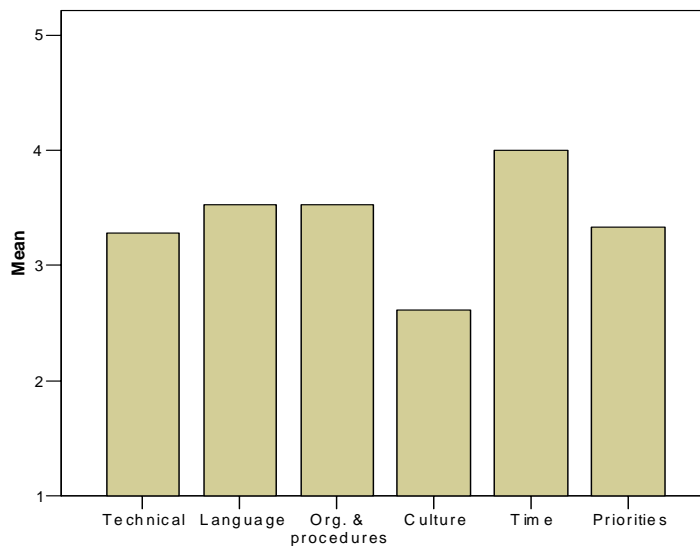
#### 3.2.1.3 Information sufficiency

There were two questions measuring how content the respondents were with the information they received. One question asked about the amount of information they received, and the other about the quality of the information. 54,5% said that they got the right *amount* of information in order to make decisions. Only 9,1% said that they received more than they needed. 31,8% reported to be somewhat content with the *quality* of the information that they received, while 22,7% reported that they were somewhat discontent. The remaining 45,5% were neutral.

The two questions had a significant correlation of .588 ( $p=.004$ ), demonstrating that the questions are related and can be deemed to measure the same underlying variable; information sufficiency, in order to provide adequate situation awareness and consequently be able to make well-founded decisions.

### 3.2.1.4 Obstacles to information-sharing

Time constraints were rated as the most important obstacle for a person to share information, while culture was rated as the least important obstacle. The distribution of answers on the various categories of obstacles for information-sharing is shown in the figure below (1.2). A high mean score is representing an important obstacle.



*Figure 1.2. Obstacles to information-sharing (min.score=1, max.score=5).*

There also turned out to be some differences between native and non-native English speakers on how important they rated the various obstacles to be. Especially pertaining to language and culture; there were some quite large differences between the two groups. Contrary to expectations, native English-speakers perceive language and culture to be a greater problem for their information-sharing than non-native English-speakers. This is shown in the figure below (Figure 1.3).

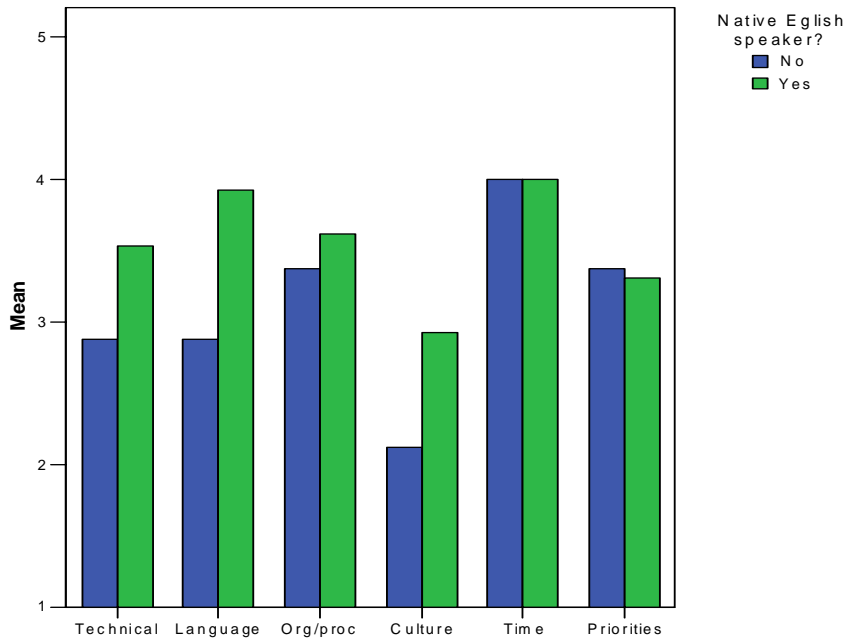


Figure 1.3. Obstacles to information-sharing: native English-speakers and non-natives (min.score=1, max.score=5).

Language is the one obstacle for information-sharing where people differ significantly depending on whether they are native English-speakers or not ( $t=-2.08$ ,  $p=.05$ ). The differences in the ratings of culture did not prove to be significant. However, since the sample was small ( $n=23$ ) and since it was not far from being a significant finding, it is included in the table below (table 1.2).

Table 1.2. T-test for difference in mean score for native versus non-native English speakers. Mean scores, with standard deviation in parentheses.

Greatest obstacle for info-sharing:	Native English speaker?		t	p
	Yes (N=9)	No (N = 13)		
Language	2,67 (1,32)	3,92 (1,44)	-2,08	.05
Culture	2,00 (1,50)	2,92 (1,44)	-1,45	.16

### Qualitative

A qualitative follow-up question revealed that the respondents also felt that there were other obstacles to their information-sharing than the items presented in the closed-ended questions of the questionnaire. These were: “differences in organizational culture”, “approachability of Commander”, and “lacking knowledge about who needs the information”<sup>14</sup>.

<sup>14</sup> The qualitative data contributed to the process of revising the questionnaire for further use. The items referred to here have been included in the now updated version of the questionnaire as closed ended questions. (As anticipated in the beginning of the analysis, chapter 3.2, the methodological development, i.e. what has been done to update the questionnaire, will continue to be presented alongside the analysis, like this - in footnotes.)

## 3.2.2 DECISION-MAKING

### 3.2.2.1 Who makes decisions - and how?

73,9% of the respondents reported that their superior made most of the decisions in their environment, while the remaining 26,1% reported that they made the decisions themselves. None said that a subordinate made most decisions. The responses are as expected from a traditional hierarchic organization.

34,8% report that decisions are made by one person (leader), while 47,8% report that decisions are made by one person (leader) in cooperation with a team. The remaining 17,4% report that most decisions are made by a team<sup>15</sup>.

### Qualitative

Qualitative data support the finding of traditional hierarchic processes and a largely centralized decision-making process in the organization (see also chapter 3.2.4.1 for more on this). More specifically, meeting observation revealed an organizational culture and process in that particular setting that can be characterized as demonstrating great respect for the leader, expectations of him having all the answers, leaving the asking of questions and decision-making up to the leader, and a lack of plenary discussions.<sup>16</sup>

### 3.2.2.2 Timeliness and speed of decisions

The majority of the respondents rated the timeliness and speed of decisions as good. 63,7% rated timeliness as either “very good”, or “good”, while 59,1% rated speed of decision-making as “just right”<sup>17</sup>.

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<sup>15</sup> In the questionnaire, only people who chose the first answer-category (“one person”) were intended to go on to answer the next question on whether or not this person tended to rely on the work and advice of others. However, many respondents had not understood this (based on feed-back from interviewees as well as the finding that more people answered this question than whom had chosen the first category answer). This was therefore clarified when revising the questionnaire.

<sup>16</sup> There are some possibly less favorable effects of such processes. When people are not included in a more free discussion, many may have things to add and things to ask, which may be lost. The abstention from asking clarifying questions may furthermore underlie subsequent lack of initiative and misunderstandings on the personnel’s part. This is typically a circumstance that also may facilitate for the “group-think” phenomenon (a phenomenon where faulty decisions are more easily made because dissident voices are not heard [Janis, 1971]). However, it should be clear that these particular interpretations are preliminary and limited to this one setting.

<sup>17</sup> The questions on the timeliness and speed of decisions are not directly correlated, due to different coding of values. However, the qualitative interpretation of their meaning, crosstabulation, and a chi-square analysis (indicating a probable curvilinear relationship) indicate that there is a relationship. The descriptive analyses described above also shows an overlap between the questions, which lead to the decision of cutting the first question, pertaining to the “timeliness of decisions”, in the now revised form of the questionnaire.

### 3.2.2.3 Quality and success of decisions

The distribution of the answers to the question pertaining to perceived decision quality is presented in the subsequent table (table 2.1). It shows that 68.1% rate decision quality as good or very good, while only 4,5% rate decision quality as poor.<sup>18</sup>

*Table 2.1. Decision quality (frequencies).*

	Frequency	Percent
Very good	3	13,6
Good	12	54,5
OK	6	27,3
Poor	1	4,5
Total	22	100,0

*One respondent did not answer this question*

54,5% rate decisions as successful in some degree, while 9,1% rate decisions as somewhat unsuccessful. The distribution of answers to this question is shown in table 2.2.

*Table 2.2. Decision success (frequencies).*

	Frequency	Percent
NA / difficult to say	1	4,5
Very successful	3	13,6
Partly successful	9	40,9
OK	7	31,8
Somewhat unsuccessful	2	9,1
Total	22	100,0

*One respondent did not answer this question*

As expected, there seems to be a close interrelatedness between the quality and success of decisions. Indeed, the questions had a significant correlation of .491 ( $p=.027$ ).

<sup>18</sup> There was found a possible discrepancy in the understanding of two questions: only one respondent says decision quality is poor, however, 7 respondents say decision quality is a problem. This should have been approx the same if the questions were measuring about the same thing - as intended. It seems that many respondents may rate decision quality as both "ok" and even as "good", while still rating decision-quality as a problem. There is no clue as to why from the qualitative data. However, it seems plausible that the wording of the two questions may have been somewhat confusing and that the first one was understood to pertain to their own environment, while the latter was understood more in general terms. Additionally, there was a negative wording in the second question, which may have given a negative priming effect. Therefore, the second question, on whether decision quality was a problem, was cut in the revision of the questionnaire.

However, people tend to rate the quality of decisions higher than success of decisions. So even though people may rate decisions as good in terms of quality, they may find them to be unsuccessful.

### **Qualitative**

Qualitative data help increase the understanding of the quantitative findings on the ratings on decision quality and success presented above.

When rating decision quality, people tend to base this on their understanding of the decision-making processes. People who rate decision quality highly tend to explain it with what they understand to be a good decision-making process, while those giving low ratings on decision quality tend to see the decision-making process as flawed. On the positive side, explanations could look like this: “Most decisions here are done very well, based on appropriate team-work in a correct and timely manner.”, or like this: ”There is strong leadership and guidance, better communication than usual, and a very accessible general”. On the negative side, people said things like: “Decision quality is often ridiculous – a lot of impulsiveness on the leadership, it seems to me.”, and: “Input to decisions are not as complete as they could be. Input to decisions is shaped by what the boss will want. Intermediate leaders are not guiding the process.”

People’s ratings on decision success appear to be more based on feedback on outcome – both for those rating the decision success positively and negatively. One subject explained that it was “based on feedback from external sources and subordinates”.

Thus, the reason for the ratings of decision quality and success seems to be somewhat different, which explains how people sometimes rate decision success to be lower than decision quality. In short, the quality rating seems to be more based on the decision-making process, while the success rating seems to be more of a rating on the feedback on the outcome. According to this, the reason for the success to be rated somewhat lower than the quality, is simply that the feedback on outcome is generally less favorable than the perceived quality of the decision-making processes.<sup>19</sup>

## **3.2.3 LANGUAGE**

### **3.2.3.1 English language proficiency level**

9 out of 23 in the sample were non-native English speakers. These answered questions on comfort, stress and tiredness to evaluate their level of English proficiency. As table 3.1 below shows, these questions were quite highly correlated. Due to a low variance in distribution on the question on comfort, Spearman’s rank-order correlation analysis was applied.

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<sup>19</sup> There is more variance in the answers on the question on decision success than on the question on quality. Cutting the question on quality to the advantage of the question on success was evaluated. However, the difference in answers were found to add value to the understanding; as indicated in the text, even though people may rate decisions as good in terms of quality, they may still find them unsuccessful. And ratings of both the decision-making process and the outcome of decisions are deemed to be valuable for the continuation of this research.



*Table 3.1. English language comfort level: Relationship between comfort, stress and tiredness. Spearman's rho. N = 9*

	Feeling stressed	Feeling tired
Feeling comfortable	.674*	.846**

\*  $p < .05$  \*\*  $p < .01$

However, the frequency distribution shows that there is very little variance in the answers to the question pertaining to how comfortable people were using the English language in their work. Moreover, 40% said they were very comfortable and 60% said they were quite comfortable with using English. However, 44,4% said they either sometimes or often became more stressed when working in English, and 75% said they either sometimes or often became more tired when working in English. This may indicate that the question about comfort only confirms what we suspected; that when asked directly, people tend to rate themselves higher on English proficiency than what their real proficiency level is at. This is understood to be caused by the high social desirability of speaking good English. Therefore, English proficiency level seems to be more accurately captured by the more indirect questions on feelings of stress and tiredness<sup>20</sup>.

The respondents' answers to the question about tiredness come closest to how people see it from the outside. Respondents claim that their colleagues either sometimes (83,3%) or often (16,7%) have problems understanding or making themselves understood in English. This corroborates the indication made above, that there is a tendency to underreport one's own language deficiencies due to the social desirability of speaking good English.

### 3.2.3.2 Language and the choice of medias of communication

Two questions measured whom the respondents communicated most with in writing (by computer) and orally. Crosstabulation shows that answers to the two questions are almost exactly the same (table 3.2 below)<sup>21</sup>. This indicates a lack of difference in which means of communication people choose when communicating with native English speakers or non-natives.

<sup>20</sup> Due the problem of social desirability affecting the answers to the question of comfort and the low variance in answers, and the fact that it seems better covered by the questions on stress and tiredness, the question on comfort was cut when revising the questionnaire.

<sup>21</sup> Due to this overlap, these two questions are condensed down to one question about communication in the revised form of the questionnaire.

*Table 3.2. Crosstabulation: Whom the respondents communicate most with in writing/by computer, and whom they communicate most with orally.*

		Communicate most with orally			Total
		<i>Native English speakers</i>	<i>Non-native English speakers</i>	<i>Speakers of my mother tongue</i>	
Communicate most with in writing/computer:	<i>Native English speakers</i>	9	1	0	10
	<i>Non-native English speakers</i>	0	9	1	10
	<i>No difference</i>	1	0	0	1
<b>Total</b>		<b>10</b>	<b>10</b>	<b>1</b>	<b>21</b>

However, a question on personal preference for the use of oral versus written medias of communication seem to indicate a slight preference towards written medias of communication for non-English speakers.<sup>22</sup> This is shown in the crosstabulation below (table 3.3).

*Table 3.3. Personal preference for the use of oral versus written medias of communication and whether the person is a native English speaker or not.*

		Comm. preference			Total
		<i>Oral</i>	<i>No preference</i>	<i>Written</i>	
Native English speaker?	<i>No</i>	3	4	2	9
	<i>Yes</i>	9	5	0	14
<b>Total</b>		<b>12</b>	<b>9</b>	<b>2</b>	<b>23</b>

The question is how English proficiency level affects non-English speakers; is there a further difference depending on how well they speak English? Crosstabulation below shows the relationship between communication preference and language proficiency (sumscore<sup>23</sup>) (table 3.4).

<sup>22</sup> On the basis of qualitative answers, the question about a preference for oral or written medias of communication was rewritten and expanded to include more details about when they may prefer one in favor of the other.

<sup>23</sup> The English language proficiency sumscore was calculated from the three questions aiming to measure this; the questions on comfort, stress and tiredness (presented in the preceding chapter).

*Table 3.4. The relationship between communication preference and language proficiency (sumscore).*

		Comm. preference			Total
		Oral	No preference	Written	
Language proficiency	2	0	0	1	1
score*:	4	0	1	0	1
	5	0	2	0	2
	7	1	1	0	2
	8	1	0	1	2
<b>Total</b>		<b>2</b>	<b>4</b>	<b>2</b>	<b>8</b>

\*A high score reflects a high degree of perceived language proficiency.

There are evidently too few respondents to conclude anything about a relationship here at this stage. However, there seems to be a slight tendency for non-native English speakers who have a lower English language proficiency level, to prefer written medias of communication. The qualitative data presented below adds to the understanding.

### **Qualitative**

Indications from the interviewees reveal that the choice of oral or written medias of communication may depend on several circumstances, such as language (of both the receiver and the sender: native/non-native English speaker)<sup>24</sup>, hierarchy (message to superior or subordinate), time (shortage), and familiarity (how comfortable you are with the person). Except when the choice is due to time shortage, people's preference for oral communication is generally based on face-to-face interaction.

People claim to choose oral communication first of all because they can get immediate feedback on the other party's understanding and can, if necessary, clarify the message. This is especially understood to be an advantage when communicating with non-native English speakers. However, several interviewees experienced that the telephone was the least well functioning medium when communicating with non-native English speakers. Furthermore, the choice of oral means of communication was deemed to depend on whether or not they felt comfortable with the person they were communicating with.

Written medias of communication were often chosen by the interviewees if the message was of high importance, so that the receiver could keep it for reference. The possibility of keeping the message for reference was deemed to be of even greater importance when communicating with non-native English speakers. The written communication allows the non-natives more time and the option to consult co-workers if they should need a clarification of meaning. This would explain the slight tendency found in the quantitative data for non-native English speakers who have a lower English language proficiency level, to choose written medias of communication.

<sup>24</sup> For the development of the questionnaire, these qualitative findings lead to the specification and expansion of the question pertaining to personal preference for oral or written communication. More specifically, in the revised form of the questionnaire specifications were included, on whether the question pertained to receiving or sending information, and whether the other was a native or a non-native English speaker.

Communicating in writing would in this way help prevent people, especially non-native English speakers, from too quickly claiming to have understood something that they in reality may not have understood. Written means of communication were also chosen when they needed to give the same message to many people. Furthermore, written means of communication were preferred if they felt uncomfortable with the other person. Finally, some said that they chose written means of communication when communicating with subordinates, while oral when communicating with their superior.

Making sure that the receiver had understood the message, seemed to be the most obvious concern for the people I spoke with. This was the reason given by both people who preferred written and oral communication. However, on a personal level, some individuals appeared to be more comfortable in a face-to-face situation, while others preferred the computer.

### 3.2.3.3 Language and communication patterns

Analysis of native English speakers and non-native English speakers was carried out in order to examine whether there were any differences between the two groups in whom they communicated most with (native English speakers or non-native English speakers). Crosstabulation showed no indication of any difference.

Further analysis of non-native English speakers was carried out in order to examine whether there were any differences in language proficiency between those who communicated most with native English speakers and those who communicated most with non-native English speakers. A t-test showed no difference in mean language proficiency score between the two groups.

Thus, neither language proficiency nor whether the person is a native English speaker or not seem to affect whom the personnel choose to communicate with. Qualitative data also supports this understanding. Interviewees generally pointed to organizational procedures and the composition of people in the organization as the reason for whether they communicated most with native English speakers or non-native English speakers.

### 3.2.3.4 Language and power relations

It was expected that language proficiency might influence power relations. There were four questions aiming to measure language-related power relations. These focused on: persuasion, understanding of another person's point of view, domination in cooperative situations, and the act of interrupting. 66,6% of non-native English speakers said that they sometimes or often found it harder to persuade their colleagues of their ideas in English than in their native language. But a lot fewer, 22,2% of non-native English speakers, said that they sometimes or often were interrupted more when communicating in English than in their native language. 81,8% of the respondents found it harder (sometimes, often or very often) to understand non-native English speakers point of view than native English speakers. 95,5 % of the respondents

found native English speakers to dominate (sometimes, often or very often) cooperative situations more than others.

From this, we understand that a great majority of the respondents found it harder to understand non-native English speakers point of view than native English speakers, as well as finding native English speakers to dominate in cooperative situations in this organization. This seems like a logic connection. Indeed, these two variables were significantly correlated (.543,  $p=.009$ ).

In other words, the great majority who perceive native English speakers to dominate, also tend to perceive non-native English speakers to have problems making themselves understood in English.

There were not found any significant differences between native English speakers and non-native English speakers on the variable pertaining to domination. However, there seems to be a tendency for native English speakers to rate the difficulties of understanding non-native English speakers' point of view as higher than what non-native English speakers seem to do. This is shown in the crosstabulation below (table 3.6). There was found a significant correlation of .428 ( $p=.047$ ) between the two variables. This is in line with the findings reported in chapter 3.2.1.4; native English speakers were also found to rate language as a more important obstacle to information-sharing than did non-native English speakers.

*Table 3.6 Relationship between being a native English speaker and finding that non-native English speakers often have problems making themselves understood.*

		Finding non-native English speakers to have problems making themselves understood					Total
		Never	Seldom	Sometimes	Often	Very often	
Native English speaker?	No	1	3	3	1	1	9
	Yes	0	0	6	6	1	13
Total		1	3	9	7	2	22

### 3.2.4 ORGANIZATION

#### 3.2.4.1 Organizational changes

In order to measure organizational changes made in the exercise-organization, there were questions pertaining to whether the personnel experienced the organization and processes as different compared to what they were used to. 87% of the respondents rate the organization that they are in during the exercise as different from what they are used to.

Three questions were asked in order to decide some of the details of the organizational changes introduced, pertaining to the respondents' perception of the hierarchy, centralization/decentralization, and flexibility of this organization compared to what they were used to. The subsequent two tables show the distribution of answers to the questions on hierarchy and on centralization/decentralization (table 4.1 and 4.2)<sup>25</sup>.

*Table 4.1. Level of hierarchy.*

	<i>Frequency</i>	<i>Percent</i>
Much flatter	6	26,1
A bit flatter	5	21,7
No difference	7	30,4
A bit more hierarchic	5	21,7
<i>Total</i>	<i>23</i>	<i>100,0</i>

*Table 4.2. Level of centralization/decentralization.*

	<i>Frequency</i>	<i>Percent</i>
Much more decentralized	2	8,7
A bit more decentralized	7	30,4
No difference	6	26,1
A bit more centralized	6	26,1
Much more centralized	2	8,7
<i>Total</i>	<i>23</i>	<i>100,0</i>

The frequency table 4.1 shows that people nearly equally often think the organization here is more centralized, the same, or more decentralized than what they are used to. Table 4.2 indicate that there is about two times as many people who think this organization is flatter than what they are used to compared to those that think it is more hierarchic. The second largest group of respondents (30,4%) think this organization is about the same as they are used to.

The distribution of answers presented above indicates that the hierarchy may have been flattened in this organization, but also that this has not been accompanied by an equal amount of decentralization. Indeed, there was found no relationship between degree of hierarchy and decentralization ( $r = .062$ ,  $p = .778$ ). Crosstabulation could not demonstrate any relationship between the two variables either. One of the respondents who rated the organization as more centralized explained that; "This is contradictory to what they are preaching, even though it (the organization) usually also is centralized." Another one said it like this: "Intermediate leaders are not empowered to make decisions, so sometimes there is a chokepoint from the top for guidance." One respondent also saw it from the other side; he indicated that there was a

<sup>25</sup> Frequency-tables show a quite good spread in answers. Hence, questions are kept in their current form in the revised questionnaire.

problem of subordinates forwarding too many questions to their superior out of convenience<sup>26</sup>. The latter two comments indicate, from two different standpoints, negative consequences when centralization accompanies a flattening of the hierarchy (which is further elaborated on in the discussion, chapter 4.4).

4,3% found the organization to be a lot more flexible, 52,2% found the organization to be a bit more flexible, while 26% found it either to be a bit or much less flexible. There was found a quite large correlation between perceived decentralization and flexibility ( $r=.618$ ,  $p=.002$ ), indicating that people who found the organization to be flexible also tended to find the organization to be decentralized. This confirms the classic finding of a link between centralized organization and inflexibility (see e.g., Morgan, 1997; Roman, 1997; Bjørnstad, 2004).

Only one of the organizational variables included in the questionnaire, degree of centralization, was significantly correlated with the variable, “rating the organization as different from usual” ( $r=.548$ ,  $p=.007$ ). The variables, perceived difference in degree of hierarchy and flexibility, are only moderately and not significantly correlated with the perception of change (i.e.,  $r=.312$ ,  $p=.147$ , and  $r=.317$ ,  $p=.317$ , respectively). However, being that there were only 22 respondents, significance can be difficult to obtain.

Stepwise regression analysis was furthermore conducted in order to check how well the variables (hierarchy, centralization, flexibility)<sup>27</sup> explained why people rated the organization as changed in this exercise. Degree of centralization turned out to explain 29,4% of the variance (adjusted  $R^2=26,1\%$ ,  $p=.007$ ). See table 4.3 below.

*Table 4.3. Regression analysis: Ability of the variable, degree of centralization, to explain why people rated the organization as changed in this exercise.*

	<i>b</i>	<i>SE b</i>	<i>Beta</i>	<i>t</i>	<i>p</i>
<i>Constant</i>	.442	.428	-	1.033	.313
<i>Degree of centralization</i>	.580	.196	.543	2.959	.007

Adding the other variables (hierarchy and flexibility) to the model did not increase its explanatory value. Indeed, it turned out to explain less of the variance (Adjusted  $R^2=22,6\%$ ,  $p=.050$ ).

### Qualitative

Qualitative data gives some insight into how and why the respondents, in their own words, perceive the organization as different. In general, they explain why they rated the organization as different by pointing to changes in organizational structure. One said that, “HQ is a stovepipe organization, this is not at all. It is quicker and there is a cross-flow of ideas.”.

<sup>26</sup> He found this problem to be accentuated by the use of computers, since, as he said, “they (computers) are impersonal and makes it too easy to ignore a message”.

<sup>27</sup> The independent variables were recoded for this analysis, so that high scores represented change in any direction (in line with the scoring of the dependent variable).

Another one said it like this: “It has changed from J-structure to effects structure (EBO). It combines different expertise differently”. Another view of the change is represented by the following statement: “There is not as many people required (in this organization), but there is not always true experts in the positions.”

The qualitative data presented indicate that people may not primarily think of variations in hierarchy, centralization and flexibility when they rate organizational changes. However, the “stovepipe” organization that many interviewees were pointing to is a type of organization that is based on the principles of hierarchy, indicating that even though people may not extract the variables as we do in research, they may include them as part of a more complex understanding of organizational changes. Additionally, the last statement pointed to above, also reflect changes in roles and responsibilities, which is further covered in the next chapter (3.2.5).

### 3.2.4.2 Perceived success of organizational changes

This variable indicates to what degree the organizational changes in this exercise are perceived to be a success by the personnel<sup>28</sup>. 54,6% of the respondents perceive the new organization as better in some degree, while 31,8% perceive it as poorer.

Taking into consideration the confusion that any organizational change induces, one may claim the changes to have been a success as there is a majority who have rated the changes to be for the better. At the same time, this is only a moderate majority, indicating that there is room for improvement.

There was found no relationship between organizational changes per se or the type of organizational changes, and the rating of the organizational changes. In other words, there were no statistical differences in how people rated the organization depending on perceived organizational changes or type of organizational changes.

### **Qualitative**

Qualitative data provides some further insight into why people rated the organization as they did. The reasons given for rating the organization as “better now”, includes finding decision-making and information flow faster, team processes better, organization flatter, and goal-achievement more in focus than what they were used to from their daily work. Here are some examples of statements that were made:

*“The team work is more complicated, but much more effective.”*

*“Decisions can be made faster because of the relatively flat organization.”*

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<sup>28</sup> Comparing the distribution of answers to the question on organizational change with this question on whether the change was to the better or worse shows that people who report no organizational change also report “no difference” on the question of success (13% on both questions). This should indicate that the questions have been understood in the way it was intended.



*“Information-flow is quicker.”*  
*“There is more focus on achieving the goal.”*

On the negative side, people rated the organization as “poorer now”, because they found the organization to be bureaucratic, that there was micromanagement, that there had been too little time for preparation, that there was a lack of manning, and that the information did not always reach everyone. Following is a couple of examples:

*“It is not very well organized; information does not always reach everyone”.*  
*“It is hard to work with NATO bureaucracy.”*

### 3.2.4.3 The interrelatedness of organization (hierarchy, centralization, flexibility) with decision-making and information-sharing (communication, obstacles)

In order to see whether organizational variables such as hierarchy, centralization and flexibility influenced decision-making and information-sharing, correlations and regression analyses were performed.

There was found no significant relationship between the organizational variables and decision-making, nor between the organizational variables and the rating of organization/procedures as obstacles for information-sharing.

Correlation analyses also showed no significant relationship between type of organization and communication pattern in terms of information-sharing/requesting/seeking. Nevertheless, regression analysis was performed for the only two variables that showed an almost significant relationship in the correlation matrix, centralization and receiving information requests from superior<sup>29</sup>. These were in fact negatively correlated ( $r=-.409$ ,  $p=.053$ ), which means that the more centralized the respondents found the organization the less requests they experienced to receive from their superior. This could indicate that the respondents tended to experience the organization as more decentralized when their superior made more contact in terms of information requests (the only measure of the respondents perception of the superiors initiative to communication with him/her here). Degree of centralization explained 16,7% of the variance (adjusted  $R^2=12,8\%$ ) in receiving information requests from superior. See table 4.4 below.

*Table 4.4. Regression analysis. Ability of the variable “ information-requests from superior”, to explain variation in perceived degree of centralization.*

	<i>b</i>	<i>SE b</i>	<i>Beta</i>	<i>t</i>	<i>p</i>
<i>Information-requests from superior</i>	-.552	,269	-.409	-2,055	,053

When using the sumscores for the communication with subordinate, superior and equal, there was found no relationship with organizational variables.

<sup>29</sup> The non-significance of this result was deemed to be due to the low number of respondents.

### 3.2.5 GROUP ROLES AND PROCESSES

#### 3.2.5.1 Tasks and responsibilities (group roles)

Four questions aimed to measure the respondents' role in the group/team and organization; whether their tasks and responsibilities were different in this organization compared to usual, whether this meant more, less or the same amount of responsibilities compared to usual, and how they liked it, both in terms of having experienced a change in tasks and responsibilities per se and in terms of an increase in responsibilities.

69,6% reported that their tasks and responsibilities were different from usual in some degree and 52,6% found the change to be for the better. 52,1% reported to have more responsibilities compared to usual and 55,4% rated that they liked the change in amount of responsibilities. The two questions measuring how the respondent rated the change per se (second question) and how the respondent liked the change in amount of responsibility (last question) were significantly correlated ( $r=.543$ ,  $p=.016$ ). This was not surprising, due to the questions' relatedness in meaning<sup>30</sup>. In addition, the two latter questions were significantly correlated ( $r=.477$ ,  $p=.025$ ), indicating that the respondents tended to like an increase in tasks and responsibilities.

#### **Qualitative**

Interviewees generally explained that their job in this exercise was different from usual because the peacetime organization, in which they had their daily job, was very different. Many people also worked in different areas here than what they usually did<sup>31</sup>. This change, however, some people found to be for the better, others found to be for the worse. It was explained to us that many people were not used to deploying, and that some of them actually never had deployed, which meant that they "were in for some frustrations", as one put it. This interviewee called it a "paradigm shift", and further said about this exercise that; "some were still very resistant (to change) while others were more accepting". The reason for such frustrations, is well explained in the following comment: "There is not always true experts in the positions; you get a role and need to fill it even if you have no expertise on it."

Some people found themselves to have less responsibility in this organization, which they tended not to like. One respondent explained that he had less responsibility here "due to centralized control". He also said that he was "normally a lot more independent and empowered in his role". This reflects back on the former chapter; the respondents tended to rate this organization as more centralized than what they were used to.

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<sup>30</sup> Based on this obvious overlap in meaning, which was also pointed out to us in the interviews, the first question was cut in the process of revising the questionnaire.

<sup>31</sup> The following comment gives us an example of this: "In 'real life' I am in an IT-support role. In this organization I am involved in intelligence gathering and dissemination via known intelligence methodology."

Another comment on tasks and responsibilities says more about the division of responsibilities per se: “Many does not want to do more than what is within their domain, which is a big problem here since the structure is changed. So, some get too busy and others far too little busy.” This comment explains why some people report that they have too much to do while others report that they have too little to do. Furthermore, the statement points to the problem often found in bureaucratic type organizations (see e.g., Morgan, 1997), of people becoming, not only very good at doing what is within their area of responsibility, but also at not doing more than this. Thus, the organizational changes introduced here could represent an easing up of the strict division of responsibilities typical of bureaucratic organizations.

**Relationship to organization**

Analyses were performed in order to see whether the respondents’ view of the organization interacted with their views on their tasks and responsibilities. Rated difference in tasks and responsibilities was significantly correlated with rated organizational difference, centralization, and flexibility (see table 5.1 for details). This means that those who found their tasks and responsibilities to be different in this exercise/organization, also tended to find the organization different, more centralized, and more flexible.

*Table 5.1 Correlations (N=23)*

	Task and responsibility (different from usual)	Amount of responsibility
Organization (different from usual)	.436*	-.023
Centralization/decentralization	.430*	.087
Flexibility	.510*	-.017
Rating of organization	.098	.559**

\* p < .05 \*\* p < .01.

A stepwise regression analysis was conducted in order to see how well these variables explained the ratings of change in tasks and responsibilities (table 5.2). Centralization was excluded from the model. Flexibility and organizational difference, together explained 46,9% of the variance (adjusted R<sup>2</sup>=41,6%, p= .002). This indicates a close relationship between the respondents’ perception of the organizational changes (in terms of flexibility and general change) and their perception of changes in their own tasks and responsibilities.

*Table 5.2. Multiple regression analysis. Dependent Variable: Task and responsibility (different from usual). N = 23.*

	<i>b</i>	<i>SE b</i>	<i>Beta</i>	<i>t</i>	<i>p</i>
<i>Constant</i>	.044	.474		.093	.927
<i>Flexibility</i>	.374	.115	.528	3.239	.004
<i>Organization (different from usual)</i>	.528	.188	.458	2.807	.011

R<sup>2</sup>=.47, Adjusted R<sup>2</sup>=.42, F(2,20)=8.83, p<.01

Table 5.1 also shows that ratings of amount of responsibility and liking the organization were significantly correlated ( $r=.559$ ,  $p=.007$ ), indicating that those who are given more responsibilities in this exercise/organization also rate the organization as better. This corroborates the finding described in the beginning of this chapter; the personnel tended to report that they liked an increase in tasks and responsibilities. Further regression analysis revealed that the amount of responsibility explained 31,2% of the variance (adjusted  $R^2=27,8\%$ ) in rated liking of the organization.

### **Relationship to communication and decision-making**

The questions on tasks and responsibilities were checked for their relationship with both communication and decision-making variables, in order to see whether these could exert any influence on one another. There was found no covariance.

#### **3.2.5.2 Cooperation (group processes)**

Two questions aimed to measure how the respondents felt that changes in tasks and responsibilities (roles) affected group processes in terms of cooperation and liking. 45% reported that the changes had affected cooperation in some degree<sup>32</sup>, and 46,2% of these reported that it was for the better. Thinking the change was for the better for how they cooperated with their colleagues, related significantly to reporting that they had more responsibility than usual ( $r=.593$ ,  $p=.033$ ), liked having more responsibility ( $r=.691$ ,  $p=.009$ ), and were integrated into central processes ( $r=.610$ ,  $p=.027$ ; see also next chapter, 3.2.5.3). This indicates that there is a link between having more responsibility, being more integrated into central processes, and better cooperation. It seems that having a more central role in the organization (more responsibility and more included in central processes), may influence the perception of group processes (in terms of cooperation) positively.

### **Qualitative**

Cooperation was commented on like this by one interview subject: “As a team this DJTF functions better now than earlier. It gets better each time. By the second day this time it started to function. First deployment where this organization was started, it was chaos.” This points to the necessity for people to practice and train together, if the personnel are to function as a team and not just an ad-hoc group. This is in line with existing research on how teams outperform ad-hoc groups (e.g., Orasanu & Salas, 1993; Brown, 1988; Hackman, 1988).

Another respondent felt that cooperation with his colleagues had been affected negatively by the changes. He said: “In Naples, I know my job and can communicate from a position of authority. In the DJTF I am still learning and therefore cannot do that.” This indicates that people’s perceived proficiency in their role also affect their cooperative behavior with others.

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<sup>32</sup> This finding is, however, somewhat unclear. It turned out that more people answered this question than those who had reported that there had been changes. This has been clarified in the revised form of the questionnaire.

### **Relationship to organization**

Correlations with organizational variables were conducted in order to see whether they could have an effect on group processes (in terms of cooperation). It turned out that decentralization was significantly correlated with how the person liked the changes in cooperation ( $r=.698$ ,  $p=.008$ ). Indeed, a regression analysis revealed that centralization explained 48,7% of the variance (adjusted  $R^2= 44,1\%$ ) in how the person liked the changes in cooperation. Thus, it seems that more decentralization may bring on more contentment with cooperation.

#### **3.2.5.3 Inclusion into organizational processes (group processes)**

Three questions aimed to measure to what degree the respondents were included into the organizational and team processes. These were questions on how well they felt integrated into central processes, their activity level, and the amount of things they had to do in their position in this organization. 60,8% reported that they in some degree felt integrated into central processes in the headquarter, 65,2% reported that they in some degree were more busy than usual, and 86,3% reported that they had either too much or the right amount of things to do in their position. This should indicate that most respondents are quite well included into the organizational and team processes.

The question on activity level was significantly correlated with both the question on integration into central processes and with the question on the amount of things they had to do ( $r=.483$ ,  $p=.020$ ;  $r=.597$ ,  $p=.003$ , respectively)<sup>33</sup>. The question on integration into central processes and the question on the amount of things they had to do were not significantly correlated.

### **Relationship to language and organization**

Correlation analysis was conducted in order to check whether language and organization may have had any effect on whether the respondents were included into the organizational and team processes.

There was not found any relationship between language (native/non-native English speaker and English language proficiency level) and inclusion into organizational and team processes. Nor was there found any significant relationship between organization (hierarchy, centralization, flexibility) and whether the respondents were included into the organizational and team processes<sup>34</sup>.

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<sup>33</sup> Due to its meaning likely being satisfactorily covered by the two other questions, the question on activity level was cut in the revised version in order to shorten the questionnaire's length.

<sup>34</sup> Centralization and activity level had the closest thing to a significant relationship of these variables ( $r=.378$ ,  $p=.076$ ,  $R^2=.143$ ).

### **Relationship to communication**

Correlation analysis was conducted in order to check whether the communication pattern may be related to whether the respondents reported being included into organizational and team processes.

There were found several significant correlations. The question about information-seeking from superior (chapter 3.2.1) was related to all three questions aiming to measure to what degree the respondents were included into the organizational and team processes.

It was significantly correlated with integration into central processes ( $r=.517$ ,  $p=.012$ ), being busy ( $r=.614$ ,  $p=.002$ ) and amount of things to do in their position ( $r=.487$ ,  $p=.024$ )<sup>35</sup>. This means that there is a tendency for people who report that they rarely seek information from their superior also to report that they are more integrated, busier and have more to do in their position. Having more to do in their position, was furthermore significantly related both to reporting more information-sharing with subordinates ( $r=-.584$ ,  $p=.004$ ), as well as to reporting more communication in general with subordinates ( $r=-.542$ ,  $p=.009$ ).

A sumscore of the three questions (integration into central processes, being busy and amount of things to do) was made in order to further find out to what degree being included into the organizational and team processes related to information-sharing with subordinates. It was moderately, but not significantly related ( $r=-.373$ ,  $p=.088$ ). This, together with the finding presented above, indicates a tendency for people who are more integrated also to integrate their own subordinates more (in terms of sharing information). This understanding is corroborated by the finding that having a lot to do is related to less information-seeking from superior. Since less information-seeking from superior is also related to being well integrated into central processes, it seems reasonable to interpret this to mean that the personnel who are well integrated centrally have less need for seeking information from a superior. Being that they are well integrated upwards may in turn indicate that they also simply have had more information to communicate to subordinates.

## **3.2.6 SOCIAL IDENTITY**

### **3.2.6.1 Affinity**

Three questions aimed to find out what formed the basis of the respondent's sense of belonging in the organization. One question related to whom in the hierarchy they worked the closest with, one asked where in the organization these worked, and one asked what gave them a sense of belonging. Frequencies show that most people work the closest with their equals and superiors (39,1% rated each of these as most important), and 72,7% say that these people are working in the same group as them in the organization. The question of what gives a sense of

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<sup>35</sup> The questions on information sharing and those on inclusion into central processes had an opposite coding, meaning that a high score on the information sharing questions indicate a high degree of information-sharing while a high score on the questions on inclusion actually indicate a low degree of inclusion.

belonging, demonstrates that the team and assignment are rated the highest, while age and gender is rated the lowest, as presented in the figure below (3.1).

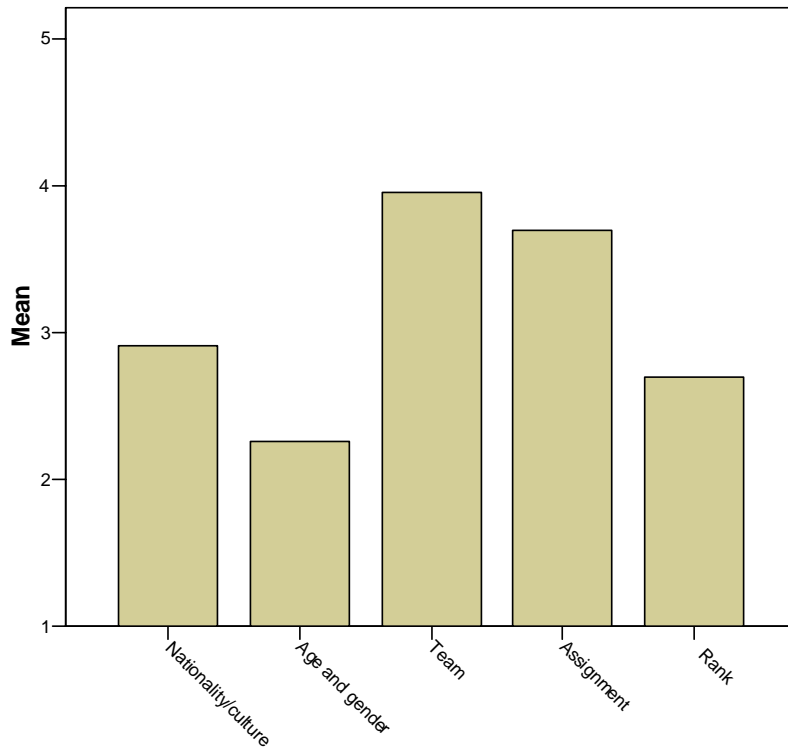


Figure 3.1. Ratings of what gives a sense of belonging (min.score=1, max.score=5).

**Relationship to language**

Further analysis was conducted in order to see if there were any differences between native and non-native English speakers in what created a sense of belonging. This is presented in the figure below (3.2).

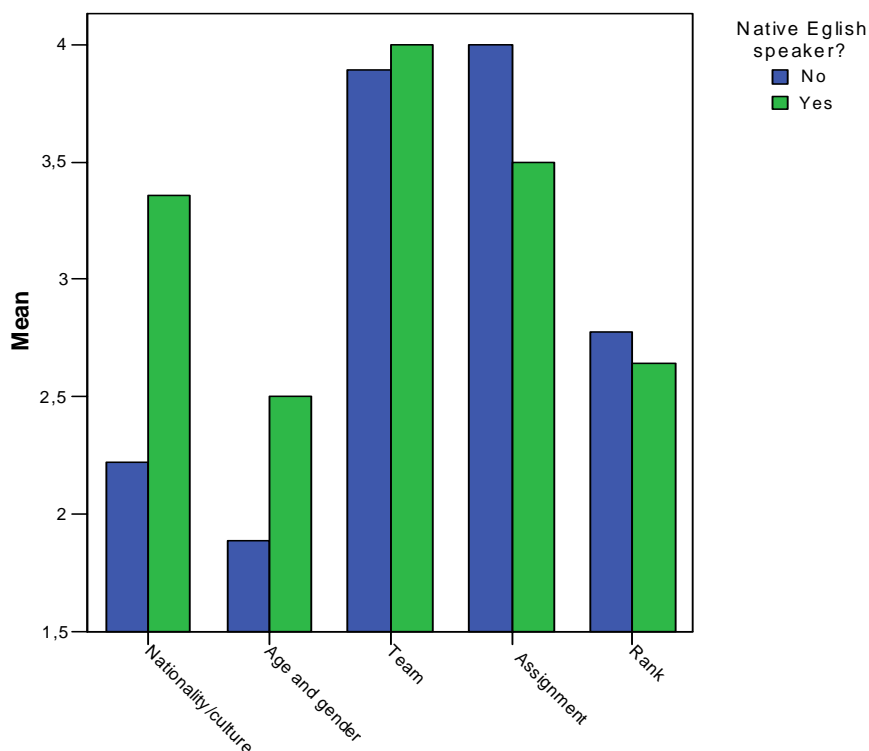


Figure 3.2. Differences between native English speakers and non-natives in ratings of what gives a sense of belonging.

A t-test demonstrated that there was a significant difference between native English speakers and non-natives in their ratings of nationality/culture ( $t=-2.446, p=.023$ ). Native English speakers found nationality/culture to be quite a bit more important for their sense of belonging in this environment than did non-native English speakers.

### 3.2.6.2 Meaning of Affinity

Three questions aimed to measure the meaning of the personnel’s affinities. These questions asked them to rate the importance of belonging, whether it is an aid in doing their job and whether it is an obstacle for them in doing their job<sup>36</sup>. Descriptive statistics show that affinity is deemed to be important in some degree by 87% of the respondents. 92,3% find it to be important for them in some degree to do their job while only 4.3% found it to be an obstacle. The two first questions were significantly correlated ( $r=.513, p=.012$ ), indicating that people who find affinity important also tend to find it helpful in doing their job. The two latter questions were almost significantly correlated ( $r=-.411, p=.051$ ), however, due to a lack in the spread of answers to the last question, a significant correlation would be difficult to obtain (see previous footnote).

<sup>36</sup> This question has been completely rephrased in the revision of the questionnaire due to a lack of variance in responses.



There was found a significant relationship between finding assignment to give a sense of belonging and finding affinity to be important ( $r=-.525$ ,  $p=.01$ ). Additionally, the relationship between finding assignment to give a sense of belonging and finding affinity to be an aid in doing their job was not far from being significant ( $r=-.394$ ,  $p=.063$ ).<sup>37</sup> This indicates that a sense of belonging can help people working on the same assignment to get the job done. From another angle, this may also indicate that having a common goal (in terms of assignment) brings people closer (in terms of cooperation and group belonging/identity).

### 3.2.7 CULTURE

#### 3.2.7.1 Cultural training

A computerized questionnaire and information program on national culture was introduced in the exercise by the LTAMC team. One of the aims was to find out whether this could have a positive effect on cross-cultural understanding and cooperation.<sup>38</sup>

There was 22.2% who rated the cultural training tool to have had some effect on their cultural understanding during the exercise. All of these turned out to be native English speakers. None of the non-native English speakers rated the tool to have been of any aid. Why there is such a difference is difficult to say, however, very few respondents answered this question, and consequently, these differences were not significant (see also preceding footnote).

Qualitative data suggests that non-native English speakers generally seem to be more aware of their own culture and more readily link their behavior and choices to culture. This could be due to them being minorities in this setting; feeling different from the majority may motivate to more reflection on cultural differences. However, it could also be that this is something they bring into the setting; people from smaller nations may be more used to contact with people from other nations, which may have contributed to them becoming more culturally aware. This would need further investigation, in order to be able to say anything with any reasonable certainty.

#### 3.2.7.2 Tendency for controlling behavior

One question aimed to obtain a rating of the use of controlling behavior. Descriptive statistics show that there was an approximate equal number of people who reported that they either very often/often, sometimes, or seldom/never found a use for increasing downward control. There was no significant difference between native English Speakers and non-natives.

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<sup>37</sup> There were found no differences between native English speakers and non-natives in the relationship between their ratings of what gives an affinity and the rated importance and aid of an affinity.

<sup>38</sup> The aim was to have personnel go through this cultural training before the start of the exercise. However, due to a delay in the arrival of the personnel, the bulk of this was done in parallel with the exercise. Consequently, the majority of respondents found it difficult to answer the question on whether the training tool had given a positive effect, hence, making the following results rather uncertain.

The aim was to see whether there were any cultural differences in how people answered this question. From the qualitative data we saw that people from low Power distance<sup>39</sup> cultures seemed to more often to rely on the ability of their subordinates to manage on their own, while people from high Pd cultures were more liable to indicate that the subordinates had to be guided in order for them to “get it right”. People from low Pd cultures tended to reveal more positive attitudes to their subordinates than did people from high Pd cultures. An example of a statement from the former would be: “The members of the organization are generally rather experienced, so I don’t feel a strong need to exercise an increased control.” An example of the latter, a more negative attitude, would be: “Some people tend to escape their tasks when they realize that the superior control is insufficient.”

This supports previous findings in cross-cultural organizational research (e.g., Bochner & Hesketh, 1994; Clegg, 1981; Hofstede, 1991; Offermann & Hellmann, 1997).

### **Culture/nationality and cooperation: Qualitative**

On the question of which nationalities the respondents cooperate most with, the majority report that they cooperate most with people from the US and the UK. The general answer from our respondents was that this is due to the general make-up of the organization, indicating that these nationalities simply outnumber other nationalities in the organization.

However, some report that they also, to a certain degree, choose whom to cooperate with based on whom they feel most similar to and most at ease with, and that this sometimes had a root in similarities in culture. Several interviewees pointed to that similarities in language, ways of thinking/understanding, and values, guided their choice of interaction with other people.

### **3.2.7.3 Culture and trust**

There were two questions pertaining to how the respondents generally related to people from different cultures and how they trusted them<sup>40</sup>. 36,4% reported that there were differences in how they related to people from different cultures, while 50% said that there were no differences. This could either mean that that there was a lack of cultural awareness in the 50%, or that they chose not to treat people differently in spite of their knowledge (which could be either in a positive or a negative sense). Qualitative data indicate that whether people choose to treat people the same, independent of culture, or differently, depending on culture, they do it because they believe it is the “right thing to do”. Some simply seem to believe that it is most correct to treat everyone the same (independent of culture), while others argue that there are advantages to “being sensitive to different cultures”.

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<sup>39</sup> Power distance (Pd) is a cultural dimension which indicates to what degree there is an actual and experienced distance between people at the top and at the bottom of the hierarchy in different national cultures (Hofstede, 1991). Low Pd indicates small differences and equality, while high Pd indicates large differences and inequality

<sup>40</sup> Due to a lack of variance in responses and indications in the interviews of this being a sensitive question (people generally will not admit to distrusting other nationalities, as this may appear racist), it has been rephrased in the revised form of the questionnaire.

Very few (13,6%) said that they trusted people from other cultures less than people from their own culture (see previous footnote). Qualitatively, on this question, interviewees generally said that trust depended more on person than on nationality. However, some also specified that they more readily trusted someone from a culture or group that they knew normally performed well in the task at hand, and that others first had to prove themselves. One said it like this: “There is more of a need to get to know people from different cultures for you to trust them; to know what to expect, etc.” Some furthermore linked trust to understanding, “you trust those you understand”. In other words, it seems that trust has a lot to do with familiarity, in terms of ability to understand and knowing what to expect.

## 4 SUMMARY AND DISCUSSION

### 4.1 INFORMATION-SHARING

#### 4.1.1 Push-pull and post-and-pull

Both the qualitative and the quantitative analysis of the information flow indicated that there might be a shortcoming in the established “push-pull” information-sharing system. This was found to support a switch to the model currently argued for in many NEC contexts, the “post-and-pull” model.

#### 4.1.2 Information-sharing and hierarchy

Different information-sharing behaviors between superior, equal and subordinate were compared. It was found that that the respondents tend to both share information with, and seek information from, equals most of the time, while information requests are most often received from superiors. The latter is descriptive of a hierarchic organization, while the former indicates a flatter type organization. This is in line with the finding on organization (chap 3.2.4 and 4.4); most people find this organization to be flatter than what they are used to. These results indicate that attempts have been made to make the organization flatter and is hence in line with the EBO concept. However, the analysis from the chapter on organization also shows that the organization was found to be more centralized, which indicates that responsibilities have been shifted up, and not down in the hierarchy. (See also chapter 4.4.)

#### 4.1.3 Obstacles for information-sharing: Time, language and culture

It was found that time constraints represented the most important obstacle for a person to share information. Native English-speakers and non-natives revealed the same opinion on this. However, there was found an important difference between native English-speakers and non-natives in how they rated language and culture; contrary to our expectations, native English-

speakers perceived language and culture to be a greater problem for their information-sharing than did non-native English-speakers.

This finding is in line with the findings on language; native English speakers also perceived it as more difficult to understand non-native English speakers' point of view than did non-native English speakers. Thus, it seems that native English speakers find it more difficult both to understand non-native English speakers as well as to trust them to understand a message.

The notion that native English speakers may hesitate to share information because they are afraid that the non-native English speakers may not understand the message is supported by the qualitative data from the interviews. Native English speakers often report that they are unsure of non-native English speakers understanding.

There is still a question why language and culture are perceived to be more of a problem for native English speakers than non-native English speakers. It could be that native English speakers are less used to cooperating with people from other nationalities (both in terms of culture and language), and thus are more unfamiliar with the setting. It may also be that native English speakers rate the problem higher because they do not have insight into the language problem from the other end, and cannot as readily understand the problem or how to deal with it. This lack of ability to see the situation from the other's point of view may create a feeling of "us and them", where the other group (the "outgroup"<sup>41</sup>) is more easily perceived negatively. This is a classic finding from the research related to Social Identity Theory (e.g., Hogg & Abrams, 1988).

## 4.2 DECISION-MAKING

The analysis showed that a relatively stable majority (around 60%) of the respondents rated the decision-making as timely, speedy, of good quality, and successful. People tended to rate the decision-making process (quality) somewhat more favorable than its outcome (success).

## 4.3 LANGUAGE

### 4.3.1 Language proficiency

The results indicated that a large majority of the non-native English speaking personnel (75%) were negatively influenced by having to work in English instead of in their native language. Increased tiredness and stress were such factors. This means that non-native English speaking personnel are subject to a larger cognitive load relative to what natives experience, and that they consequently may be more vulnerable to additional stressors (see e.g., Fiske & Taylor,

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<sup>41</sup> Term used in Social Identity Theory (e.g., Hogg & Abrams, 1988) denoting a group that the person in question does not belong to.

1991; Khan, 2002). The poorer the language proficiency, the higher the cognitive load. This will have an impact on their function in the organization, especially in times of high demands.

#### 4.3.2 Language and means of communication

When it comes to the choice of means of communication, there seemed to be a very slight preference for written means of communication when the receiver and/or the sender was a non-native English speaker. However, quite a lot of respondents also preferred face-to-face interaction<sup>42</sup>. The telephone was the least preferred medium, perceived to augment the risk for misunderstandings.

#### 4.3.3 Language and power relations

It was found that the great majority of our respondents perceived native English speakers to dominate cooperative situations more than others (95,5%), and that these tended to rate it more difficult to understand non-native English speakers point of view than native English speakers. These findings indicate that non-native English speakers clearly have a disadvantage in the organization and in cooperation compared to native English speakers.

### 4.4 ORGANIZATION

87% of the respondents rated this organization as different from what they were used to. It is very possible that this could influence the effectiveness of the organization. The optimal situation is that there is congruence between the organization one is used to and the organization one is to work in during an exercise or real operation. What has been practiced daily for years will evidently form a persons basic understanding of how the organization works and how he/she should do his/her work within it, in time becoming automatic and less subject for conscious evaluation. Especially in situations of high mental demand (stress), people increasingly depend on their most salient mental models, i.e. what they are most used to doing (e.g., Fiske & Taylor, 1991). Changing the organizational structure and processes is therefore a difficult and long process (see also Hofstede, 1991); people's basic understanding, or existing mental models, will continue to influence their behavior until new mental models become more salient. One cannot really expect a change in organizational structure and processes to become effective until this has become the norm for the people working in it. This point was also underlined in one of the interviews, where it was pointed out to us that the organizational changes meant that many people were put in positions where they did not possess the expertise they felt they needed in order to do the work.

On the other hand, one has to start somewhere in order to make changes, and one cannot expect the whole NATO organization and processes to change over night. Thus, the

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<sup>42</sup> We do not have much data on this now (too few respondents), but there seems to be some indications (primarily from the qualitative data), that such preferences also may be somewhat culture-dependent.

organizational and procedural changes introduced in this DJTF, can be understood more like a step on the way than being final or complete in any way (i.e. the organizational changes resulted from the Commanders operationalization of the EBO concept). Hopefully, what studies like this may contribute to, is to increase the understanding of the effects of the changes and learn from the experiences of people who are in the middle of it.

A moderate majority rated the organizational changes to have been for the better. This was linked to an increase in speed of decision-making and information-flow, flatter organization and more effective team processes. Those who felt the changes had been for the worse, pointed to NATO bureaucracy, micromanagement, and a lack of time and manning.

The respondents tended to rate this organization as more centralized than what they were used to. This was reflected both in relation to the questions on organization and to the questions in relation to tasks and responsibilities. At the same time, the organization tended to be rated as flatter. This is in line with other empirical findings from the field; decentralization and flattening of the hierarchy are not always going hand in hand (e.g., Vego, 2003). Indeed, new technology and flattening the hierarchy often mean a centralization of decision-making rather than decentralization (see e.g., Bjørnstad, 2004). However, this is not optimal for the efficiency of organizational processes, as the top end of the hierarchy easily gets overloaded when too many decisions are routed upwards (see e.g., Dekker, 2003; Bjørnstad, 2004). This latter interpretation was further supported by qualitative data. In the interviews, it was explained that the decision-making process often was hindered due to an overload at the top end of the organization (“chokepoint”), because intermediate leaders were not sufficiently empowered to make decisions. Other interviewees saw it from the other side, indicating that subordinates forwarded too many questions to their superior out of convenience. Both viewpoints refer to organizational processes that make personnel lower down in the hierarchy less able to make decisions. This may be linked to the process of learned helplessness<sup>43</sup>; there is a risk that people become passive in systems where they get used to having insufficient authority to achieve set goals. If the person gets used to not being able to make a difference, it is a natural consequence to stop trying.

Decentralization and flexibility were found to be closely related; people who found the organization to be flexible also tended to find the organization decentralized. This confirms the classic finding of a link between centralized organization and inflexibility (see e.g., Morgan, 1997; Roman, 1997; Bjørnstad, 2004).

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<sup>43</sup> This is a classic finding from psychology (Seligman, 1975); people (and animals) learn quickly to stay passive when they previously have learned that their actions are unsuccessful. This knowledge is furthermore transferable to different situations than where it was learned.

## 4.5 GROUP ROLES AND PROCESSES

### 4.5.1 Tasks and responsibilities

It was found that a majority (almost 70%) of the respondents perceived that their tasks and responsibilities to be different from usual in this exercise. This was found to be closely related to perceiving the organization to have changed.

Those who were given increased responsibilities in this exercise/organization were found to like it better as well as rate the organization as better.

Furthermore, it was pointed to some inherent problems with the division of responsibilities per se; as people had been used to having clear boundaries for their tasks and responsibilities, some were reluctant to assume responsibility for new and/or additional domains, which the new organization required. This was linked to a classic problem found in bureaucratic type organizations; people becoming very rigid when working in a system with strict division of responsibilities (Morgan, 1997). Hence, running into problems when introducing a change to a previously bureaucratic type system, should not be surprising. Maybe the reluctance could be looked upon as a good sign, as it indicates that organizational change really has been introduced.

### 4.5.2 Cooperation

It was found that good teamwork depended on training together within the organizational structure. This was linked to research within “natural decision-making”, which have demonstrated that teams perform better than ad-hoc groups on decision-making (Orasanu & Salas, 1993).

Results indicated a link between having more responsibility, being more integrated into central processes, and better cooperation. Thus, it seems that characteristics of a decentralized and flat organization, like shared responsibility and high integration of all levels, may have a positive effect on cooperation.

Results furthermore indicated a link between decentralization and contentment with cooperation. This could indicate that teamwork is ameliorated by decentralized control. Such an interpretation is supported by research on team decision-making; democratic leadership has been found to be more effective and advantageous in many respects (e.g., Chidester, 1990; Eisenhardt, 1989; Haleblian & Finkelstein, 1993).

### 4.5.3 Inclusion into organizational processes

Most respondents seemed to be well included into the organizational and team processes. This was found to be negatively related to seeking information from superior. Additionally, there

seemed to be a tendency for people who were more integrated, to integrate their own subordinates more (in terms of sharing information). This was interpreted to mean that the personnel who were well integrated centrally had less need to seek information from a superior as they more naturally gained the knowledge and subsequently possessed more information to communicate to subordinates. Additionally, feeling included by ones own superiors could play a part in producing more inclusive behavior toward ones subordinates. Such reciprocity may be understood as part of the implicit processes included in an organization's culture.

## 4.6 SOCIAL IDENTITY

### 4.6.1 Affinity

It was found that the team and the assignment meant most in creating a sense of belonging for our respondents. Age and gender was found to be the least important.

There were pointed to some differences between native and Non-native English speakers. Native English speakers rated nationality/culture as quite a bit more important for their sense of belonging in this environment than did non-native English speakers. They also rated culture as more of a hinder for their information-sharing than did non-native English speakers. This may indicate that native English speakers focus more on culture than non-native English speakers do, both as something positive (giving a sense of belonging) and as something negative (an obstacle for sharing information).

### 4.6.2 The importance of affinity

There was found a link between finding affinity to be important and an aid to get the job done, and finding the assignment to give a sense of belonging, indicating that a sense of belonging can help people working on the same assignment to get the job done. From another angle, this may also indicate that having a common goal (in terms of assignment) brings people closer (in terms of cooperation and group belonging/identity). This is in line with classic research on group processes; common goals and mutual dependency has the ability to create a common identity (i.e. psychological sense of belonging; see e.g. Hogg & Abrams, 1988) and to bring people even from conflicting groups together in cooperation (Sherif et al, 1961).

## 4.7 CULTURE

There was found a tendency for people from low Pd cultures to expect their subordinates to manage on their own, while people from high Pd cultures were more liable expect their subordinates to need close guidance<sup>44</sup>. People from low Pd cultures tended to reveal more positive attitudes to their subordinates than did people from high Pd cultures. As indicated

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<sup>44</sup> Results from the qualitative data analysis.



previously, this supports findings from cross-cultural organizational research (e.g., Bochner & Hesketh, 1994; Clegg, 1981; Hofstede, 1991; Offermann & Hellmann, 1997). Bochner & Hesketh, for instance, found that higher Pd was related to a preference for closer supervision and a belief in the necessity of having to *make* people work hard. Clegg found high Pd to be linked to controlling behavior on the leader's part.

Trust seemed to have a lot to do with familiarity, both in terms of ability to understand and knowing what to expect. The respondents pointed to being able to understand and knowing what to expect, as important factors in relying on other people.

## 5 REVISION OF THE QUESTIONNAIRE AND VALIDATION

Both qualitative and quantitative data provided input to the revision of the questionnaire. As previously indicated, the actions taken were presented in footnotes alongside the analysis.

In general, it was checked whether the respondents understood the questions as they were intended and whether there were an adequate distribution of answers. If there were detected a problem, the question was either rephrased or cut. Since length also had been an issue for our respondents, measures were taken in order to shorten the questionnaire. This was generally done by cutting what seemed like superfluous or overlapping questions. Additionally, as most open-ended questions had primarily served the exploratory nature of this study, many of them were cut in the revised version. On some open-ended questions, the subject responses provided the background from which additional closed-ended questions were developed.

There were also made some structural changes to the questionnaire; issues that seemed to be natural for the respondents to answer initially, were moved to the beginning, etc. Additionally, the lay-out and some of the phrases were updated in order to make it more readable, clear and user-friendly.

The content validity of the form should have been satisfactorily established by the measures thus described. The feedback given by the respondents, primarily in the interviews, but also through comments that were made in writing, gave indications of good face validity.

In sum, this pilot study gave very useful feed-back and help to the development of the questionnaire. The instrument still has room for improvement, but is in its current form deemed to be useful and valid for the further study of cooperation, information-sharing and organizational processes in a military multicultural environment.

## 6 LIMITATIONS

Due to the small number of respondents in this study, the results must be understood as only preliminary. It is quite possible that larger samples in subsequent studies, may provide different results. However, since an organizational analysis necessarily is very much connected

to the case at hand, one must to a certain degree also expect variation in the findings from different organizations.

## **7 FURTHER WORK**

Both in relation to the development of the questionnaire and the analysis of organizational issues in a military multicultural setting, the current work is not final. It has been conducted as a pilot study, aiming to be followed up by further studies and analyses. Due to a temporary inability to access the culture-data collected in the AW04 exercise, the interaction with culture and nationality will be analyzed in a part II of this report (which will be published shortly). Nevertheless, there is a need to obtain more adequate data on cultural factors, especially in order to achieve the goal; to learn something new about the cultural interaction with organizational processes in military multicultural decision-making settings.

At this time, data has been collected from Norwegian subjects in the Battle Griffin exercise that took place in the beginning of March 2005. This data is in the process of being analyzed as part of the NBD-O project at FFI. As this sample was a homogenous group in terms of national culture, the analysis will not look at culture or language as a factor. There is furthermore a plan in the LTAMC project for further studies at the upcoming NATO exercise AW05 this Fall, and MNE4 (Multinational Experiment number 4) in the winter of 2006.

## **8 CONCLUSION**

This pilot study provided some interesting findings related to the organizational changes introduced in a multinational NATO Headquarter, some anticipated – others not. The study provided some preliminary insights into the organizational processes linked to cooperation. To ensure a richness of understanding, both qualitative and quantitative measures were employed. The instrument developed for this study, an organization-focused questionnaire, proved useful for analyzing the cooperation in the multicultural military setting and was updated according to both the quantitative data and the qualitative feed-back provided to us in the interviews. Although it still has room for improvement, it is deemed to be of value also for further research in this area.

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## **FFI RAPPORT**

### **PART II: ALLIED WARRIOR 2004 - Pilot study and analysis of cross-cultural organizational issues**

BJØRNSTAD Anne Lise

**FFI/RAPPORT-2006/00112**





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analysis of cross-cultural organizational issues**

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THESAURUS REFERENCE: 8) ABSTRACT <p>FFI-project 879 Network Based Defense in Operations aims to increase the understanding of the transformation of the Norwegian Armed Forces toward NBD, including both theoretical and empirical examinations of the concept, linked to both the technological and the organizational development.</p> <p>This report presents the analysis of the cross-cultural issues linked to the organization and cooperation in a NATO Headquarter (HQ), based on the data collected at the NATO exercise Allied Warrior 2004 (AW04). (Part I of this report focused on the organizational processes, as well as reporting on the methodological issues involved in the development of the organization-focused questionnaire employed in the data collection.)</p> <p>The results of the analysis provide some preliminary insights into the cultural influence on organizational processes linked to cooperation in a multinational headquarter.</p>														
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## PART II: ALLIED WARRIOR 2004 - Pilot study and analysis of cross-cultural organizational issues

### 1 INTRODUCTION

FFI-project 879 *Network Based Defense in Operations* (NBD-O) aims to increase the understanding of the transformation of the Norwegian Armed Forces toward NBD<sup>1</sup>. The project focuses on theoretical and empirical examinations of the concept, linked to both the technological and the organizational development. Included in this work is also an analysis of the consequences for cooperation in military operations both nationally and internationally. This overlaps with some of the aims of the NATO Concept Development and Experimentation (CD&E) project *Leader and Team Adaptability in Multinational Coalitions: Cultural Diversity in Cognition and Teamwork* (LTAMC)<sup>2</sup>. LTAMC's general focus is on cooperation and adaptability in multinational coalitions, where the author of this report contributes with a focus on cross-cultural organizational issues linked to cooperation in international NATO headquarters.

The LTAMC team collected data for the first time at the Deployable Joint Task Force (DJTF) HQ during NATO exercise Allied Warrior 2004 (AW04) in October/November. Data was collected on culture, cognitive readiness, personality, and organizational variables via questionnaires, observation, and semi-structured interviews. The study is considered a pilot study, as it was the first time these measures were employed together and a new questionnaire<sup>3</sup> developed and put into use to measure the organization-related variables.

This report presents the second part ("Part II") of the analysis of the data on cross-cultural organizational issues from the AW04 exercise, aiming is to contribute both to the LTAMC and the NBD-O projects. The main focus here is the interaction between national culture and organization. "Part I" of this report focused on the organizational issues covered in the organization-focused questionnaire (Bjørnstad, 2005). Part I also described the actions taken to revise the questionnaire based on the data collected.

The aim is to increase the understanding of the interconnections between organizational and group processes, decision-making, information-sharing, language and culture<sup>4</sup>. The intention is

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<sup>1</sup> The Norwegian term for Network Enabled Capabilities (NEC).

<sup>2</sup> LTAMC was established in 2004 under NATO Strategic Allied Command Transformation (HQ SACT, Concept Development and Experimentation (CD&E) and is led by the U.S. Army Research Laboratory (ARL). The project is also registered as a NATO Research and Technology Organization (RTO) Human Factors and Medicine (HFM) Research and Technology Group (RTG) – 138, titled *Adaptability in Coalition Teamwork* (ACT). The currently participating nations are Canada, Norway, Sweden and the United States (Greece and the United Kingdom participate as observers).

<sup>3</sup> Developed within the NBD-O project at FFI.

<sup>4</sup> The importance of culture has been documented from many angles. For instance, stress, time-pressure, etc, typical for military operations, has been found to augment stereotyping (Khan, 2002). This is because increased

ultimately to provide important feedback, evaluation and input to the organizational development and training in NATO and Pfp<sup>5</sup> nations in general and in the Norwegian Armed Forces in particular. This is linked to the NATO goal of transforming its forces toward NEC (NATO HQ SACT, 2004).

### **1.1 The AW04 exercise**

The exercise was designed to certify readiness of the NATO Response Force 4 (NRF 4) from January through June 2005. The HQs for NRF 4 demonstrated this capability during the planning and conduct of a simulated Crisis Response Operations (CRO) down to the Combined Joint Force Land Component Command (CJFLCC) HQ level.

The AW04 was a command post exercise (CPX)<sup>6</sup> and in reality a rerun and a control of the readiness of the NRF 4, as they were officially approved on their former exercise in 2004. The personnel at the DJTF from HQ Naples were the focus of our study.

Organizational changes had been introduced in a preceding exercise in 2004, making this the second time the personnel in the DJTF exercised the new organizational structure.

The aim of this study was to research what the reorganization meant for the personnel and how this interacted with national culture.

## **2 METHOD**

This report presents the analysis of the data from the AW04 exercise focusing on cross-cultural organizational issues, using both qualitative and quantitative measures and methods of analysis. More specifically, a combination of observation, semi-structured interviews and questionnaires were employed for the data collection.<sup>7</sup>

### **2.1 Sample and execution of study**

The data-collection was carried out in the course of 6 days, November 2004. The military personnel at the DJTF from HQ Naples were the focus of our study. They counted approximately 90 persons and were from 12 different nations; the majority of whom had their daily work at the NATO HQ in Naples.

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cognitive load leads to an economization of cognitive processes. It is especially relevant to consider cross-cultural issues in multinational military operations because of the potential negative effects that stereotyping between the participating nations may have on the cooperation across nations.

<sup>5</sup> Partnership for Peace.

<sup>6</sup> I.e. run by an exercise command.

<sup>7</sup> For a more in-depth introduction to the case and methodology, especially pertaining to the organizational questionnaire, please see part I of this report (Bjørnstad, 2005).



We had two key informants, who gave us an overview of the exercise and the organization. 13 persons from the DJTF were interviewed and 15<sup>8</sup> filled out the questionnaire on organization-related topics. 11 out of these had also answered a computerized questionnaire on culture in the beginning of the exercise.

## 2.2 Measurements and theoretical background

The organization-related topics were measured through a newly developed questionnaire. This data was collected both through interviews and pen-and-paper questionnaires. For more details on this, please see Part I of this report (Bjørnstad, 2005).

The cultural data was collected through Meridian Global's "Globesmart" Self-Assessment Profile Tool (SAP)<sup>9</sup> developed in cooperation with David Matsumoto ([www.meridianglobal.com](http://www.meridianglobal.com); Matsumoto, 2004; Matsumoto et al, 1997; Strathman et al, 1994). The SAP contains 36 questions on culture-related topics and behaviors essential in business relations across cultures ([www.meridianglobal.com](http://www.meridianglobal.com)). These questions give scores on six dimensions of cultural values and attitudes considered to be relevant in a business context. In addition, data were collected on demographics.

The dimensions are called: Independence/Interdependence, Egalitarian/Status, Risk/Restraint, Direct/Indirect Communication, Task/Relationship, and Short-term/Long-term Orientation.

- Independence/Interdependence (I/I) refers to whether people are primarily oriented towards and organized around the individual or the group. Group orientation is linked to tight ties between people, whereas individual orientation is linked to loose ties between people. High scores indicate interdependence (Int).
- The Egalitarian/Status (E/S) dimension refers to differences in status orientation, i.e. to which degree the people in an organization find status differences important for how they act and perceive other members of the organization. High scores indicate status (S) orientation.
- The Risk/Restraint (R/R) dimension refers to differences in willingness to engage in risk-taking behavior. People from restraint oriented cultures are more rule oriented. High scores indicate restraint (Re).
- Direct/Indirect Communication (D/I) refers to the degree to which people prefer to communicate a message in a direct or indirect manner. High scores indicate indirect (Indir) communication.
- The Task/Relationship dimension pertains to differences in whether people tends to focus on the task at hand or on the relationships in the organization in order to get the work done. High scores indicate Relationship (Rel) orientation.

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<sup>8</sup> 5 of these questionnaires were mailed to us and arrived after the writing of Part I.

<sup>9</sup> Also called CSQ (Culture Standardized Questionnaire).

- Short-term/Long-term Orientation (St/Lt) refers to differences in time orientation; i.e. the degree to which people focus on today or the distant future when for instance making decisions. High scores indicate long-term orientation (Lt).

The dimensions have been validated through studies of industry and business teams in different countries ([www.meridianglobal.com](http://www.meridianglobal.com)). There is no research publication on all the dimensions collectively, i.e. the SAP(CSQ) tool of measurement, but there are separate publications establishing the basis from which five of the dimensions have been developed (Egalitarian/Status: Matsumoto, 2004; Independence/Interdependence<sup>10</sup>: Matsumoto et al, 1997; background for Short-term/Long-term Orientation: Strathman et al, 1994; background for Risk/Restraint<sup>11</sup>: Matsumoto et al., 2003, 2001; background for Task/Relationship<sup>12</sup>: Schwartz & Sagiv, 1995).

It is important to be aware that different cultural dimensions developed by different researchers in the field both have differences and similarities that can easily be confused when they use the same or similar name for a dimension which may have the same core meaning, but differ in important other aspects. For instance, the I/C dimension of Hofstede and Triandis carry the same name and reflect the same in the core, i.e. to which degree a culture has group or individual orientation (Triandis, 1995; Hofstede, 1991). However, Triandis' dimension is a much more inclusive dimension than Hofstede's dimension, in that it for instance also refers to variations in power orientations (i.e. the subcategories, vertical/horizontal), which in Hofstede's system is defined as variations within a different dimension, Pd. Thus, using both Triandis' I/C dimension and Hofstede's Pd dimension, would lead to a considerable overlap in meaning of the two measurements and procure the tool's discriminate validity. The risk of using overlapping dimensions has previously been identified by many researchers in the field (see e.g., Triandis, 1995; Bjørnstad, 2000). It is a problem that may apply to the SAP dimensions from the Globesmart tool. The definitions that are used seem to be somewhat overlapping, as well as there currently being no overall validation of the dimensions used together in one tool (discriminate validity).

The SAP dimensions have much in common with the most well-established and empirically tested cross-cultural work in the field; the cultural dimension of Triandis (1995: Individualism/Collectivism) and the work related value-dimensions developed by Hofstede (1991: Individualism/Collectivism, Power distance, Uncertainty avoidance, Masculinity/Femininity, Short-term/Long-term Orientation).

Hofstede's dimensions can in short be explained as follows (Hofstede, 1991):

- Individualism/Collectivism (I/C) refers to a cultural difference in group as opposed to individual orientation. Group orientation is linked to tight ties between people, whereas

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<sup>10</sup> Adapted from the IC Interpersonal Assessment Inventory (Matsumoto et al, 1997).

<sup>11</sup> Adapted from Matsumoto et al.'s tool for measuring adaptability, the ICAPS (2003, 2001).

<sup>12</sup> Developed from Schwartz' Value scale (Schwartz & Sagiv, 1995).

individual orientation is linked to loose ties between people. High score indicate individualism (I).

- Power distance (Pd) is defined as a difference in the actual and experienced distribution of power between people in a hierarchy. High scores indicate high Pd.
- Uncertainty avoidance (Ua) refers to a difference in need for predictability and rule orientation. High scores indicate high Ua.
- Masculinity/Femininity (M/F) refers to whether the culture values toughness, assertiveness and a focus on material success as opposed to modesty, concern for others and a focus on the quality of life. High scores indicate masculinity (M).
- Short-term/Long-term Orientation (St/Lt) refers to a difference in focus; the present versus distant future. The former indicates a propensity for action whereas the latter indicates a propensity for planning. High scores indicate long-term orientation (Lt).

Three of the SAP dimensions are, deducted from the information available, more or less similar to three of Hofstede's dimensions; Independence/Interdependence (I/I) seem to equal Individualism/Collectivism (I/C), Egalitarian/Status (E/S) seem to equal Power distance (Pd), and Short-term/Long-term Orientation (St/Lt) shares both name and much of the content with Hofstede's dimension. The Risk/Restraint (R/R) dimension has some in common with Hofstede's Uncertainty avoidance dimension (Ua)<sup>13</sup>, and the Task/Relationship (T/R) dimension seem have some overlap with both Hofstede's Masculinity/Femininity (M/F) and Individualism/Collectivism (I/C) dimensions. The content of the Direct/Indirect Communication (D/I) seems to some extent to be covered in both Hofstede's and Triandis' Individualism/Collectivism dimension, especially pertaining to the subcategories High/Low context and Tight/Loose society of Triandis' dimension (1995).

### 2.2.1 Challenges of measurements

Unfortunately the data collected on culture with the SAP matches less than half of the sample that we have organizational data on<sup>14</sup>. This has obviously made analyses difficult, and it was deemed useful to explore other sources of cultural data. Since we had information about the nationality of almost the whole sample, we were able to match this with Hofstede's cultural data for the subjects from these nationalities. In other words, Hofstede's national scores were employed in order to provide a supplementary basis for the cultural analysis. The use of such national scores is widely used within cross-cultural research.

The choice of Hofstede's data and research to complement the SAP-data is based on this being the most well-established and researched cross-cultural data we have – especially as concerns

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<sup>13</sup> The definition of the R/R dimension seems to have some elements in common with Hofstede's Uncertainty avoidance (Ua) dimension, i.e. the rule orientation part ([www.meridianglobal.com](http://www.meridianglobal.com)). However, Hofstede is very clear about his dimension referring to uncertainty and not risk (Hofstede, 1991). Hence, the differences seem to be more prominent than the similarities. All in all the definition of this dimension seems somewhat unclear; risk orientation is for instance both linked to decision-making by consensus and by authority.

<sup>14</sup> This is true also for the demographic data; these data matches only for the same respondents as the SAP.

organizational and work related issues. His work has been corroborated and expanded through numerous other studies (e.g., Adler, 1991; Fernandez et al, 1994; Hoppe, 1998; Triandis, 1994).

### 3 ANALYSIS

#### 3.1 The case (the DJTF)

Our key informant reported that the traditional J-structure had a problem; personnel did not interact across their organizational boundaries (i.e. “J-1 does not communicate with J-2.”). To his understanding this motivated the alteration of the organization in this DJTF.

Moreover, based on what we learned from our key informant, the Commander had aimed to have the DJTF organized according to his understanding of how to reach the goals set by the EBO concept. The most evident example of this for the researchers was the joint structure of the CJOC (Combined Joint Operations Centre)<sup>15</sup>. We were informed that the traditional J-structure had been broken up and that people were put together across services into different “cells” (e.g., command group, current operations, sustainment cell, planning cell, etc). Most of the personnel had trained together and generally knew one another since 10 months back. This, we were informed, was quite unique. In other words, there had been put quite some effort into making this CJOC a team and not just an ad-hoc decision-making group. This was pointed out by our key informant and many of the interviewees as a great advantage.<sup>16</sup> However, it is important to underline that this was an organizational structure they had only been confronted with once before in this series of NRF 4 DJTF exercises.

#### 3.2 Tools of measurement: evaluation

As indicated in the presentation of theory and measurement (chapter 2.2), it seemed that at least two of the dimensions of Matsumoto and Hofstede were similar enough for us to expect them to correlate. These were Matsumoto’s I/I dimension and Hofstede’s I/C dimension, as well as Matsumoto’s ES and Hofstede’s Pd dimensions; the former two pertaining to a variation in group-individual orientation, the latter two pertaining to a variation in power distribution. There were indeed found such relationships, however, in the opposite direction of what was expected; I/I was negatively related to I/C ( $r=.291$ ,  $p=.415$ )<sup>17</sup> and ES was negatively related to Pd ( $r=-.434$ ,  $p=.210$ ). Of course, these relationships were not significant, and with such a small sample there could be numerous sources to this irregularity. But if the tendencies

<sup>15</sup> The CJOC is the central point of contact in and out of the DJTF. This is where information about the unfolding situations at the tactical end comes in and is distributed within the DJTF. The information from the field forms the basis from which orders and intent are formed and distributed back to the tactical end to be acted upon.

<sup>16</sup> This perception supports research within “natural decision-making”, which has demonstrated that teams perform better than ad-hoc groups on decision-making (e.g., Orasanu & Salas, 1993).

<sup>17</sup> These dimensions were scored in the opposite direction, thereby giving the positive correlation opposite meaning.

reflect some accuracy, it could either indicate a coding error or that at least one of the measurements is less than valid or reliable. The fact that Hofstede's tool is by far the most corroborated and researched, speaks in favor of his tool. However, the fact that we have individual scores on Matsumoto's dimensions instead of aggregated scores, speaks in favor of the scores from his tool.

This confusion, together with a very small sample, has made interpreting the results somewhat difficult.

The Risk/Restraint (R/R) dimension did not show much variance for this sample, thus making it difficult to use. Therefore, there are no analyses reported that have used this dimension. This adds to the previous reservations (made in chapter 2.2) as to whether this is a good measure.

Even though carrying the same name, the St/Lt dimensions of Matsumoto and Hofstede did not prove to be related in this sample. The last two dimensions in the SAP (CSQ), D/I and T/R, did not show any relationship to Hofstede's dimensions.

### 3.3 INFORMATION-SHARING AND CULTURE

#### 3.3.1 Information-pull related to Rank and Culture (I/C, I/I, Pd, ES)

There were two questions in the questionnaire measuring whether the respondents primarily pushed or pulled information. These questions were significantly correlated ( $r=-.45$ )<sup>18</sup>; individuals who indicated that they mostly pushed information to *many* persons, tended to indicate that the information was pushed *to* them, and those who indicated that they only pushed information to *a few* persons, tended to indicate that they pulled information *themselves* (Part I, Bjørnstad, 2005). Qualitative data suggested that the choice between these strategies might depend on the position the person had in the exercise.

Controlling for the effect of rank gave a non-significant and weaker relationship between the two variables ( $r=-.311$ ,  $p=.382$ ,  $N=8$ ). Hence, it seems that some of the covariance in the push-pull behavior is explained by a difference in rank (i.e. there is less connection between the variables for personnel higher in the hierarchy). Controlling for culture (I/C and Pd) did not affect the relationship much.

Theory and empirical research on the effects of culture on cooperative behavior has indicated that there is a difference in willingness to cooperate with others depending on their culturally defined predispositions. Collectivistic cultures have been found to emphasize cooperation more than individualistic cultures (e.g., Cox et al., 1991; Triandis et al, 1985; Diaz-Guerrero, 1984 in Cox et al, 1991). Diaz-Guerrero found that individualistic cultures rather emphasized competition. However, while some researchers (e.g., Triandis, 1989) have suggested that

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<sup>18</sup>  $P<0.05$ .

collectivism mainly predisposes to show cooperative behavior towards people from one's own group or team ("in-group"), later research (Cox et al., 1991) have shown that this tendency also extends to relations with people from other groups. The sharing of information with other members of an organization is deemed to be an example of cooperating behavior, and we hypothesized that people from collectivistic cultures would be more willing to share information (i.e. "push") than people from individualistic cultures.

The data from AW04 seems to support this supposition, even if the sample is too small to provide any significant numbers. There was found a small tendency for people from a collectivistic culture to report that they push information to more people than those from individualistic cultures ( $r=-.255$ ,  $p=.241$ ,  $N=23$ ).

However, confusing the results somewhat, the SAP measurement, I/I, showed the opposite ( $r=-.343$ <sup>19</sup>,  $p=.301$ ,  $N=11$ ); that people from an independent culture push information to more people. This is in line with the finding presented in chapter 3.2, of I/I and I/C being positively correlated while carrying the opposite meaning. This is of course only a pilot study, and it is our hope that further research will clarify such discrepancies<sup>20</sup>.

Based on previous research it was also anticipated that a culture's degree of Pd might affect the degree to which people pull the information themselves. Low Pd has been linked to less leader supervision and more initiative from people lower down in an organization's hierarchy (see e.g. Hofstede, 1991; Bochner & Hesketh, 1994; Triandis, 1995).

There was found no relationship with the Pd scores. However, the ES dimension was found to correlate negatively with the degree to which a person reported to seek out the information him/herself ( $r=-.662$ ,  $p=.027$ ,  $N=11$ )<sup>21</sup>. This result would confirm the hypothesis, that an equality orientation is linked to more initiative to seek out information.

### 3.3.2 Information-flow in the hierarchy and Culture (Pd)

Different information-sharing behaviors between superior, equal and subordinate were compared (Part I, Bjørnstad, 2005). It was found that that the respondents tended to both share information with, and seek information from, equals most of the time, while information requests were most often received from superiors. The only significant difference in mean score was found between information seeking from superior versus equal ( $t = -3.51$ ,  $p = .002$ ); the personnel tended to seek more information from equals.

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<sup>19</sup> Low I/I indicates the opposite of low I/C. See chapters 2.2 and 3.2 for more on this.

<sup>20</sup> For more on this, see also chapter 5.

<sup>21</sup> Controlling for rank did not affect the relationships much.

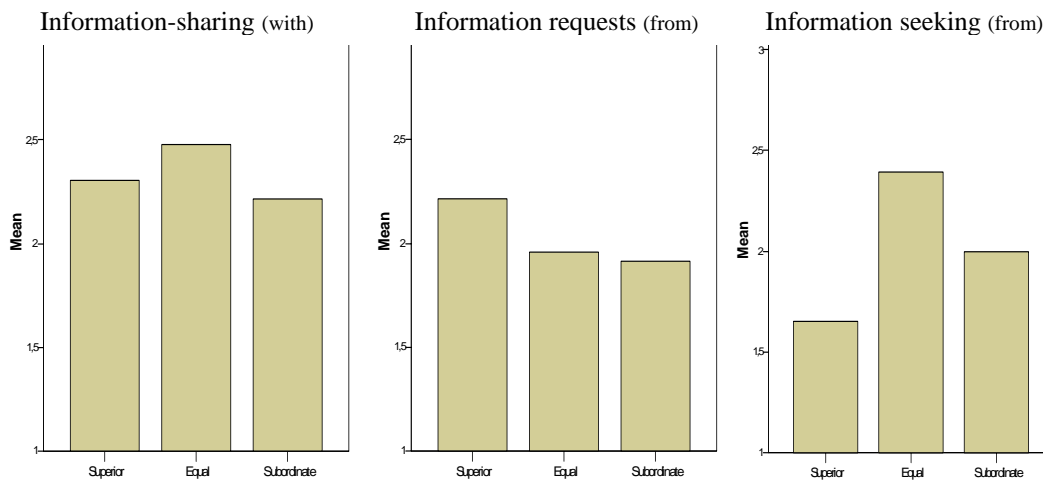


Figure 3.1. Differences in information- sharing, requests and seeking, between superior, equal and subordinate (1=min.score, 3=max.score).

We wanted to find out whether this communication pattern related to culture. Offermann & Hellmann (1997) found Pd to be negatively related to leader delegation and communication with subordinates, i.e. low Pd indicating higher leader communication. The question was whether our findings of different types of communication in the hierarchy related Pd.

The difference between information seeking from superior and equal was not found to be significantly related to Pd. Nevertheless, as Figure 3.2 shows, there were some differences in the communication pattern depending on Pd<sup>22</sup>. In general, lower Pd scores seemed to be related to: more information- sharing, requests and seeking with/from equal, and more information- requests and seeking from subordinate. These differences were not significant, which may be as expected from such a small sample.

<sup>22</sup> Results have been controlled for rank; i.e. the two enlisted (who per definition had no subordinates to communicate with) were cut from the sample in these analyses, as well as all those we had no rank information available for (n=14).

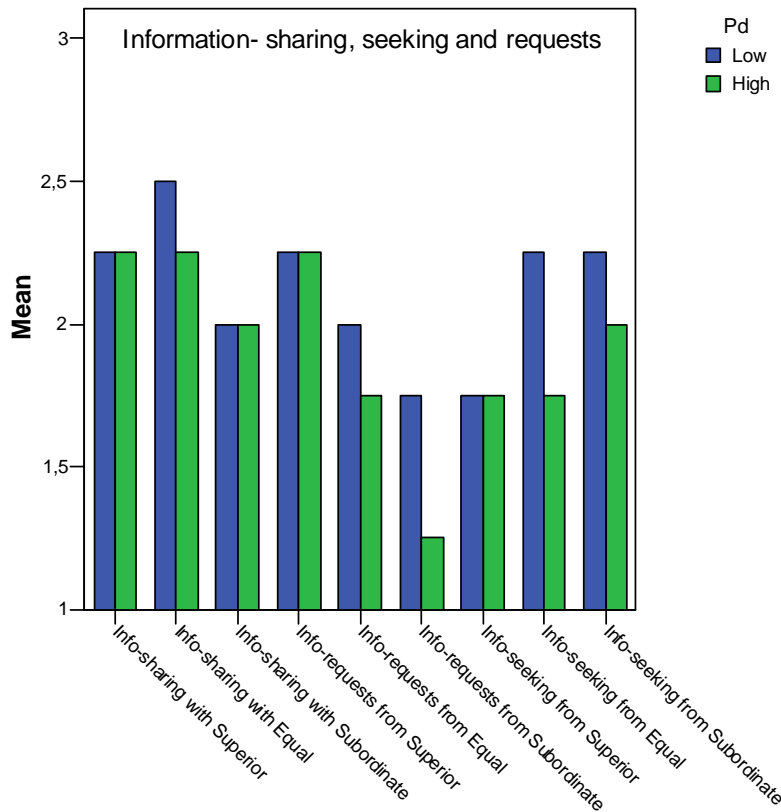


Figure 3.2. Differences in information- sharing, requests and seeking, between superior, equal and subordinate (1=min.score, 3=max.score) depending on degree of Pd (low [n=4] vs high [n=4]: blue=low, green=high).

We used sumscores<sup>23</sup> to see whether the *general* communication pattern would be related to Pd. As indicated above, Offermann & Hellmann (1997) found Pd to be negatively related to leader communication with subordinates. Results seem to corroborate this finding; those with low Pd report more communication both with equals and subordinates (Figure 3.3)<sup>24</sup>. These differences are, however, not significant, and can only be looked upon as tendencies<sup>25</sup>.

<sup>23</sup> Factor analysis demonstrated a pattern of reported sharing, receiving requests for, and seeking information, which indicated that the respondents may not have differentiated much between the different types of communication they were rating (see Bjørnstad, 2005).

<sup>24</sup> Results have been controlled for rank; i.e. the two enlisted (who per definition had no subordinates to communicate with) were cut from the sample in these analyses as well as those we had no rank information available for (n=14).

<sup>25</sup> The difference in communication with subordinates depending on degree of Pd had a p-value of 0.675.



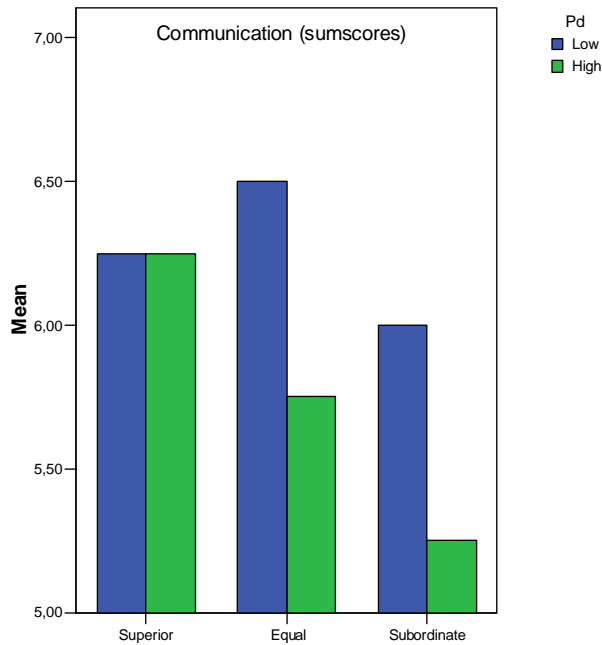


Figure 3.3. Sumscore for communication (sharing, seeking, and receiving requests for information) (3=min.score, 9=max.score) with superior, equal and subordinate, depending on degree of Pd (low vs high: blue=low, green=high).

### 3.3.3 Obstacles for information-sharing, and Culture (Ua)

Time constraints were rated as the most important obstacle for a person to share information, while culture was rated as the least important obstacle.

Native English-speakers were found to perceive language and culture to be a greater problem for their information-sharing than did non-native English-speakers. This is shown in Figure 3.4.

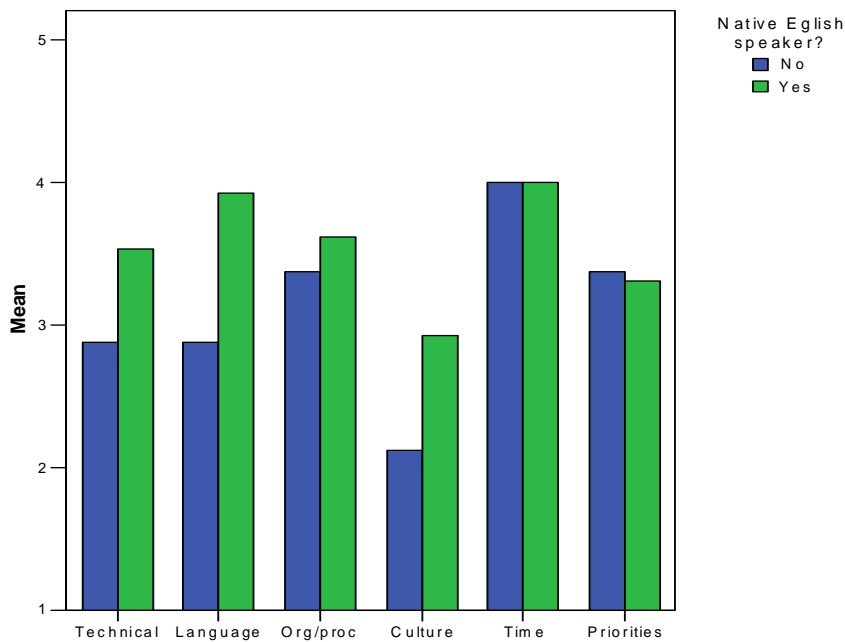


Figure 3.4. Obstacles for information-sharing: native English-speakers ( $n=15$ ) and non-natives ( $n=12$ ) (min.score=1, max.score=5).

Language is the one obstacle for information-sharing where people differed significantly depending on whether they were native English-speakers or not ( $t=-2.08$ ,  $p=.05$ ). The differences in the ratings of culture were not significant.

Ua is the cultural dimension that primarily would be expected to cause a difference in the rating of obstacles for information-sharing. Since high Ua is indicating a culture where what is different is considered dangerous (Hofstede, 1991), one would have expected that people high in Ua find differences in language and culture to be more difficult than those with low Ua. However, the data here does not support this expectation (Figure 3.5). Figure 3.5 rather shows that people with low Ua rate language, organization & processes, and time as more important obstacles for information-sharing than do those with high Ua.

In other words, Ua does not seem to influence whether people find language and culture to be a problem when sharing information, while language<sup>26</sup> does. However, due to the small sample, no conclusions can be made at this stage.

<sup>26</sup> I.e. native compared to non-native English speakers.

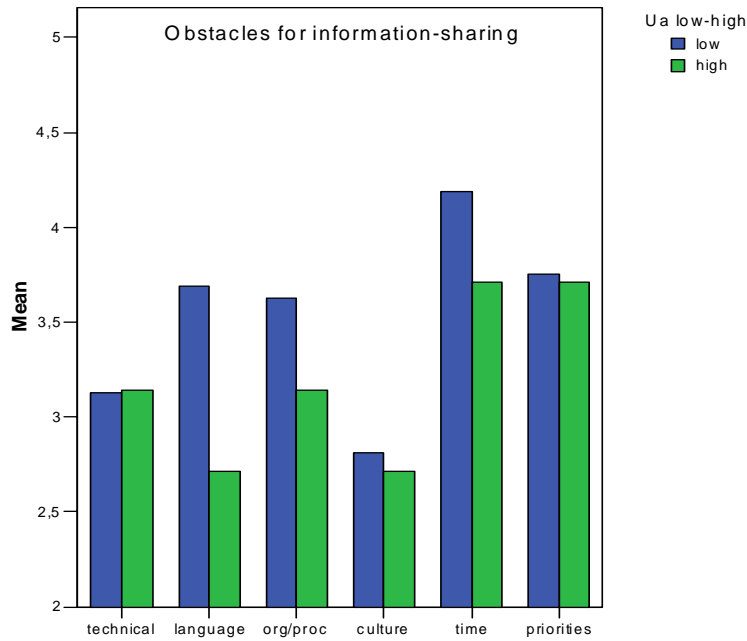


Figure 3.5. Obstacles for information-sharing: low Ua (n=17) and high Ua (n=7) (min.score=1, max.score=6).

### 3.4 ORGANIZATION AND CULTURE (Pd and Ua)

87% of the respondents rated this organization as different from what they were used to. A moderate majority rated the organizational changes to have been for the better.

There was found no relationship between organizational changes per se or the type of organizational changes, and the rating of the organizational changes. In other words, there were no statistical differences in how people rated the organization depending on perceived organizational changes or type of organizational changes. Ratings of the organization and the organizational changes did not show any relationship to culture either.

According to previous findings it was hypothesized that people with high Ua would be more negative to organizational change than those with low Ua (Hofstede, 1991). Splitting the file in low and high Ua showed that for those with low Ua there were no relationship between the experienced degree of organizational changes and the rating of the organization<sup>27</sup>. However, for those with high Ua there was found an almost significant negative relationship ( $r=-.718$ ,  $p=.069$ ). This means that for those from low Ua cultures, the type of organizational change experienced here may or may not have been to their liking (i.e. no relationship), whereas for those from high Ua cultures, the type of organizational change experienced here tended to be understood as negative. In other words, there seems to be some support to the hypothesis found in this sample; high Ua seems to predispose people to perceive any organizational changes as negative. This makes sense. As previously indicated (and elaborated in part I of this report; Bjørnstad, 2005), there were reports of chaos linked to the organizational changes

<sup>27</sup> I.e. rating this organization as “better” or “worse” than what the respondents were used to.

implemented, indicating that the environment is less predictable and more ambiguous. According to theory, people from high Ua cultures will have more difficulties dealing with this (Hofstede, 1991).

We also expected that Pd would affect how the respondents rated the organizational changes. Low Pd has been linked to liking to work in flatter and more decentralized organizations (Hofstede, 1991). Thus, we expected that those with low Pd would look more positively on the organization changes if they perceived that the organization had become flatter and/or more decentralized. There was found a positive relationship between perceiving this organization as more decentralized and rating the organization as better for those from low Pd cultures ( $r=.595$ ,  $p=.091$ )<sup>28</sup>. There was found no relationship between centralization and/or hierarchy and rating the organization as better for those with high Pd.

### **3.5 GROUP ROLES AND PROCESSES AND CULTURE (Ua, Pd, ES and M/F)**

#### **3.5.1 Changes in tasks and responsibilities, and Culture (Ua)**

It was found that a majority (almost 70%) of the respondents perceived their tasks and responsibilities to be different from usual in this exercise. This was found to be closely related to perceiving the organization to have changed.

Those who were given increased responsibilities in this exercise/organization tended to like the change (increase) in responsibilities<sup>29</sup> as well as rate the organization as better<sup>30</sup> (Part I: Bjørnstad, 2005). The question is whether this can be related to culture.

As previously indicated (chapter 3.4), Ua could predispose for handling change less well. The former link, made between increased responsibilities and liking the change (increase) in responsibilities, was only found for those with low Ua ( $r=.513$ ,  $p=.042$ ,  $n=16$ ). This could mean that, in line with the findings in chapter 3.4, a propensity for disliking change (high Ua) may have affected how change was rated.

However, the latter link, between increased responsibilities and rating the organization as better, was found for both low and high Ua personnel. Seen together, these findings seem to indicate that those with high Ua do not like the change per se (increased responsibility), but that the change (increased responsibility) has a secondary effect, improving their insight into the organizational processes, thereby making the organization more predictable, less ambiguous, and thus more likable for persons from a high Ua culture. This interpretation is reinforced by the finding that increased responsibilities seemed to have a bigger effect on those

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<sup>28</sup> The relationship was not significant, but considering the size of the sample, we found the result worth reporting. The relationship for hierarchy showed the same, but weaker tendency ( $r=.423$ ,  $p=.256$ ). Results from the same analyses using the ES measure of culture showed the same relationship as Pd, only weaker.

<sup>29</sup>  $r=.477$ ,  $p=.025$ .

<sup>30</sup>  $r=.559$ ,  $p<.01$ .

with high Ua than on those with low Ua for their rating of the organization (high Ua:  $r=.785$ ,  $p=.037$ ; low Ua:  $r=.520$ ,  $p=.039$ ). This is of course only a hypothesis at this time, which further research could clarify.

### 3.5.2 Cooperation and Culture (Pd, ES, M/F)

It was found in Part I that good teamwork depended on training together within the organizational structure (Bjørnstad, 2005). This was linked to research within “natural decision-making”, which have demonstrated that teams perform better than ad-hoc groups on decision-making (Orasanu & Salas, 1993).

Results from Part I indicated a link between having more responsibility, being more integrated into central processes, and better cooperation (Bjørnstad, 2005). Thus, it seems that characteristics of a decentralized and flat organization, like shared responsibility and high integration of all levels, may have a positive effect on cooperation. The relationship (correlations) between these variables was re-estimated, to decide the effects of culture (Pd, M/F)<sup>31</sup>. Partial correlation showed that these relationships were not affected much by culture.

Results reported in Part I furthermore indicated a link between decentralization and contentment with cooperation. This could indicate that teamwork is ameliorated by decentralized control. Such an interpretation is supported by research on team decision-making; democratic leadership has been found to be more effective and advantageous in many respects (e.g., Chidester, 1990; Eisenhardt, 1989; Haleblan & Finkelstein, 1993). Using partial correlation, it was controlled for culture (Pd and ES); it did not have much effect on the relationship between decentralization and contentment with cooperation.

### 3.5.3 Inclusion into organizational processes related to Rank and Culture (I/C & I/I)

Three questions aimed to measure to what degree the respondents were included into the organizational and team processes. These were questions on how well they felt integrated into central processes, their activity level, and the amount of things they had to do in their position in the organization. Most respondents reported that they were quite well included into the organizational and team processes (Part I: Bjørnstad, 2005).

#### **Inclusion into central processes, increased responsibility and culture (Ua)**

Since increased responsibility was linked to increased liking of the organization, and especially for those with high Ua (chapter 3.5.1), we wanted to find out whether this could be related to the self-ratings of inclusion into organizational processes. There was found no such relationships.

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<sup>31</sup> It was also attempted to estimate the effect of ES, however, this was precluded due to very few respondents having scores on all variables.

**Can the reported inclusion into central processes be explained by rank?**

According to the usual understanding based on differences in job descriptions, it seemed reasonable to expect officers to report that they were more integrated in the organization's central processes than enlisted personnel. According to this, the personnel's self-reported inclusion into central processes should correlate with rank. There was a small but consistent tendency for higher rank to be related to reporting to be more integrated, have more things to do and have a higher activity level ( $p=.274$ ,  $r=.415$ ;  $r=.500$ ,  $p=.141$ ;  $r=.302$ ,  $p=.367$ ; respectively,  $N=11$ <sup>32</sup>). So even though there was no significant numbers found here, we find this to be a plausible connection that has a reasonable chance to be confirmed in later studies with larger samples.

**Can the reported inclusion into central processes be explained by culture?**

There was found no significant relationship between culture and the reported inclusion into central organizational and group processes. This was quite according to expectations; there was no reason to presume that culture should affect this.

However, one could expect that having a similar cultural make-up as the leading nation in the organization, would make it easier to be included in the central processes. The strongest relationship was found between the sumscore for integration<sup>33</sup> and the cultural dimension I/I, reflecting group versus individual orientation ( $r=.578$ ,  $p=.063$ ,  $N=11$ ). This indicates that high integration may be related to the cultural orientation independence. The almost significant relationship corresponds to expectations, in that independence is a typical cultural make-up of the US culture, the country which is also dominant in the organization. Excluding US respondents from the sample did not affect the relationship much (interdependence:  $r=.516$ ,  $p=.127$ ,  $n=10$ ), which indicates that the connection does not only mirror the national culture of the respondents from the dominant nation in the exercise. Controlling for language through a partial correlation, affected the relationship only in a positive direction; it made the relationship to I/I significant ( $r=.659$ ,  $p=.038$ ).

The relationship between the sumscore for integration and the dimension I/C, also reflecting group versus individual orientation, make the results more contradictory ( $r=.325$ ,  $p=.122$ ,  $N=24$ )<sup>34</sup>. This relationship indicates that high integration is related to collectivism. This could mean that collectivists are better at getting integrated, or simply that they *feel* more integrated than individualists would have done in the same situation. Controlling for language weakened the relationship to I/C ( $r=.209$ ,  $p=.338$ ) further. This is not surprising, considering that I/C is significantly correlated with language proficiency while I/I is not ( $r=-.736$ ,  $p=.000$ ,  $N=24$ ;  $r=.053$ ,  $p=.877$ ,  $N=11$  respectively). This is probably to some extent explained by the difference in type of scores; I/I contains individual scores for less than half the sample, while I/C are national group scores for almost the whole sample. Furthermore, US and UK

<sup>32</sup> Enlisted:  $n=2$ , officers:  $n=9$ .

<sup>33</sup> Higher score means less integrated!

<sup>34</sup> I/I indicates the opposite of I/C. See chapters 2.2 and 3.2 for more on this.

respondents all score maximum on English proficiency at the same time as they represent cultures with the highest scores on individualism (Hofstede, 1991).

As previously indicated (chapter 2.2, 3.2, 3.3.1), it is beyond any doubt that the relationship between the I/C and I/I dimensions need to be clarified in further research. We anticipate that the relationships between integration and individualism/collectivism (I/C and I/I) will be better understood in follow-up studies<sup>35</sup>.

### **Can the relationships found between inclusion into central processes and the communication pattern be explained by culture?**

It was found that the communication pattern was related to whether the respondents reported being included into organizational and team processes (Part I: Bjørnstad, 2005). We wanted to find out whether the previously found positive relationship between information-seeking from superior and feeling more integrated, busier and having more to do, could be explained by culture (Pd). There was found no relationship. As Figure 3.2 shows, degree of information-seeking from superior seemed to be unrelated to culture (Pd).

It was furthermore checked whether the positive relationship between having more to do and sharing information and communicating with subordinates was related to culture (Pd). This was not found to be related to culture either. Figure 3.2 indicates that degree of information-sharing with subordinates was unrelated to culture (Pd). Figure 3.3 did, however, indicate a relationship between communication with subordinates and Pd; low Pd indicating more communication with subordinates. But the relationship between Pd and reporting to have more to do turned out to be the opposite; low Pd indicating having less to do. Hence, none of the connections between communication pattern in the hierarchy and inclusion into central processes made in part I of this report (Bjørnstad, 2005), could be explained by culture.

## **3.6 SOCIAL IDENTITY AND CULTURE (I/C)**

In part I it was found that the team and the assignment meant most in creating a sense of belonging for our respondents (Bjørnstad, 2005). Age and gender was found to be the least important.

The only affinity which seemed to be related to culture was assignment; I/C was related to rating assignment as important ( $r = -.386$ ,  $p = .062$ ,  $N = 24$ )<sup>36</sup>. This means that the respondents from collectivistic cultures tended to rate common assignment as more important for their sense of belonging than what the respondents from more individualistic cultures did.

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<sup>35</sup> See chapter 5.

<sup>36</sup> I/I had the opposite relation to the rating of affinity ( $r = -.524$ ,  $p = .089$ ,  $N = 11$ ) (I/I indicates the opposite of I/C. See chapters 2.2 and 3.2 for more on this), which confuses the results somewhat. As previously indicated, this is not surprising considering how these dimensions are opposite related. But as this is only a pilot study, we expect further research (for more on this, see also chapter 5) to clarify such discrepancies.

In general, group belonging is more emphasized in collectivistic than in individualistic cultures (e.g., Hofstede, 1991; Triandis, 1995). To find out whether this was reflected in our sample, it was checked whether there was a difference in how important the respondents rated affinity. There did not seem to be any difference in how they rated the importance of the affinity in general.

In part I (Bjørnstad, 2005) there was also found a link between finding affinity to be important and an aid to get the job done, and finding the assignment to give a sense of belonging, indicating that a sense of belonging can help people working on the same assignment to get the job done. From another angle, this may also indicate that having a common goal (in terms of assignment) brings people closer (in terms of cooperation and group belonging/identity)<sup>37</sup>. Culture (I/C, I/I) did not seem to affect this relationship much. In other words, it appears that this link is valid for both individualists and collectivists alike.

### **3.7 CONTROLLING BEHAVIOR, TRUST AND CULTURE (Pd, ES, Ua, and I/C, I/I)**

#### **3.7.1 Tendency for controlling behavior and Culture (Pd, ES and Ua)**

There was found a tendency for people from low Pd cultures to expect their subordinates to manage on their own, while people from high Pd cultures were more liable to expect subordinates to need close guidance (Part I: qualitative data analysis). People from low Pd cultures also tended to reveal more positive attitudes towards their subordinates than did people from high Pd cultures. This supports findings from cross-cultural organizational research (e.g., Bochner & Hesketh, 1994; Clegg, 1981; Hofstede, 1991; Offermann & Hellmann, 1997). Bochner & Hesketh, for instance, found that higher Pd was related to a preference for closer supervision and a belief in the necessity of having to make people work hard. Clegg found high Pd to be linked to controlling behavior on the leader's part.

What we wanted to find out here was whether this could be supported by the quantitative data; was there a link between the self reported controlling behavior and the Pd, ES and Ua dimensions of culture? There was found no such relations in our data.

#### **3.7.2 Trust and Culture (IC/II and Ua)**

There were two questions pertaining to how the respondents generally related to people from different cultures and how they trusted them. 36,4% reported that there were differences in how they related to people from different cultures, while 50% said that there were no

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<sup>37</sup> This is in line with classic research on group processes; common goals and mutual dependency has the ability to create a common identity (i.e. psychological sense of belonging; see e.g. Hogg & Abrams, 1988) and to bring people even from conflicting groups together in cooperation (Sherif et al, 1961).



differences. Very few (13,6%) said that they trusted people from other cultures less than people from their own culture. However, it was also found that trust depended on familiarity and ability to understand and knowing what to expect from the other person/culture (Part I; Bjørnstad, 2005).

Research indicates that the cultural dimensions I/C and Ua may affect people's tendency to trust people from different cultures (Cox et al., 1991; Hofstede, 1991). Is there a tendency for people scoring high on collectivism to find it more difficult to trust people from other groups than their own (because the in-group is of higher importance for people in collectivist cultures; e.g., Triandis, 1995) or are they on the contrary better at trust, even in people from other groups than their own (as found by Cox et al., 1991)? And does the tendency toward perceiving what is different as dangerous of high Ua cultures (Hofstede, 1991) make it harder for them to trust people from different cultures than their own?

Results show that no relationship was found between the direct question on trust and the cultural dimensions (I/C, I/I, Ua)<sup>38</sup>. However, the question on whether the respondents related differently to people from other cultures, revealed correlations with both the I/C and the Ua dimensions; I/C was negatively related ( $r=-.366$ ,  $p=.078$ ) and Ua positively related ( $r=.408$ ,  $p=.048$ ). This indicates that respondents from individualistic and low Ua cultures tended to report that the culture of the other person influenced how they related to them. Collectivists and high Ua persons, on the other hand, tended to distinguish less between how they related to people from different cultures.

### **3.8 DECISION-MAKING & CULTURE AND LANGUAGE & CULTURE**

Analyses of decision-making and language in relation to culture did not provide any results.

## **4 SUMMARY AND DISCUSSION**

### **4.1 INFORMATION-SHARING AND CULTURE**

There was found a small tendency for people from collectivistic cultures to report that they push information to more people than those from individualistic cultures. This was in line with expectations; collectivism has previously been linked to more cooperative behavior, while individualism has been linked to competitive rather than cooperative behavior.

It was also checked for a link between information-sharing in the hierarchy and culture (Pd).

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<sup>38</sup> As indicated in Part I, the question on trust has been revised in the new version of the questionnaire, due to the sensitivity of the topic and the consequent low variance in the answers. Because of the low variance, the lack of findings here was not surprising, and attributed to the problems of measurement.

It was found that those from a low Pd culture reported more total communication both with peers and subordinates than did those from a high Pd culture. This was in line with previous research having found Pd to be negatively related to leader communication with subordinates.

As high Ua may predispose for handling the unknown less well, it was found plausible that Ua would influence how people rated certain obstacles for their sharing of information. However, our results indicated no link between Ua and whether people find language and culture to be a problem when sharing information. But due to the small sample, no conclusions can be made at this stage. On the other hand, native English speakers rated language (and culture<sup>39</sup>) significantly higher as a problem than did non-natives.

## 4.2 ORGANIZATION AND CULTURE

High Ua predisposes for handling change (esp. chaos and ambiguity) less well, and it was anticipated that Ua could affect the rating of organizational change. For those with high Ua there was found an almost significant negative relationship between the experienced degree of organizational change and the rating of the organization. High Ua seemed to predispose people to perceive any organizational change as negative.

It was found that respondents from a low Pd culture who perceived the organization to be more decentralized, tended to rate the organization positively (almost significant positive relationship). This was in line with expectations; low Pd should make it more natural to work in flatter and more decentralized organizations. However, there was found no relationship for high Pd cultures. This is of course only a very small sample, making it risky to read too much into the results. Nevertheless, it would be interesting to follow up on this. Is it possible that people from low Pd cultures find it harder to adapt to a more centralized organization than people from high Pd cultures find it to adapt to a more decentralized organization?

## 4.3 GROUP ROLES AND PROCESSES AND CULTURE

The significant link between increased responsibilities and liking it, was only found for those with low Ua. This could mean that, in line with the findings in chapter 3.4, a propensity for disliking change (high Ua) may have affected how change was rated. However, there were indications that those with high Ua did not like the change per se (increased responsibility), but that the increased responsibility has a secondary effect - improving their insight into the organizational processes and thereby making the organization more predictable, less ambiguous, and thus more likable for persons from a high Ua culture.

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<sup>39</sup> Culture was only almost significant.

There was found no link between culture and how the respondents rated cooperation. Nor was culture found to influence the previously found relation (Part I) between responsibility, integration and cooperation, and between decentralization and cooperation.

We wondered whether having a similar cultural make-up as the leading nation in the organization, would make it easier to be included in the central processes. The strongest relationship was found between integration (sumscore) and independence. It seems that this cultural aspect may have some influence on organizational inclusion. However, results were somewhat confusing in that the variable's relation to the I/C dimension indicated the opposite; that integration was related to collectivism. This was attributed to discrepancies in the instruments of measurement, which, as indicated previously, there is a need to clarify for further research<sup>40</sup>.

None of the connections between communication pattern in the hierarchy and inclusion into central processes made in part I of this report, could be explained by culture.

#### **4.4 SOCIAL IDENTITY AND CULTURE**

Assignment was the only social affinity which seemed to be related to culture. Respondents from collectivistic cultures tended towards rating common assignment as more important for their sense of belonging than what their colleagues from individualistic cultures did.

There did not seem to be any cultural difference in how the respondents rated the importance of the affinity in general.

The link found in part I, between finding affinity to be important and an aid to get the job done, and finding the assignment to give a sense of belonging - indicating that a sense of belonging can help people working on the same assignment to get the job done, was found to be valid for both individualists and collectivists alike.

#### **4.5 CONTROLLING BEHAVIOR, TRUST AND CULTURE**

There was found no link between self reported tendency for controlling behavior and culture (Pd, ES and Ua) in the quantitative data. However, as reported in Part I, there was found a link to Pd in the qualitative data.

Respondents from both individualist and low Ua cultures tended to report that the culture of the other person influenced how they related to them. Collectivistic and high Ua persons, on the other hand, tended to distinguish less between how they related to people from different cultures. As indicated in chapter 3.7.2, these results seem to go mostly in the opposite direction

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<sup>40</sup> Also discussed in 3.2.

of previous research. Due to the small number in our sample, we do not want to put much into the interpretation of this. However, the finding that respondents from high Ua cultures tend to report that they do not make any differences in how they relate to people from various cultures may reflect an effect of them being more rule oriented; they may believe it is correct not to make any difference and report their behavior accordingly. This is of course little more than speculations. As far as the link with I/C is concerned, it is interesting to note that even though collectivists are more group oriented and therefore also more aware of, and sensitive to, differences between groups, they do not report to differentiate more, rather less. A question for further research would be check whether this is found in larger samples, and if so, why it is that individualists may differentiate more.

## 5 LIMITATIONS

The most obvious limitation to this study is the sample size. In line with this, it is urged that the reader look upon the results here as only preliminary. The type of analyses conducted bears also witness to this; they are based on the simple statistics possible to conduct considering the sample size. As indicated in Part I (Bjørnstad, 2005), two follow-up studies are already planned for within the LTAMC project.

The MeridianGlobal (Matsumoto) scores on culture were only available for under half of the original sample (N=11), which obviously made the analysis difficult. Also, as indicated initially, chapter 2.2 and 3.2, this measurement tool (SAP/CSQ) has not been as thoroughly validated as one may have wished for<sup>41</sup>. It was felt that an additional cultural parameter would add value to the analysis. For that reason Hofstede's country scores were also included for almost<sup>42</sup> all the respondents in the whole sample (N=23), used as an alternative cultural measurement in the analyses. However, as these are average scores for each culture, and not individual scores, the accuracy of the analyses is of course somewhat lower. The use of such country scores, are nevertheless, widely used within cross-cultural organizational research. Also, at least in this study, the analyses seemed to demonstrate higher construct validity for the Hofstede scores than the SAP scores.

## 6 CONCLUSION

This pilot study has provided some initial analyses of the links between organizational processes and culture in a military headquarter. The results presented here are preliminary, but does, however, give us an indication of the many influences that culture can have on the

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<sup>41</sup> This is also a point for further research; it would definitely be a great advantage to include another measurement of culture that has been more thoroughly explored.

<sup>42</sup> Save those respondents (n=5) that were from nations not included in the Hofstede study.

processes in such an organization. It is expected that the follow-up studies planned for, will lend us the needed data to allow us some wider and more generalizable results.

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Benytt ny side om nødvendig.

# Organization, Culture and Group Processes in Operational and Simulated Environments

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## **ABSTRACT**

*This paper presents results pertaining to organizational and cultural issues central for cross-cultural cooperation in a military context. The analyses are based on three studies, two field studies from NATO exercises at HQ and tactical levels (Allied Warrior 2004 and Battle Griffin 2005) and one experimental laboratory study. Data was collected through interviews, questionnaires and through the NwN/SABRE<sup>1</sup> computer based role play of a simulated mission. Results are presented on the interrelationship between organizational structure, process and flexibility, culture and trust.*

## **1.0 INTRODUCTION**

Operative NATO organizations and the Norwegian armed forces are currently undergoing changes towards NATO Network Enabled Capabilities (NNEC; e.g., [1]). This includes a reorganization of humans to best take advantage of the new information and collaborative technologies. Increased organizational effectiveness is usually the goal for organizational changes, but is not always the result. It is essential to gain better understandings of the interactions with and between organization and team structure, processes, and culture. This has also been articulated in the field of cross-cultural psychology (e.g., [2][3][4][5]).

NNEC entails increased collaboration across borders and cultures within NATO, a trend we also see in civilian organizations. This augments the need to better understand how differences in national culture affect both organizational and team processes. Culture affects our knowledge structures, beliefs, and how we understand the world around us, make attributions, behave, communicate, etc (e.g. [6][7][4][8][9][10][11][12]). In other words, culture influences how we make sense of things, as well as how we act; it may influence how we experience and exercise organization and team-work – locally as well as in distributed networks.

This paper presents research conducted in the context of the NATO Human Factors and Medicine (HFM), Research and Technology Group (RTG) – 138 / Leader and Team Adaptability in Multinational Coalitions (LTAMC) and focuses on selected organizational and cultural issues central for cross-cultural cooperation in NATO operations. Field data was collected at the NATO Deployable Joint Task Force (DJTF) during the Allied Warrior exercise in 2004 (AW04) and at a tactical level unit during the NATO winter exercise Battle Griffin 2005 (BG05). Experimental data was collected using the NwN/SABRE<sup>1</sup> game environment of a simulated mission, in the period from April 2006 to May 2007. Both experimental and survey data was collected in the experiments, while interview and survey data was collected in the field studies. The

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<sup>1</sup> NwN: NeverWinter Nights (by Bioware). SABRE: Situation Authorable Behaviour Environment (by BBN-Technologies).

studies have been reported separately and in more detail in Bjørnstad [14][15][16][17].

## **2.0 THEORY AND AIMS OF STUDY**

### **Culture**

The construct of culture has many definitions. Two often referred to in cross-cultural research are held by Hofstede ([7] p. 5; [4] p. 9): “The collective programming of the mind that distinguishes the members of one group or category of people from another” and Kluckhohn ([18]p. 86): “Culture consists in patterns of thinking, feeling and reacting, [..]; the essential core of culture consists of traditional [..] ideas and especially their attached values”. Hofstede and Kluckhohn as well as most researchers within the field of cross-cultural psychology include values at the core, while not excluding behavior in their definition of culture [2][18][19][34][1]. Research within cross-cultural psychology focuses on culture at a national level and has generally operationalized cultural differences as dimensions of culture, primarily value dimensions, building on an understanding of culture as at least relatively stable over time [20]. This is also the stance taken in this paper.

Hofstede’s five dimensions of culture represent the core of the most well-established and validated cross-cultural theory we have – especially as concerns organizational and work related issues. The dimensions are called: Individualism/Collectivism (I/C), Power distance (Pd), Uncertainty avoidance (Ua), Masculinity/Femininity (M/F), Long-term /Short-term Orientation (Lt/St) [4][7][37]. His work has been corroborated and expanded through numerous other studies (e.g., [20][21][22][23][24][10]), also with military samples [25][24]. This study will make use of the dimensions of I/C, Pd and Ua, as these are expected to be directly related to the organizational issues at the focus of the research presented in this paper (as presented below). Individualism/Collectivism (I/C) refers to a cultural difference in group as opposed to individual orientation. Group orientation is linked to tight ties between people, whereas individual orientation is linked to loose ties between people (high scores indicate individualism - I). Power distance (Pd) is defined as a difference in the actual and experienced distribution of power between people in a hierarchy (high scores indicate high Pd). Uncertainty avoidance (Ua) refers to a difference in need for predictability and rule orientation (high scores indicate high Ua).

One of the many areas culture interacts with is organizational and team behavior (e.g., [26][4][7][10]). It is anticipated that both organization structure as well as national culture have an impact on organizational and team processes.

### **Organizational change and Uncertainty avoidance**

High Uncertainty avoidance (Ua) has been linked to less tolerance for ambiguity and chaos [7][4]. We wanted to find out if high Ua also would mean more negativity to organizational changes in operative military organizations. As NATO operative organizations are facing both current and future organizational changes, this should be important to understand.

### **Organizational structure and process**

It may seem natural that an organization which is hierarchic also should have centralized processes. Also in the organizational literature these variables are often considered as pairs (e.g., [27]). However, findings from the field suggest that in the actual development of NATO organizations, these issues may not be considered as two sides of the same coin (e.g., [28]). The current study aims to research the relationship between the variables; are they complimentary, somewhat related, or not at all related? And what are the implications for an organization’s well functioning?

We were also aiming to find out whether there would be any preferences for any particular organizational structure (hierarchy/flat) or process (centralization/decentralization), and if this would be affected by culture. Hofstede linked Low Power distance to cultures where people tend to work in flatter and more decentralized organizations [4]. Thus, we expected that those with low Pd would look more positively on the organization if they perceived that the organization was flat and/or decentralized.

### **Organizational flexibility**

The creed of today seems to be that all organizations need to be flexible in order to be efficient. This is also a basic assumption in the NNEC related literature (e.g., [29][1]). Is this true? And what constitutes the prerequisites for flexibility? Decentralization? Flat structure? Heterogeneity in team and organizational composition?

Some assumptions are made in parts of both military and civilian literature about flat structure and decentralization giving more flexible and adaptable organizations (e.g., [27][29]). In the NNEC related literature, this has been made one of the main organizational points (e.g., [29]). The study aimed to test this.

### *Trust*

Heterogeneity in team and organizational composition may influence flexibility positively, but how does it affect team trust? It has been shown that trust is an important factor in organization and team cooperation and for the information and knowledge flow in organizations (e.g., [30][31][32]). Information is crucial to any organization, and especially to information-heavy environment like international military organizations. Research on trust has pointed to that similarities between people and time to get to know one another, influences the building of trust positively (e.g., [33][31][34]). None of these studies have, however, looked at whether similarities/dissimilarities between team members in terms of national culture, have an effect on team trust. These are important issues to understand for NATO coalitions and made even more salient by the decision to implement NNEC. The current research aims to find out whether ad-hoc teams composed of culturally homogenous members will have higher levels of team trust than teams composed of culturally heterogeneous members, due to the dissimilarity of members increasing the need for time to build trust.

In turn, the study also intended to research whether the cultural characteristics of personnel could influence their level of trust in team-mates, as suggested by the work of Triandis [35] and Cox et al. [36] – and if so, how? As Triandis points out, people from collectivist cultures are more group oriented, and more aware of group affiliation and identity than people from individualist cultures. Therefore they are expected to make more difference between in-group and out-group members, also in regard to trust. On the other hand, Cox et al. found that people from collectivist cultures actually were better at trusting all people, even those from other ethnic groups than their own.

## **3.0 METHOD**

In order to explore these organizational issues, culture and trust, and to ensure both ecological and internal validity, both field studies and lab experiments were employed. Field data was collected from the NATO Response Force (NRF) exercise AW04 at headquarter (HQ) level and at the BG05 exercise at tactical level. Experimental data was collected from a computer simulated game environment (NwN/SABRE). 48 of the experiments were conducted using local networks in 5 different countries while 8 of the experiments were conducted over the internet from the same 5 countries.

## **Participants**

In the AW04 field study, the military personnel at the DJTF in AW04 were the focus of our study. They counted approximately 90 persons and were from 12 different nations, the majority of whom had their daily work at the NATO HQ in Naples. 13 persons from the DJTF were interviewed<sup>2</sup> and 15<sup>3</sup> filled out the then newly developed organizational questionnaire, rendering a total of 28 respondents. Our respondents were from Denmark, Germany, Greece, Hungary, Italy, Turkey, the UK and the USA.

In the BG05 field study, the sample consisted of 55 persons from a tactical level unit<sup>4</sup>, where all but two were Norwegian (the remaining two were from the Netherlands). The personnel filled out the revised version of the organizational questionnaire developed for AW04.

In the laboratory experiments, there were a total number of 224 subjects participating, 4 in each experiment. A total of 56 experiments were conducted in Norway (16+6), Sweden (9+6), Bulgaria (8+6), the Netherlands (8+8) and the USA (7+6). The first number in the parenthesis indicate the number of national experiments in each country, with a nationally homogenous subject composition, while the latter number indicate the number of international experiments that each country participated in, with a nationally heterogeneous subject composition. This means that 48 of the groups were culturally homogenous while 8 of them were culturally heterogeneous<sup>5</sup>. All participants were military officers, with the rank of OF-1 to OF-5<sup>6</sup>, 117 male and 7 female, aged from 19 to 57<sup>7</sup>. The organizational questionnaire was not activated in the Swedish (9), Bulgarian (8) and in 5 of the Dutch national experiments, rendering organizational survey data from 34 experiments<sup>8</sup>.

## **Measurements**

The AW04 field study was considered the pilot work in the development of a new organizational questionnaire. The questionnaire endeavours to measure organizational variables of importance for the cooperation and decision-making in a military multicultural setting like a NATO headquarter. The questionnaire was especially constructed to map transformation in central organizational structures and processes. It covers the topics of: group roles and processes, organization, decision-making, information-sharing, language, identity and culture.

On the basis of the AW04 data analyses (both qualitative and quantitative), the questionnaire was revised for later use. For more details on this methodological process, please be referred to Bjørnstad [14]. The content validity of the form should have been satisfactorily established by the measures taken. The feedback given by the respondents, primarily in the interviews, but also through comments that were made in writing, gave indications of good face validity.

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<sup>2</sup> The interviews were semi-structured and had the same questions in the base as the organizational questionnaire (the main tool for the quantitative data collection).

<sup>3</sup> 5 of these questionnaires were mailed to us and arrived after the main part of the organizational analyses had been conducted and reported in Bjørnstad ([14][15]; N=23). N=28 for the organizational analyses in this paper.

<sup>4</sup> This represented a return rate of about 60%.

<sup>5</sup> In Norway, there were conducted two series of national experiments, with samples from two different Norwegian military populations (one from a graduate and one from an undergraduate military college), which were also intended to function as a controls when making comparisons across national cultures.

<sup>6</sup> NATO standard. 4,9 % had ranks just below OF-1.

<sup>7</sup> Mean age 31, with a standard deviation of 7,6.

<sup>8</sup> N=133, 3 missing values total.

In the AW04 field study, cultural differences was operationalized as Hofstede's [4][7] value dimensions and the national scores that Hofstede identified in his original research was used as the basis for the cross-cultural analysis of the organization<sup>9</sup>. This was the seminal work of Hofstede in the 1966-73 IBM survey of the work-related values and attitudes of 116 000 IBM employees [4][7]. Using existing cultural mappings to explore the relationship to other subject areas, like organization, is a customary method within cross-cultural psychological research.

In the BG05 field study, data was collected using a revised version of the organizational questionnaire developed for AW04.

In order to study cooperation in multinational teams in a controlled environment, the LTAMC employed a computer based role play, NeverWinter Nights (NwN), which was adapted for our research purposes through the Situation Authorable Behavior Research Environment (SABRE). The method was considered both explorative and innovative in the study of issues related to cross-cultural cooperation. The SABRE game world is a modern urban environment without magic or violence. There can be 4 players on-line simultaneously in addition to an invisible character, through which the experimenters can monitor the experiments.

In the experiments, demographics/background, culture and organizational data was collected employing computerized surveys before and after the experimental game session. Hofstede's Value survey Module (VSM-94) was employed to measure culture and is today, to the author's knowledge, the most extensively validated instrument we have to measure culture quantitatively, especially in an organizational context (e.g., [10][21][23][24][25]). The VSM survey is validated to measure culture at a national/regional level, and is the result of continuous work since the original study [4][7][37]. The organizational survey was constructed for the LTAMC experiments and contains 36 questions developed from the organizational surveys employed in the field studies (AW04 & BG05). Questions in this experiment version were further reviewed by peers and revised on the basis of feed-back from the subjects in two pilot studies conducted in Norway prior to the first experiments.

### **Procedure**

#### *AW04 and BG05 field studies*

The first data-collection was carried out at the DJTF during the AW04 exercise, in Verona, Italy. The organizational questionnaires and the interviews were completed on site towards the end of the exercise. The subjects were recruited on the basis of free willingness.

During the BG05, the survey data was collected in the last part of the exercise at a tactical level unit in Steinkjer, Norway.

#### *Laboratory experiments*

In the experimental set-up, the 4 subjects in each experiment were randomly assigned to a role in the game. They each controlled a game character or avatar. In the game scenario, the subjects were given an assignment as a team and could cooperate to solve the assignment. They communicated through "chat".

The national experiments were conducted within local networks while the international experiments were done over the internet. The experiments were timed to one hour, but subjects were in for 5-6,5 hours on the experiment day, which included getting a brief before starting, game learning and planning sessions, completing surveys, and receiving a debrief at the end.

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<sup>9</sup> For Hungary, which was not in the original IBM-survey, we used the estimated scores (based on two later studies) presented in Hofstede [4].

The game started with a tutorial program, aimed at teaching the subjects how to play the game. In the second part of the tutorial session, the players were brought together and taught how to communicate. The subjects would proceed at their own speed in the tutorial session. Before the real experimental session started, there was a so-called planning session where the players were guided through planning by different game instructors. At the end of this, the players entered into the play's experimental scene, at which time the experimental session started - timed to exactly 1 hour. When the subjects started the planning session they were informed that one of them was the team leader. This was randomized.

In the experiment session, the subjects' characters would be in a modern urban environment where their mission was to find weapons hidden in crates ("caches"), which would give the team points ("goodwill points")<sup>10</sup>. There were no individual scores, but when someone gained points everyone was informed when this happened and by whom. In order to do their mission the subjects had a set of tools to help them out. These were scarce, so as to promote cooperation between the players. The distribution of tools was done by the players.

Communication between the players was limited to chat, there was no voice communication. There were two different chat functions, one short-range and one long-range. With the short-range chat the players could "talk" to all the other players in their closest vicinity, who would all "hear" simultaneously. With the long-range chat the players could only "talk" to one at the time, but were not limited by distance.

## **4.0 RESULTS**

### **Organizational change and Uncertainty avoidance**

It was hypothesized that people with high Uncertainty avoidance (Ua) would be more negative to organizational change than those with low Ua. First we analyzed the AW04 sample, which was culturally mixed. In this sample 43% experienced large organizational changes, 43% some changes and 14% no change. Organizational changes had been introduced as the DJTF aimed to approach a structure in line with Effects Based Operations (EBO)<sup>11</sup>. This included a change from the formerly used J-structure into to a cellular "EBO structure", a change from separate services into a joint structure, and increased focus on the commander's goals. Splitting the file in low and high Ua<sup>12</sup> showed that for those from low Ua cultures, there were found no relationship between the experienced degree of organizational changes and the rating of the organization (positive/negative). For those from high Ua cultures, there was found a tendency for a negative relationship, although not significant ( $r=-.487$ ,  $p=.183$ ). This means that, there seems to be a tendency that the type of organizational change experienced in the AW04 was understood as more negative for those from high Ua cultures. The BG05 sample was low Ua only, and as expected there was found no relationship between the experience of organizational changes (32% experienced large organizational changes, 41% some changes and 27% no change) and the rating of the organization.

### **Organizational structure and process**

In both field and experimental studies, three questions were asked in order to decide the respondents' perception of structure (hierarchy/flat), centralization/decentralization and flexibility of the organizations, using 5-point bipolar measurement scales.

Responses indicated that hierarchy may have been relatively flat in the AW04 organization (43% said the organization was flat, 25% that it was hierarchic), but also that this was not accompanied by an equal

<sup>10</sup> The players could both gain and loose points in various degrees depending on their actions.

<sup>11</sup> EBO is e.g. described in the "NATO networked enabled capability (NNEC) foundation document" [1].

<sup>12</sup> Low Ua is defined as  $Ua < 54$ , i.e. below the mean Ua value in the AW04 sample.



amount of decentralization (32% said the organization was decentralized, 43% that it was centralized). Indeed, there was found no relationship between degree of hierarchy and decentralization ( $r=.155$ ,  $p=.430$ ,  $N=28$ ). Qualitative data revealed some of the negative consequences of centralization accompanying a flattening of the hierarchy; intermediate leaders were reported not to be sufficiently empowered and subordinates were reported to forward too many questions to superiors, hence creating a chokepoint at the top of the hierarchy.

In the BG05 organization, about 50% of the respondents found the organization to be both hierarchic and centralized. However, there was found little relationship between the variables ( $r=.206$ ,  $p=.134$ ,  $N=55$ ).

In the experiments, 56% of the subjects found the team structure to be flat (30% hierarchic) and 62% found the team processes to be decentralized (12 % centralized). The variables, centralization and hierarchy, were significantly positively correlated ( $r=.454$ ,  $p<.001$ ,  $N=133$ )<sup>13</sup>.

## **Flexibility**

### *Flat structure and decentralization as predictors of flexibility*

It was expected that hierarchy and centralization would be related to flexibility in both operational and game environments.

In the AW04 data, regression analysis demonstrated no relationship between structure (flat/hierarchy) and flexibility, but quite a strong significant relation between perceived decentralization and flexibility ( $\beta=.671$ ,  $p<.001$ ,  $R^2=.45$ ). This implies that people who found the organization to be flexible also tended to find the organization to be decentralized.

In the BG05 data, regression analyses showed that there was a tendency for people who rated the organization as more flexible also to rate the organization as flatter and more decentralized ( $\beta=.336$ ,  $p=.024$ , and  $\beta=.369$ ,  $p=.007$ , respectively). Hierarchy and centralization explained over 26% of the variance in the flexibility ratings. In this organization, both flat structure and decentralization seemed to be good predictors of an organization's flexibility.

In the experimental data, regression analysis found only almost significant relations between perceptions of flat structure and flexibility ( $\beta=.148$ ,  $p=.119$ ), and decentralization and flexibility ( $\beta=.179$ ,  $p=.060$ ), including both national and international groups ( $N=133$ )<sup>14</sup>. Flat structure and decentralization explained 8% of the variance in flexibility ( $p=.005$ ). The same relationships turned up when the analyses were done on the basis of aggregated scores at the group level; the relationships were even somewhat stronger while not significant at the .05 level<sup>15</sup>.

Figure 4.1 shows the model portraying the relationships between flat structure, decentralization and flexibility, based on the analyses from all three studies. The results lend support to the hypothesis that flat structure and decentralization are positive predictors of organizational flexibility<sup>16</sup>. The link between decentralization and flexibility was clearly the strongest. The values in the model are weighted mean coefficients. The statistical procedure for computing the weighted mean coefficients is based on Hunter and Schmidt's [38] method for estimating the weighted average of correlations.

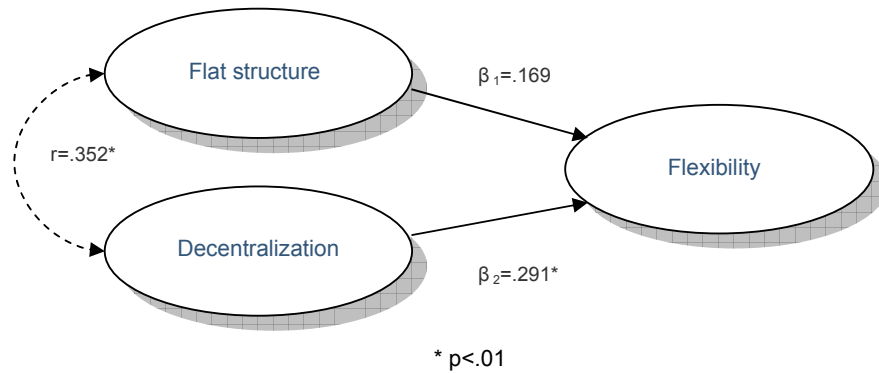
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<sup>13</sup> As the organizational questionnaire had failed to be activated in the Bulgarian, Swedish and approximately half of the Dutch national experiments, we lack data on the organization related measurements from these. Therefore,  $N=133$ .

<sup>14</sup> Looking at the same for the international groups only, gave the same relations, just a bit stronger.

<sup>15</sup> Flat structure & flexibility,  $\beta=.190$ ; decentralization & flexibility,  $\beta=.293$ ,  $R^2=.151$ ,  $p=.078$ ,  $N=34$ .

<sup>16</sup> The weighted beta-value for flat structure was not significant ( $p=.11$ ).



**Figure 4.1 Model: predicting flexibility through the organizational variables flat structure and decentralization. Correlation and beta coefficients are weighted.**

*Cultural heterogeneity as a predictor of flexibility*

It was expected that cultural heterogeneity of team composition might affect flexibility positively. We had measurements of this only from the experiments (only in this controlled environment could we manipulate the team composition). A t-test showed a tendency in line with expectations; the culturally heterogeneous groups (N=20) scored on average 0.4 higher on the flexibility ratings (5-point scale) than the culturally homogenous groups (N=100)<sup>17</sup>. The difference was almost significant (p=.069). Cohen’s d-value was estimated to be 0.45, indicating a moderate difference between these two groups<sup>18</sup>.

*Cultural heterogeneity and trust*

Trust, defined as task related confidence in team-members, was expected to affect team processes, and possibly also be linked to culture. In the experiments, team trust was measured through 3 questions in the Organizational questionnaire (experiment version). Internal consistency test shows satisfactory reliability of the measure; Cronbach's Alpha = .714. See table 4.1 for details; mean score was computed on the basis of the items listed.

**Table 4.1 Team trust: Items and reliability of measure. N=133.**

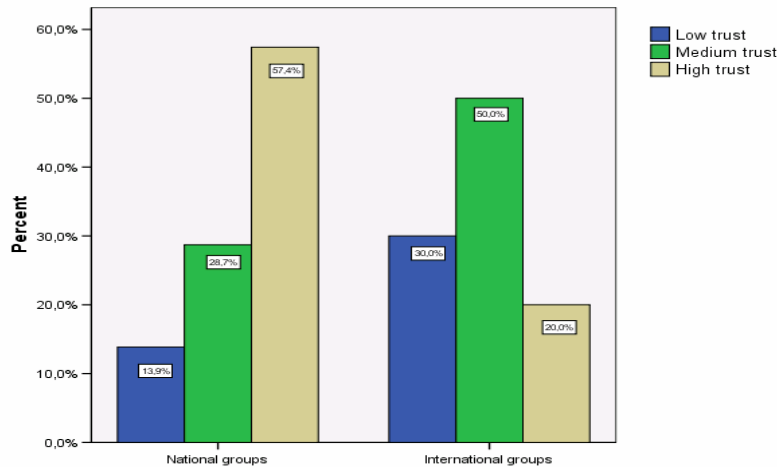
Items	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
How confident were you that team members would assist you if you needed help?	,548	,610
How confident were you that team members would fulfill their responsibilities?	,490	,676
How confident were you that your team members would share important information with you?	,569	,579

Answer categories: 5-point scale from very confident to very doubtful.

<sup>17</sup> As we had no flexibility scores from the Bulgarian and Swedish national experiments, the data from the Bulgarian and Swedish participants in the international experiments were excluded when comparing the national and international groups, in order to have matched samples for comparison purposes. Therefore, N=121 total.

<sup>18</sup> Cohen’s d-value is a measure of effect size, in this case signifying the relative difference between two groups. Conventionally, a d-value of +/- .20 is interpreted as a small difference, +/- .50 a moderate difference and +/- .80 and above a large difference.

Figure 4.2 shows the distribution of answers on trust split in national and international experiments. The figure indicates higher trust within the national than within the international groups. The mean trust scores in the national and international experiments were 3.6 (SD=0.8) and 2.9 (SD=0.8), respectively. This is a difference in mean trust scores of 0.7 point on a five-point scale, significant on a .001 level. Cohen's *d*-value for difference between these two groups was estimated to be 0.85, indicating a rather large difference in trust scores between the two groups. The lack of answers from all countries in the national experiments was controlled for<sup>19</sup>.



**Figure 4.2. Trust within nationally homogenous groups and nationally heterogeneous groups.  
N=121.**

#### *Trust and Individualism/Collectivism*

It was expected that trust may be related to the Individualism/Collectivism (I/C) dimension of culture, but there was found no such relationship in our data. In the analyses it was checked for correlations in the sample both as a whole, as well as within the national (homogenous) and international (heterogeneous) groups separately.

#### **Rating the organization and the effects of Power distance**

In both field and experimental studies, we checked how the structural (hierarchy) and processual (decentralization and flexibility) organizational descriptions were related to how the respondents rated the organization (positive/negative). The correlations are reported in table 4.2.

<sup>19</sup> As we had no data on trust from the Bulgarian and Swedish national experiments, the data from the Bulgarian and Swedish participants in the international experiments were excluded when comparing the national and international groups, in order to have matched samples for comparison purposes. Therefore, N=121.

**Table 4.2 Correlations between organizational rating and flat structure, decentralization and flexibility in AW04, BG05 and experiments.**

	Flat structure	Decentralization	Flexibility
Org.rating AW04 (N=27)	r=.140 (p=.487)	r=.326 (p=.098)	r=.343 (p=.080)
Org.rating BG05 (N=55)	r=.208 (p=.128)	r=.200 (p=.146)	r=.652**
Org.rating Exp. (N=133)	r=-.368**	r=-.389**	r=.121 (p=.166)

\*\*p<.001

Table 4.2 shows how rating the organization can be understood as being influenced by flat structure, decentralization and flexibility. There were no significant findings in the AW04 study, but the tendencies were the same as in the BG05 study; the flatter, more decentralized and flexible the organization was rated, the more content the respondents seemed to be with the organization in general. The relationship to flexibility was the strongest result in both studies and significant at the .001 level in the BG05 study. The weighted mean correlation coefficients are presented in table 4.3.

**Table 4.3 Weighted mean correlations between organizational rating and flat structure and organizational rating and decentralization from AW04 and BG05, and the weighted mean correlation between organizational rating and flexibility from all studies (AW04, BG05 and experiments).**

	Flat structure	Decentralization	Flexibility
Org.rating AW04 & BG05 (N=82)	r=.185	r=.241	r=.550**
Org.rating AW04, BG05 & Exp (N=215)			r=.285*

\*p<.01, \*\*p<.001

We also expected that Power distance (Pd) would affect how the respondents rated the organization. We expected that those with low Pd would look more positively on the organization if they perceived that the organization was flat and/or decentralized. In the BG05 sample, we had only low Pd respondents. Splitting the AW04 file in low and high Pd<sup>20</sup>, showed that there were significant correlations in the low Pd group only (N=11): decentralization and rating (r=.778, p=.005) as well as flexibility and rating (r=.608, p=.047) were quite strongly correlated.

The correlations in table 4.2 show that in the experiments, the relationships between rating the organization and both flat structure and decentralization were in the opposite direction of those in the field studies. Respondents in the experiments seemed to have a more positive view of the team organization when they experienced it as more hierarchic and centralized. Only the relationship to flexibility was the same as in the field studies (table 4.2). In the experimental data we found no effect of splitting the file in low and high Pd. We also checked through regression analysis if Pd interacted with hierarchy and centralization on how subjects rated the organization. This was not found.

However, there was found a significant correlation between Pd and rating the organization: r=.193 (p=.026), indicating that there was a small tendency for subjects from high Pd cultures to rate the team

<sup>20</sup> Low Pd defined as Pd<40, i.e. below the median Pd value in the AW04 sample.

organization more positively than those from low Pd cultures. The same relationship, although not significant, was found in the AW04 data ( $r=.248$ ,  $p=.213$ ).

The results from the experiments presented above, that the team organization which was perceived as hierarchic and centralized also tended to be rated as better, needed a further inspection. A regression analyses was first performed, showing that flat structure ( $\beta=-.241$ ) and decentralization ( $\beta=-.279$ ) explained 20% of the variance in rating (beta values:  $p<.01$ , model:  $p<.001$ ). It was suspected that the game context could have influenced these findings. Simultaneous communication to all other players at the same time could for instance only take place if they were standing in each others vicinity in the game, otherwise they would have to type the same message repeatedly to all.

Over 96% of the respondents in the experiments indicated that the game tools influenced group processes. Regression analysis showed that 14 % of the variance in Game influence on team processes could be explained by the two variables, Technical obstacles for sharing information ( $\beta_1=.216$ ,  $p_1<.01$ ) and Tool influence on communication ( $\beta_2=.323$ ,  $p_2<.001$ ). These analyses indicate that team members experienced team processes, including both communicational patterns and sharing information, to be influenced by the technological solutions in the game.

Qualitative data from the experiments<sup>21</sup> indicated that subjects often found the communication through chat and the information management system to be cumbersome and take too much time. The comments suggest that playing may have been more time efficient, as well as less chaotic and confusing if the team organization was more hierarchic and centralized. There were also indications that our subjects interpreted the game organization in light of what they were used to in their military organization.

Further analyses showed that the tendency to like a hierarchic and centralized organization was found both for those who had previously spent a lot of time playing computer games (experts) as well as for those that had played little or nothing (novices) (the correlations were just a bit stronger for those who had played more games). Hence, both those who could be expected to find the game complex and those who could be expected to find the game simple rated the team organization higher when the organization was hierarchic and centralized. In other words, game expertise could not explain the correlations between hierarchy and rating, and centralization and rating.

Finally, in relation to the experiments (we had no performance measures in the field studies), it was explored whether organizational structure and process was related to performance, in terms of game points. There was found a significant correlation at group level only: game points per transaction was positively related to hierarchy ( $r=.371$ ,  $p=.031$ ), indicating that a hierarchic organization also paid off in the game.

## **5.0 DISCUSSION**

### **Organizational change and Uncertainty avoidance**

The AW04 data gave some support to the hypothesis of high Uncertainty avoidance (Ua) predisposing people to perceive organizational changes as negative. As there were reports of chaos linked to the organizational changes implemented in the AW04 DJTF organization, the environment could be described as less predictable and more ambiguous (for more on this, see [14]). According to theory, people from high Ua cultures will have more difficulties dealing with this [4]. There were no high Ua respondents in the BG05 sample, and as expected there were found no tendency to perceive organizational changes as negative in that data.

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<sup>21</sup> From open-end questions in the organizational questionnaire, experiment version.

### **Organizational structure and process**

Even though the structural description of hierarchy and the processual description of centralization often are considered to be closely related in an organizational context (e.g., [27][26]), the current studies show that hierarchy and centralization were significantly related in only one of the three studies. This indicates that the variables may be independent, and that they may or may not be related in different organizations. Earlier studies from military operative organizations have also reported that organizational developments that include flattening the structure often do not entail decentralization (e.g., [28]).

But what does it mean for the organizational effectiveness if hierarchy and centralization are not related in any given organization? In the AW04 data, there were indications that a lacking relationship between the variables can mean a less well functioning organization – especially if flatter structure is not accompanied by decentralization. The top end of the hierarchy seemed to get overloaded as too many decisions were routed upwards. Similar problems have also previously been reported from the field (see e.g., [39][40]). Such organizational processes can typically make personnel higher up in the hierarchy overworked and those lower down in the hierarchy less able to make decisions. There is also a risk that people may become passive in systems where they get used to having insufficient authority to act. If a person gets used to not being able to make a difference, it is a natural consequence to stop trying<sup>22</sup>.

### **Flexibility**

#### *Flat structure and decentralization as predictors of flexibility*

Results from the three studies support a model where flexibility can be predicted through the organizational variables flat structure and decentralization. The strongest and most consistent relationship was found between decentralization and flexibility. In both the BG05 and the experimental data, flat structure and decentralization were found to predict flexibility. In the experiments, this was found both at individual and group levels of analysis. The relationships were however, stronger at the group level, lending further support to the interpretation at the organizational level of analysis. The AW04 field data confirmed only the link to decentralization, which also was the strongest relationship found in the two other studies.

These results support one of the most basic hypotheses onto which the idea of NNEC has been built; the supposition that flatter organizational hierarchy and decentralization will lead to greater flexibility (e.g., [1][29][39]). Similarly, organizational theory (e.g., [27]) has described hierarchic, centralized organizations as inflexible. The current research has confirmed the proposed connections in empirical analyses from both field and experimental studies in cross-cultural military contexts. In addition, the current research has consistently shown that decentralization is the most important element in order to achieve flexibility. However, in at least in some parts of NATO, organizational development in the NNEC era does not seem to reflect a conscientious approach to such issues, i.e. there are many reports of centralization rather than decentralization (for a review, see e.g., [39]).

#### *Cultural heterogeneity as a predictor of flexibility*

In the experiments, there was found a moderate almost significant difference between the culturally heterogeneous and the culturally homogenous groups in flexibility. The difference was in the hypothesized direction; a tendency for the heterogeneous teams to be more flexible.

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<sup>22</sup> Learned helplessness is a now classic finding in psychological research [41] that explains how people learn to stay passive if they experience that their actions are unsuccessful. The knowledge is furthermore transferable to different situations than where it was learned.

### *Cultural heterogeneity and trust*

Even though culturally heterogeneous teams may be more flexible than homogenous teams, there are also challenges linked to this. Results indicated quite large, and significantly higher, levels of trust within the national than within the international teams. This supports research on trust having indicated that it is more difficult to build trust in heterogeneous groups than in homogeneous groups [31][33][34]. The current results expanded the notion of heterogeneity to culture in relation to trust, hence adding new insight into the fields of cross-cultural group processes and trust.

One lesson from these studies is that one needs to invest more time and training together in order to build trust in international work groups, like NATO coalitions, as compared to national work groups, and the more culturally diversified at the outset, the more time will be needed. NNEC includes increased cooperation, also between countries, which indicates that this will be an important lesson to include in order to succeed with the implementation of NNEC.

### *Trust and Individualism/Collectivism*

It was also expected that trust may be related to Individualism/Collectivism (I/C). Research indicate that the cultural dimension of I/C may affect people's tendency to trust people [35][36]. However, there was found no significant links between the I/C dimension of culture and trust in our data; neither in the whole sample, nor for nationally and internationally composed groups when analyzed separately. The lack of results may not be so surprising as the research of Cox et al. [36] and Triandis [35] actually points in opposite directions; the former having demonstrated that collectivists trust both in-group and out-group members more than individualists, while the latter indicated that collectivists trust out-group members *less* than individualists. If both Cox et al. and Triandis are equally right, that collectivists are better at trusting per se while at the same time also differentiating more between the in-group and out-group members, we could end up with the two tendencies canceling each other out if they are made equally salient in the context they are measured.

### **Rating the organization and the effects of Power distance**

There seemed to be a general preference in the field studies for a flat organizational structure and decentralized and flexible organizational processes. The preference for organizations that were flexible was the only result that proved significant and was consistently found in all studies, including the experimental study. Assuming that a positive attitude toward the organization is linked to higher motivation, one may in turn hypothesize that a flexible military organization may lead to more motivated personnel.

Low Power distance (Pd) seemed to strengthen the preference found for decentralized and flexible organization in the field studies. This was in line with expectations; low Pd indicates a culture where people are used to working in flatter and more decentralized organizations [4]. There was, however, found no opposite relationship for high Pd cultures. Is it possible that people from low Pd cultures find it harder to adapt to a more centralized organization than people from high Pd cultures find it to adapt to a more decentralized organization? It seems to make sense that it is more frustrating having to adapt to less power and influence than one is used to, as opposed to more power and influence than one is used to.

Contrary to what was found in the AW04 analysis, in the experiments, respondents seemed to have a more positive view of the team organization when they experienced it as more hierarchic and centralized. The question is why this is so. We know from research on organization and problem-solving (e.g., [13][42][43]) that simple tasks tend to make a centralized organization advantageous. Could this be the reason also in this case; that the experiment situation could be deemed a simple task situation? Certainly, a military operative organization is both more complex and deals with more complex issues than what a

small controlled lab experiment can be. Nevertheless, qualitative data indicated that many subjects experienced the game as a complex environment, and possibly more so the subjects with less experience playing computer games. But as indicated in the results chapter, even though the correlations were somewhat stronger for the gamers, the same relationships were found for both gamers and non-gamers. This seems to indicate that it was not a lack of complexity in the game that gave the preference for hierarchy and centralization. On the other hand, even though the game was somewhat complex, the main task could still be viewed as relatively simple, at least compared to tasks in a military operative exercise.

Both qualitative and quantitative data indicated that the game may have had an influence on the team-processes in the experiments. Technical solutions in the game, such as communication and information management tools, were found to influence the group processes, including restricting information-sharing and influencing the communication processes. For further research purposes, this finding points to the importance of also analyzing how experimental tools may influence at least certain measurements. Transferred to a military context, the finding underlines the importance of understanding the effect that collaborative technologies have on the collaborative processes in an organization.

In the game, long distance communication was restricted to sending messages to only one other player at the time, and represents a technological solution that did indeed influence the communicational pattern. This meant that it would take more time to communicate and share information with all in a decentralized manner than in a centralized manner if the team was dispersed, which could explain why the subjects seemed to prefer a hierarchic and centralized organization. It simply saved time and effort in the game.

Qualitative data from the experiments also indicated that playing may have been more time efficient, as well as less chaotic and confusing for the subjects, if the team organization was more hierarchic and centralized. Some comments also indicated that our subjects interpreted the game organization in light of what they were familiar with in their jobs in a military organization. In other words, if the organization was less hierarchic and centralized in the game than in the teams subjects were used to working in, they could interpret this as being the problem if there was confusion. What we know is that people work most efficiently in systems to which they are accustomed. (For a discussion on this topic, see [14].)

The finding in the experiments, that subjects from high Pd cultures tended to rate the team organization more positively than those from low Pd cultures, could mean that the organization and/or game solutions for communication and information sharing were supporting more hierarchic and/or centralized organization and processes than what our respondents from low Pd cultures were accustomed to and/or preferred. This strengthens the above indications of the game having communication and information sharing solutions favoring centralized communication. Since organizations in low Pd cultures typically are flatter and more decentralized [4], subjects from these cultures may have been more frustrated having to work centralized than those from high Pd cultures.

It was also found that hierarchy affected performance scores; more hierarchically structured teams tending to get higher game point scores per transaction than flatter structured teams. This could simply mean that this structure paid off in this game, and could hence be one of the reasons why this structure was more preferred among the players.

## **6.0 CONCLUSION**

The results presented from two NATO exercise field studies and one experimental laboratory study have provided insights into organization, culture and trust in multinational settings. Results on the relationship between organizational structure and flexibility supported the theories of a positive relationship between flat structure, decentralization and flexibility proposed in the NNEC concept. Especially decentralization was consistently and strongly related to flexibility in the studies. In turn, flexibility was the organizational



element that made personnel in all studies inclined to give the organization higher ratings. In the field studies, especially in low Pd cultures, decentralization and to a lesser extent flat organizational structure, also tended to give higher organizational ratings. In the experiments these relationships tended to go in the opposite direction. Cultural heterogeneity of team composition in the ad-hoc experimental teams was on the positive side related to flexibility, but on the negative side also to lower team trust. These findings on trust support and expand on existing research and suggest a need to invest more time and training in order to build trust in culturally diversified teams in NATO coalitions.

Field and experimental studies were in general pulling in the same direction in the results presented. However, attention was also brought to important experimental game characteristics that could make certain results point in the opposite direction of those in the field studies. The use of a game environment that allowed distributed collaboration was what made the cross-cultural experiments possible, but as the results here also indicate, there is a need to be aware of the limitations of such studies in terms of generalizations; certain processes risk being influenced by the research tool. However, as we are only in the early days of both building the knowledge of how to create and use good simulated environments for research in human factor areas, the author of this paper believes the results from the LTAMC research, of which some has been presented here, show that there is a future for such methods in both cross-cultural as well as other human factor research, for military and civilian purposes alike. There is also much new development in the field of serious gaming and virtual worlds that show good promise for the future of using games in human factor research.

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## Examining Teamwork Dimensions in a Coalition Environment: Perspectives from a NATO Joint Task Force Exercise

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### ABSTRACT

*In order to better understand the impact of culture on teamwork, the current field study was designed to examine several teamwork dimensions in the context of a NATO Joint Task Force exercise. Teamwork dimensions, shown to be important to team effectiveness within Western views, are examined in the context of a diverse, multinational setting. Interviews aimed at addressing teamwork dimensions were conducted with NATO officers and are analyzed from the perspective of six cultural dimensions. Results are discussed and future research needs identified.*

### 1.0 BACKGROUND

Multi-national coalition operations are highly complex multi-team processes [3, 4]. They involve performing specific, structured tasks that require attention to detail, coordination among multiple teams, analysis of large amounts of information, and frequent demands for communications and meetings to clarify progress. Information is often ambiguous and incomplete, and there is extreme time pressure to perform tasks according to a pre-specified schedule. Pierce [4] found such factors pose significant challenges for coordination and collaboration within multi-national forces. Sutton et al. [12] proposed that operations planning teams will be adaptable if they use effective teamwork behaviours, including: sharing information, providing guidance and communicating priorities (leadership/initiative); and monitoring and supporting other team members (e.g., correcting errors, responding to overload and recognizing a person is having difficulty with a task) [1, 5, 6, 7, 8, 11]. Furthermore, they [12] suggested that multi-national teams will require "cultural adaptability" which is "the ability to understand one's own and other's cognitive biases and to adapt, as necessary, to ensure successful team performance" (p. 144). Sutton et al. [12] developed a cause and effect framework in which they identified the following cultural cognitive biases that could influence team effectiveness: egalitarian or status; taking risks or risk restraint; interdependence or independence; direct or indirect communications; relationship or task focus; and a short-term or long-term focus on the future.

A main objective of the NATO Adaptability in Coalition Teamwork (ACT) program was to conduct research to explore the potential relationship between cultural biases and teamwork dimensions [9]. To this end, the ACT program conducted research with NATO Response Forces (NRF) during their Combined Joint Task Force exercises in which NRF capabilities are certified [2, 9]. The exercise requires multi-national officers to work as teams in specific divisions (e.g., intelligence, logistics, command and control) to coordinate and conduct NATO operational planning tasks [2]. The purpose of this paper is to describe the results of research conducted during the Allied Warrior 2005 (AW05) NRF exercise [2, 9]. Interviews were conducted with experienced and culturally diverse NATO officers. As subject matter experts, we proposed they had developed "culturally adaptable" perspectives about what makes multi-national teams effective. Therefore, we tested the Sutton et al. [12] propositions about the effect of cultural cognitive biases on responses to teamwork.

### **1.1 Egalitarian - Status Orientation**

A preference for being self-directed, using flexible roles, and challenging opinions of others in power ("egalitarian" orientation) will be more effective in supporting teamwork than a preference that team members follow and enforce rules, use appropriate behaviours for specific roles, and respect status and position power ("status" orientation). Therefore, NATO officers will tend to prefer an "egalitarian" orientation in describing behaviours associated with information sharing, leadership/initiative, and supporting behaviours (**Proposition 1**).

### **1.2 Risk - Restraint**

A preference for demonstrating quick results and valuing flexibility and initiative ("risk") will be more effective in supporting teamwork than a preference for taking time to do background research, establishing proper processes and systems, and taking time before making a change ("restraint"). Therefore, NATO officers will tend to use a risk orientation in describing behaviours associated with information sharing, leadership/initiative, and supporting behaviours (**Proposition 2**).

### **1.3 Interdependent - Independent**

A preference for cooperation and group goals, using group decision making styles, and rewarding and recognizing the group ("interdependent" orientation) will be more effective in supporting teamwork than a preference for individual initiative, using individual decision making styles, and rewarding/recognizing individuals ("independent" orientation). Therefore, NATO officers will tend to use an "interdependent" orientation in describing behaviours associated with information sharing, leadership/initiative, and supporting behaviours (**Proposition 3**).

### **1.4 Direct - Indirect**

A preference for using explicit, detailed communication and feedback ("direct" orientation) will be more effective in supporting teamwork than a preference for using indirect communications when saving face is the concern ("indirect" orientation). Therefore, NATO officers will tend to use a "direct" orientation in describing behaviours associated with information sharing, leadership/initiative, and supporting behaviours (**Proposition 4**).

### **1.5 Relationship - Task**

A preference for networking, affect, and interpersonal goals ("relationship" orientation) will be more effective in providing backup and supporting behaviours than a preference for achievement, objective accomplishments, and getting down to business ("task" orientation). Therefore, NATO officers will tend to

use a "relationship" orientation in describing behaviours associated with taking time to monitor and support other team members (**Proposition 5**).

## 1.6 Short-Term - Long-Term

A preference for quick results and focusing on immediate issues before moving on to the big picture ("short-term" orientation) will be more effective in supporting teamwork than valuing persistence, considering alternative opinions, and planning thoroughly ("long-term" orientation). Therefore, NATO officers will tend to use a "short term" orientation in describing behaviours associated with information sharing, leadership/initiative, and supporting behaviours (**Proposition 6**).

## 2.0 METHODS

Content analyses of officer interviews were evaluated using a quantitative and qualitative approach based on a frequency analysis of their responses to questions.

### 2.1 Participants

Twenty-two NATO officers volunteered to be interviewed and 12 countries were represented: Canada, Denmark, France, Germany, Greece, Netherlands, Norway, Portugal, Romania, Spain, Turkey, and the United Kingdom.

### 2.2 Materials

Interview questions were designed to obtain responses concerning how, in general, officers communicated with others on the job, and whether the nationality of the individual with whom they were speaking affected their communication style. Interviewers clarified that officers should think about their job overall, at the multi-national headquarters, as well as in the AW05 exercise. The questions were:

- Information Sharing

1a) How do you share information with others?

1b) How does sharing information change depending on the nationality of the individual?

- Leadership/initiative

2a) How do you provide guidance? For example, directing someone to take action or instructing them on how to perform a task.

2b) How does providing guidance change depending on the nationality of the individual?

2c) How do you communicate your priorities to others?

2d) How does communicating priorities change depending on nationality of the individual?

- Supporting behaviour

- 3a) How do you bring an error to a team member's attention and see that it is corrected?
- 3b) How does error correction change depending on nationality of the team members?
- 3c) What do you do when you see that a team member is overloaded or having difficulty performing a task?
- 3d) How does providing help change depending on the nationality of the individual?

### **2.3 Procedure**

Four researchers conducted the approximately one-hour, semi-structured interviews in a NATO experimentation cubicle room located inside the AW05 exercise building. Officers selected interview appointments for time they had available during the exercise. Each interviewer asked all of the questions and responses were documented by hand. Interviews began with the questions about information exchange, but in keeping with the natural flow of the interview, the remaining questions were asked depending on the direction the interviewee's answers took. Interview times ranged between 20 minutes to one hour.

### **2.4 Measures, Rating Process & Data Analysis**

A content analysis of interview transcripts was conducted using a cultural orientation assessment tool that was developed for this study. First, the published literature was reviewed to collect behavioural indicators and definitions for each of the six cultural orientations [9, 10, 11, 12]. The behavioural anchors selected were provided by Aperian Global © with their permission and have been used extensively in prior work within the GlobeSmart® Commander training [10]. A single 5-point rating scale was created for each orientation. Figure 1 presents the Egalitarian - Status rating scale. For example, a "2E" rating was made if the rater observed the response had phrases (behavioural indicators) that supported a strong egalitarian orientation. A "1E" rating indicated the response had phrases that supported a somewhat strong egalitarian orientation. A "2S" rating indicated the response had phrases that supported a strong status orientation. A "1S" rating indicated the response had phrases that supported a somewhat strong status orientation. An "E/S" rating indicated the rater observed an equal number of phrases that supported a "balanced" egalitarian and status orientation. A "Not Applicable" rating was given when there was no response, or a response did not include sufficient detail to allow for a rating.

Egalitarian Orientation    2E      1E      E/S      1S      2S    Status Orientation

**Figure 1. Rating Scale for Egalitarian - Status Orientation**

Using these scales, two raters, blind to interviewee nationality, made independent ratings of responses to each interview question. The same response was rated with each of the six scales. A consensus discussion between raters led to a single rating for responses in which initial disagreement occurred. Raters made 792 ratings.

Due to small sample sizes, the rating frequencies for each dimension were reduced to three categories and percentages were calculated. For example, frequencies for 2E and 1E ratings were summed and converted to a percentage representing an "egalitarian" orientation. Frequencies for an E/S rating were summed and converted to a percentage representing a "balanced" orientation. Frequencies for 2S and 1S ratings were summed and converted to a percentage representing a "status" orientation. Propositions were tested with the non-parametric Chi-Square test.



### 3.0 RESULTS

#### 3.1 Egalitarian – Status Orientation

Table 1 presents the percent of interview responses rated for an egalitarian-status orientation. Proposition 1 was partially supported. Officers (45%) were more likely to use an egalitarian perspective in describing supporting behaviour than a status (9%) perspective ( $\chi^2(1, 12) = 5.33, p < .05$ ). A trend for using an egalitarian orientation was observed for describing leadership and information sharing behaviours, but differences were not significant.

**Table 1: Percent of Interview Responses Rated for Egalitarian/Status Orientation**

	Egalitarian	Balanced	Status	Response Rate
Information Sharing	22.73	13.64	9.09	68
Leadership/initiative	31.82	22.73	18.18	73
Supporting Behaviour	45.45*	18.18	9.09	73

\* $p < .05$

#### 3.2 Risk-Restraint Orientation

Table 2 presents the percent of interview responses rated for Risk-Restraint. A non-significant trend was observed for using a restraint orientation to describe supporting behaviour. Responses to information sharing and leadership were split between both orientations.

**Table 2: Percent of Interview Responses Rated for Risk-Restraint Orientation**

	Risk	Balanced	Restraint	Response Rate
Information Sharing	23.81	9.52	23.81	57
Leadership/initiative	27.27	9.09	31.82	68
Supporting Behaviour	14.28	4.76	38.09	57

#### 3.3 Interdependent-Independent Orientation

Table 3 presents the percent of interview responses rated for an interdependent-independent orientation. Proposition 3 was partially supported. Officers (41%) were more likely to describe supporting behaviour with an interdependent orientation rather than an independent orientation (9%) ( $\chi^2(1, 11) = 4.46, p < .05$ ). Although not significant, it was observed that officers tended to describe leadership from an interdependent

and balanced perspective compared with an independent orientation. A similar trend was observed for information exchange, but the response rate was very low.

**Table 3: Percent Interview Responses Rated for Interdependent-Independent Orientation**

	Interdependent	Balanced	Independent	Response Rate
Information Sharing	22.73	0	4.54	27
Leadership/ initiatives	27.27	31.82	13.64	73
Supporting Behaviour	40.91*	27.27	9.09	77

\*p < .05

### 3.4 Direct-Indirect Orientation

Table 4 presents the percent of interview responses rated for a direct-indirect orientation. Proposition 4 was partially supported. Officers (67%) more often described leadership with a direct orientation compared to those reporting a balanced (5%) ( $\chi^2(1, 16) = 9.00, p < .05$ ) or indirect orientation (10%) ( $\chi^2(1, 16) = 9.00, p < .05$ ). Officers (45%) more often described supporting behaviour using a direct orientation compared to those reporting a balanced orientation (5%) ( $\chi^2(1, 11) = 7.36, p < .05$ ); and, though not significant, compared to an indirect orientation (23%). A non-significant trend was observed for using a direct orientation to describe information sharing, but the response rate was very low.

**Table 4: Percent of Interview Responses Rated for Direct-Indirect Orientation**

	Direct	Balanced	Indirect	Response Rate
Information Sharing	22.73	0	4.54	27
Leadership/ initiative	66.67*	4.76	9.52	81
Supporting Behaviour	45.45*	4.54	22.73	72

\*p < .05

### 3.5 Relationship - Task Orientation

Table 5 presents the percent of interview responses rated for relationship-task orientation. A non-significant trend was observed for using a relationship orientation to describe supporting behaviours. Information sharing was split across the three categories and Leadership behaviours were described using a task orientation.

**Table 5: Percent of Interview Responses Rated for Relationship - Task Orientation**

	Relationship	Balanced	Task	Response Rate
Information Sharing	14.28	23.81	19.05	57
Leadership/initiative	23.81	14.28	42.86	81
Supporting Behaviour	33.33	14.28	10.05	67

### 3.6 Short-Long Term Orientation

Table 6 presents percent of interview responses rated for short-term and long-term orientation. The response rate was much lower for behaviours in this category. A non-significant trend was observed for using a short-term orientation to describe information sharing, leadership, and supporting behaviour.

**Table 6: Percent of Interview Responses Rated for Short-Long Term Orientation**

	Short-Term	Balanced	Long-Term	Response Rate
Information Sharing	23.81	14.28	9.52	48
Leadership/initiative	33.33	19.05	4.76	57
Supporting Behaviour	28.57	9.52	19.05	57

## 4.0 DISCUSSION

Content analysis of NATO officer interviews revealed trends supporting proposed cultural orientation profiles. An egalitarian, interdependent, and direct orientation was found in descriptions of effective supporting behaviours. In addition, a direct orientation was found in descriptions of effective leadership/initiative behaviours. Furthermore, many of the observed trends, though not statistically significant, were in the direction of the propositions.

Caution should be taken interpreting the findings. The unstructured interviews resulted in variations in response time and length, and low response rate to some questions, which may be confounded with orientation type. In addition, the "balanced" perspective while offering a finer grained analysis of the data, may have led to some results being non-significant because it restricted the number of expected frequencies per cell. Another issue could be the potential for interviewers influencing officer responses to describing teamwork strategies. But, this was not likely as some trends were not in the expected direction. Further qualitative analyses of officer responses are needed to identify potential reasons for the mixed trends. For example, we discovered such recurring themes as technology and language skills that may affect teamwork. Many officers reported communicating face-to-face (FTF) was more effective for information exchange, but was less effective when there was a need to transmit large amounts of information through email. Another concern was the influence of language skills on how information was communicated. Officers explained that

native English speakers have many more meanings for a single word, and that non-native English speakers may only understand a few of them. Consequently, all the officers were aware they had to use a common language that everyone could understand.

In conclusion, the results provided strong support for pursuing research that increases understanding of cultural factors that influence multi-national teamwork. The current findings and results from future research should provide guidance for continuing to develop such training interventions as GlobeSmart<sup>®</sup> Commander and GlobeSmart<sup>®</sup> Soldier for preparing an individual to work in such environments [10].

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## Measuring Cultural Cognitive Biases in Multi-National Research

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### **ABSTRACT TITLE**

*A goal of military research has been to understand how culturally-based cognitive biases may enhance or hinder coalition team performance. Psychometrically-sound measures of cultural constructs are important to these efforts. Problems often encountered in cross-cultural research include readability, perception of construct relevance, and culture-based response biases. In the current study, we discuss implications of findings based on an examination of a cultural-biases questionnaire completed by five nations in a NATO research study on Adaptability in Coalition Teamwork (ACT).*

### **1.0 INTRODUCTION**

Sutton and Pierce [15] assert that team adaptability and performance will be a key enabler of decision making in NATO forces. They define "national culture," as the values, beliefs, and cognitions that guide interpretation of unfolding events and social interactions. Sutton et al. [16] proposed that individuals use a cultural cognitive framework to interpret personal experiences, form values, and perform on the job. The expectation is that cultural norms dictate that a person will perform certain tasks and can only speak to designated people; what information can be shared up and down the chain of command or among peers; and how much information is needed to make a decision. Sutton and Pierce [15] described a team member's cultural competence as having a clear understanding of the dominant values and orientations of other team members, and recognizing that the thoughts and behaviours of others are influenced by such cultural norms. The increasing multi-national and distributed nature of teams may impair member's ability to effectively share information. Sutton and Pierce [15] proposed that leaders and team members who understand the impact of cultural biases on teamwork would be able to adapt their behaviours to ensure mission success.

The concept of cognitive biases based on cultural norms became an important research variable in the NATO Human Factors and Medicine Research and Technology Group 138 (HFM RTG-138) Adaptability in Coalition Teamwork (ACT) [14]. The ACT research charter was to study ways to enhance multinational team performance in NATO Response Forces. A main objective was to identify potential cultural biases that affect individual and team performance [14]. Sutton and Pierce [15] developed a framework for understanding cultural diversity in teamwork. Six culturally-based cognitive dimensions and related behaviours were created. Each variable represents a person's orientation toward either end of a single bipolar continuum. The following list of dimensions and definitions are described in [14]:

*Independent - Interdependent.* An independent orientation is a preference for individual initiative and action, whereas, an interdependent orientation is a preference for a more group-oriented approach that emphasizes the interests of the team as a whole.

*Egalitarian - Status.* An egalitarian orientation is a preference for mutual consultation in decision-making, whereas, a status orientation is a preference for greater deference to rank and hierarchy.

*Risk - Restraint.* A risk orientation is a preference for rapid action and risk-taking, whereas, a restraint orientation is a preference for more cautious and calculated actions based on ample information.

*Direct - Indirect.* A direct orientation is a preference for open and explicit communication, whereas, an indirect orientation is a preference for careful attention paid to context, or to implicit meanings in a given message.

*Task - Relationship.* A task orientation is a preference for immediate attention to getting the job done, whereas, a relationship orientation is a preference for establishing strong and trusting personal relationships first.

*Short Term - Long Term.* A short term orientation is a preference for making choices based upon a narrow time horizon, whereas, a long term orientation is a preference for considering the impact that choices will have over a longer span of time.

The ACT program developed a self-report questionnaire to assess degree of orientation on each dimension [14]. Ensuring such measures remain valid in multi-national settings has been problematic [7, 10]. Sanchez et al. [10] reported a number of methodological issues frequently ignored in multi-cultural research, yet central to developing the construct validity of self-report scales. For example, Sanchez et al. [10] reviewed the multi-national stress research and found item interpretation was a problem because English was a second language, and/or national origin affected how the meaning of an item was interpreted. Sanchez et al. [10] and others [12] suggested that high internal consistency reliability does not guarantee that the individual items reflect the construct of interest. Therefore, Sanchez et al. [10] recommended a factor analysis to examine correlations among individual items to determine if they are being interpreted as intended. Second, they [10] recommended a readability analysis be conducted to identify the degree to which responses to the items are affected by it. Finally, Sanchez et al. [10] suggested that degree of agreement or cohesion of an individual nation's responses to scale items be used to identify item relevance to a particular nation. Therefore, in the current study, we explored the psychometric properties of the GlobeSmart® Commander Self-Assessment Profile (GS-SAP) [14] instrument following the guidelines noted by Sanchez et al. [10].

## **2.0 METHOD**

### **2.1 Design**

The study was a post-test only between-groups design with Single Nation and Mixed Nation teams as one of the independent variables.

### **2.2 Participants**

Participants were 224 volunteer military officers from five participating NATO nations separated into 56 four-person teams. Mean age of the participants was 31.25 years ( $SD = 7.63$ ). Participants were primarily male (96.4%) junior officers of NATO rank OF-3 or below (89.2%). All officers were represented their country of origin, having lived less than six months outside their nation before age 18.



Teams were composed of countries representing: Bulgaria ( $n = 32$ , 8 teams), Netherlands ( $n = 32$ , 8 teams), Norway ( $n = 64$ , 16 teams), Sweden ( $n = 36$ , 9 teams), and the United States ( $n = 28$ , 7 teams). Eight mixed-nation teams ( $n = 32$ ) participated. Only four nations could compose a single mixed-nation team, therefore, a counterbalanced design was employed to ensure the five nations were represented.

### **2.3 Experimental Task**

The Situation Authorable Behavior Research Environment (SABRE) is a scenario authoring tool that supports the simulation of interactive role-playing games [18]. The collaborative role-playing scenario used for the current study is based on the game “Neverwinter Nights.” Participants performed the task in teams of four, with one participant chosen as the team leader. The task objective was finding hidden weapons caches around a simulated urban area. Teams earned “goodwill” points when they found the caches and created good relations with local residents portrayed by avatars. Points were lost when they searched for caches in the wrong locations, or if they offended the local residents. Team members had information and tools displayed on their computers to support collaboration and maintain awareness of each other’s actions and locations.

### **2.4 Measure**

The six GS-SAP dimensions are based on previous cultural assessment research [3, 5, 6, 11, 13, 17]. However, the GS-SAP items differ from other efforts to measure similar constructs in that they assess cultural values and behaviours within an international military work context. GS-SAP is composed of 32 Likert-type items asking for a self-report assessment on each of the dimensions. Table 1 lists the number of items in each dimension.

### **2.5 Procedure**

Teams composed of individuals from the same nation performed the simulation task at individual computer terminals in the same room. Team members were positioned to prevent seeing or hearing each other in order to create a distributed team environment, and eliminate confounding results due to face-to-face or nonverbal interactions. Mixed-nation team members performed the task over the Internet from their home nation. Team members began by completing the GS-SAP and other questionnaires, and then received a two-hour training session that focused on communication and navigation skills through computer inputs. Next, team members practiced several group planning tasks to become familiar with their unique and shared roles, and with more advanced collaboration strategies. Last, teams participated in a one-hour scenario while their communications and performance outcomes were automatically collected in real-time.

## **3.0 RESULTS**

Table 1 lists number of scale items, alpha reliabilities, sample items, and item scoring for each GS-SAP dimension. All scales demonstrated reliabilities lower than the .70 benchmark suggested by Nunnally [9]. Removal of items with the lowest corrected item-total correlations resulted in an average increase in coefficient alpha of .15, bringing the alpha values for the Risk - Restraint (corrected alpha = .63) and Short-term - Long-term dimensions (corrected alpha = .65) closest to the benchmark.

**Table 1. Number of scale items, alpha reliabilities, sample items, and item scoring for each GS-SAP dimension.**

Dimension	Number of Items	Alpha	Sample Item	Higher Scores Indicate
<b>Independence - Interdependence</b>	6	0.29	If a mission succeeds because of my efforts, I try and share the credit with everyone in my unit.	Interdependence
<b>Egalitarian - Status</b>	6	0.31	I should be able to sit back and relax when interacting with my superiors.	Status
<b>Risk - Restraint</b>	6	0.36	I enjoy taking on new challenges whether I am certain I can handle them or not.	Restraint
<b>Direct - Indirect</b>	6	0.37	When someone says something, I try to figure out what they really mean.	Indirect
<b>Task - Relationship</b>	5	0.09	Getting along with members of my unit is more important to me than career advancement.	Relationship
<b>Short-term - Long-term Orientation</b>	3	0.53	The future is too uncertain to make long term plans.	Long-term

A number of additional analyses were performed to identify reasons for the low observed reliabilities of the GS-SAP dimensions. First, principal components analyses were used to explore the latent factor structure underlying the GS-SAP. Both un-rotated and varimax-rotated solutions yielded three latent factors, but further analyses were deferred because no progress was made in interpreting the items loading on each factor.

Next, the internal constancy of the scale items was assessed for reading difficulty level. The Flesch readability index is a linear function of word and sentence length, producing an index that ranges from 0 –to 100 [2]. Sentences composed of fewer, shorter words result in estimates of high reading ease. The Flesch readability index was computed for each GS-SAP item. Average readabilities per dimension ranged from 47.61 (Egalitarian - Status) to 86.33 (Short-term - Long-term) corresponding to a 7<sup>th</sup> - 12<sup>th</sup> grade United States reading level. The readability index of the NEO-FFI, a measure of the five-factor model of personality [8] used in the current study, was calculated for comparison. The GS-SAP was found to have a significantly lower readability level ( $M = 60.76, SD = 18.79$ ) compared to the NEO-FFI [ $M = 71.05, SD = 21.64; F(1, 90) = 5.15, p < .05$ ], indicating that the GS-SAP items were more difficult to read.

Next, we examined the effect of word and item length, and reverse-keying items on the discrimination parameters of individual items. Item discrimination refers to the ability of an individual test item to discriminate between individuals who are high versus low on the underlying trait being assessed. It is the correlation between the item and the whole test correcting for the autocorrelation caused by the item score being used in calculating the total test score [12]. A multiple regression analysis indicated that the number of words in the item ( $\beta = -.36, t = -3.56, p < .01$ ) and whether or not the item was reverse-keyed ( $\beta = -.20, t = -2.03, p < .05$ ), together accounted for approximately 15% of the variance in item discrimination estimates. The last test we conducted was to examine the degree of agreement among same-nation and mixed-nation teams in their responses to individual GS-SAP items. The average deviation index (*AD*) was calculated to create an interrater agreement statistic based on the average absolute deviation of a set of ratings from the

mean or median of the ratings [1]. The AD index was computed along with its associated test of statistical significance for each team's responses to each item on the GS dimensions. Then, for each team, the proportion of items on each dimension for which the team members had non-chance (i.e., statistically significant) levels of agreement was calculated. Results showed that, except for the Egalitarian - Status dimension, same-nation teams were uniformly similar on the remaining GS dimensions, having significant levels of agreement (i.e., average deviation statistic with a  $p < .05$ ) on approximately 80% of the items for any one dimension (see Table 2). Although all nationalities had adequate agreement on at least half of the Egalitarian - Status items, they differed with respect to their level of agreement. Norwegian teams were most in agreement (86% of items had significant agreement), and mixed-nation teams had the least agreement (i.e., 54% of items had significant agreement) on this dimension.

**Table 2. Percent agreement by nation for each GS-SAP dimension**

	<b>Indep - Interdep</b>	<b>Egalitarian - Status</b>	<b>Risk - Restraint</b>	<b>Direct - Indirect</b>	<b>Task - Relationship</b>	<b>Short-term - Long-term</b>
<b>1</b>	82.25%	86.31%	88.56%	92.50%	90.56%	83.50%
<b>2</b>	86.89%	77.78%	79.56%	84.44%	90.67%	66.78%
<b>3</b>	71.43%	76.00%	78.57%	82.86%	85.71%	66.71%
<b>4</b>	79.25%	81.13%	79.13%	87.50%	89.50%	66.88%
<b>5</b>	87.38%	77.13%	87.50%	80.00%	91.63%	71.00%
<b>6</b>	60.38%	54.25%	70.88%	72.50%	70.75%	54.25%

**1=Norway; 2=Sweden; 3=United States; 4=Netherlands; 5=Bulgaria; 6=Mixed Nations**

Results also indicated small between-nation differences with respect to the GS-SAP dimensions with significant differences by nationality on the Egalitarian - Status, Risk - Restraint, Direct - Indirect, and Short-term - Long-term dimensions. The Swedes scored closest to an Egalitarian orientation ( $M = 3.49$ ,  $SD = .56$ ), whereas the Bulgarians scored closest to a Status orientation [ $M = 4.34$ ,  $SD = .70$ ;  $F(5, 217) = 7.33$ ,  $p < .01$ ]. The Bulgarians scored closest to a Risk orientation ( $M = 3.05$ ,  $SD = .53$ ), whereas the Dutch scored closest to a Restraint orientation [ $M = 3.54$ ,  $SD = .58$ ;  $F(5, 217) = 2.86$ ,  $p < .05$ ]. The Swedes scored closest to a Direct orientation ( $M = 3.37$ ,  $SD = .77$ ), whereas the Americans scored closest to an Indirect orientation [ $M = 4.09$ ,  $SD = .67$ ;  $F(5, 217) = 5.40$ ,  $p < .01$ ]. The Bulgarians scored closest to a Short-term orientation ( $M = 4.36$ ,  $SD = .96$ ), whereas the Americans scored closest to a Long-term orientation [ $M = 5.37$ ,  $SD = 1.12$ ;  $F(5, 217) = 3.15$ ,  $p < .01$ ].

In summary, the findings indicate poor scale reliability is partially a result of item readability. Despite this result, single nation members had significant levels of interrater agreement on a substantial portion of the GS-SAP items. Finally, reliable and interpretable national differences were found in response to items on four of the six GS-SAP dimensions.

## **4.0 DISCUSSION**

The GS-SAP scale has a critical role in the ACT research study to assess the impact of cultural biases on team performance. Using the Sanchez et al. [10] guidelines to establish the psychometric state of GS-SAP gives us confidence that the scale items are important to assessing cultural bias in the ACT research. In addition, further work needs to be done to fully develop items for these important dimensions. Improving the readability of the English items is clearly a priority. Sanchez et al. [10] also recommend using bilingual item developers to gain a better understanding of the English translation of items; increasing the pool of items to get a better representation of range of responses on items; and conducting card sorting tasks to refine dimensions for cultural biases. In addition, Sanchez et al. [10] recommend that an Item Response Theory

(IRT) analysis should be used to further understand the underlying psychometric properties of multi-cultural scales, and we report on IRT findings for GS-SAP in this issue [4].

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# Applying Unfolding Item Response Theory to Enhance Measurement of Cultural Norms

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## **ABSTRACT TITLE**

*The purpose of this study was to evaluate the psychometric properties of a measure of cultural norms and values, the GlobeSmart Commander Self-Assessment Profile (GS-SAP), using a psychometric model appropriate for ideal-point assessment items. We argue that assessments of norms and values, like many self-report measures, correspond to an item response process in which the probability of agreement with an item depends on the distance between the person's level of the underlying trait and the trait level imposed by the item (i.e., the probability is maximized at the "ideal point" of person-item correspondence). Results provided substantial support for the applicability of the model to cultural assessment data and have implications for the development and validation of new measures.*

## **1.0 INTRODUCTION**

An important finding of team research is that cultural norms and values influence sharing mission-critical information, perceiving and reacting to status differences, and willingness to tolerate risk in making key decisions [13]. Moreover, cultural differences may influence team performance indirectly through a number of complex mechanisms, and other individual differences could affect the form or strength of the underlying relationships involved. Exploring this issue was one of the research objectives of the NATO Human Factors and Medicine Research and Technology Group 138 (HFM RTG-138) Adaptability in Coalition Teamwork (ACT) program. ACT sought to identify whether cultural cognitive biases would have an impact on team performance in collaborative tasks, and to explore the potential interactive effects of other individual differences, such as personality.

The study of the potential effect of cultural biases on team performance highlights the key role of accurate assessments of individual differences in cultural constructs. Researchers have detailed specific problems with the reliability and validity of self-report measures in multi-national research, describing how properties such as measurement equivalence can affect the validity of cultural measures ([2], [5], [7]). However, a specific item format that could affect measurement equivalence, that is, use of polarized, Likert-type test items, has received little attention. Positively and negatively keyed items targeting the extremes of the latent trait

continuum can compromise the validity of a measure in two ways. First, such items fail to capture subtle differences in cultural norms and values that can translate into significant performance differences. Second, such items assume a response process consistent with the dominance model, that is, that higher levels of the trait increase the probability of agreement with the test item. We argue that cultural constructs are more consistent with an unfolding model, that is, the probability of agreement is maximized when the respondent's level of the trait matches the level of the trait imposed by the test item. Therefore, the purpose of the current study was to address these problems with the application of a specific psychometric model drawn from item response theory (IRT), known as the Generalized Graded Unfolding Model (GGUM; [6]) to scoring the GlobeSmart Commander Self-Assessment Profile (GS-SAP), a measure of cultural norms and values used in the ACT research.

### **1.1 Measurement Challenges in Cultural Research**

Self-report measures of culture are indirect assessments in which responses to items are used to infer the respondent's standing on an unobservable latent trait. As such, they are subject to the same sources of random error variance that compromise the reliability of any self-report individual difference measure (e.g., fatigue, lapses of attention, poor readability).

In addition, cultural measures present a unique assessment challenge in that cultural and language differences can systematically affect how respondents interpret the content of specific items. The psychometric property of measurement equivalence refers to a measure's ability to retain its core measurement properties (e.g., latent factor structure, individual item parameters such as difficulty and discrimination) across distinct classes of individuals performing the assessment (e.g., different cultural groups). In cultural research, measurement equivalence is often compromised because the construct being assessed systematically influences the measurement instrument being used to assess it [7].

A related issue concerns the influence of item format on response patterns, and the sensitivity of cultural measures to variations in the construct being assessed. One traditional item format has been the use of bipolar (i.e., either positively or negatively keyed) test items targeting the extremes of the latent trait continuum. Differences in the respondents' levels of agreement, usually assessed using a set of graded response categories (e.g., "Strongly Disagree" to "Strongly Agree"), are used to infer differences in their standing on the construct.

We note two problems associated with the use of this format in cultural assessments. First, extreme items are biased towards measurement of extreme levels of the target construct. Although some national cultures can be considered extreme with respect to a single cultural dimension (e.g., certain Asian cultures have a high collectivist orientation), most cultures fall somewhere between the extremes on most cultural dimensions. Thus, few respondents would actually endorse response options of "Strongly Agree" or "Strongly Disagree" to many extreme Likert-type items. The resulting lack of variability prevents the items from extracting the maximum amount of information possible on respondents' levels of the latent trait, especially for those who are somewhere between the extremes of the trait continuum. Additionally, by focusing on the extremes of the trait of interest, the assessment method can fail to capture subtle differences in cultural norms and values that can translate into significant performance differences.

The second problem is the assumed response process (i.e., the effect of the latent construct on an individual's patterns of responses to items that vary in terms of content and difficulty) that is invoked by Likert-type items. Measures of cognitive ability can be distinguished from those of non-ability constructs (e.g., attitudes, values, personality) in that they result in a dominance response process. That is, higher levels of cognitive ability will



result in monotonic increases in the probability of answering the item correctly (i.e., a generally increasing, though not necessarily linear trend). IRT, a family of psychometric models that allow one to estimate the probability of test item responses as a function of person and test parameters, provides a useful framework for examining response processes associated with different tests. Some IRT models (e.g., the Rasch model) use a logistic relationship to model the dominance process, have been used extensively to score ability measures, and have also been extended to some non-ability measures that are assumed to invoke the same process (e.g., personality). For example, one could argue that individuals with increasingly high levels of conscientiousness would have increasingly high probabilities of responding “Agree” to the following conscientiousness item: “You consider yourself to be a highly conscientious person.” However, it has been argued that many non-ability constructs measured with agree/disagree items result in an unfolding process as opposed to a dominance process [6]. That is, the probability of agreement is maximized when the respondent’s level of the trait matches that imposed by the test item (i.e., the individual and the item are on the same point on the trait continuum). Thus, the probability of a positive response increases non-monotonically (i.e., “unfolding”, like the normal curve, after the ideal point of agreement) with the respondent’s actual trait level.

Although cultural assessments, which heavily emphasize attitudes and values, are likely to conform to an unfolding model, no research has attempted to develop items with the appropriate format and psychometric model. One potentially useful item format may be that of Thurstonian, or ideal-point items, that is, items that are designed to target a specific portion of the latent trait continuum. Thurstonian items vary in their level of difficulty or traitedness. Therefore, a set of Thurstonian items has the potential to collectively measure the entire spectrum of the latent trait being assessed and to capture subtle differences in the construct of interest with a greater degree of accuracy compared to Likert-type items [9]. Often, Thurstonian items consist of statements to which an individual can disagree for two reasons: the individual’s trait level is either below that targeted by the item, or above that targeted by the item. Consider the following item which targets the middle of the trait continuum: “You sometimes find time to organize your belongings.” An individual can disagree with the item because he or she always finds time to organize, or because he or she never finds time to organize. An appropriate psychometric model for Thurstonian items can be drawn from the family of unfolding IRT models, such as the Generalized Graded Unfolding Model [6].

In summary, cultural assessment items often pose a unique threat to measurement equivalence – they are only valid measures for members of cultures with either extremely high or extremely low levels of the cultural trait. An assessment framework that would likely mitigate this problem would be one in which items are written to cover the entire range of the trait continuum, not just the extremes (i.e., Thurstonian items), and IRT models that conform to an unfolding response process are used.

### 1.2 Applicability of Unfolding IRT to Cultural Assessment

The purpose of this paper is to provide an initial investigation of the applicability of a specific IRT model, the GGUM [6] to scoring a measure of cultural norms and values, the GS-SAP. The measure is the product of research [12] describing cultural competence in terms of understanding how cultural norms affect team members’ values, intentions, and behaviour. The measure is based on a framework for understanding cultural diversity in teamwork and consists of six culturally-based cognitive dimensions [11]. Individual scale items were developed to assess preferences for:

- Independence/Interdependence -- identifying with the individual or with the group;
- Egalitarian/Status -- preference for mutual consultation or deferring to rank and hierarchy to make

decisions;

- Risk/Restraint -- engaging in risk-taking or risk-averse behaviours;
- Direct/Indirect -- communicating in a direct or indirect manner;
- Task/Relationship -- desire to emphasize tasks or relationships; and
- Short-term/Long-term -- focus on present or future circumstances and outcomes when making decisions.

The individual GS-SAP test items were written in the Likert tradition of targeting either the positive or negative end of the targeted trait (i.e., positively or negatively keyed). However, the items can naturally vary in terms of their location on the latent trait continuum, essentially resembling ideal-point items. We proposed that many of the items were likely to fall at the extreme levels of the trait continuum, considering that items written in the Likert tradition are intended to do so. Some items, however, may fall in between the extremes. The GGUM is a useful IRT model for developing item parameters for such a measure because it can be used to fit monotonically increasing item response functions (i.e., for extreme items) but can also fit non-monotonic functions for items that lie between the extremes ([11]). Thus, we applied the GGUM to GS-SAP data from multinational teams as a preliminary step in investigating the psychometric properties of the instrument and the relevance of the ideal point process to cultural assessment.

## **2.0 METHOD**

### **2.1 Participants**

Participants were 224 volunteers and officers from five participating NATO nations separated into 56 four-person teams. There were eight teams from Bulgaria ( $n = 32$ ), eight from the Netherlands ( $n = 32$ ), 16 from Norway ( $n = 64$ ), nine from Sweden ( $n = 36$ ), seven from the United States ( $n = 28$ ), and eight mixed-culture teams ( $n = 32$ ). The mixed teams consisted of individuals from at least two different nations and performed the experimental task via internet from their respective nations. All officers ethnically and culturally identified with their reported culture, spending no more than six months outside of their nation before the age of 18. Mean age of the participants was 31.25 years ( $SD = 7.63$ ). Participants were primarily male (96.4%) junior officers of NATO rank OF-3 or below (89.2%).

### **2.2 Experimental Task**

The Situation Authorable Behavior Research Environment (SABRE) is a scenario authoring tool that supports the simulation of interactive role-playing games. The collaborative role-playing scenario used for the current study is based on the game “Neverwinter Nights”. Participants perform the task in teams of four, with one participant chosen as the team leader. The objective of the task is to find hidden weapons caches around a simulated urban area. Team members gain “goodwill” points by finding hidden weapon caches and by establishing good relations with local residents portrayed in the scenario, and lose points by searching for caches in the wrong areas or by offending the local residents. Team members have at their disposal a variety of information, tools, and monitors to support collaboration and maintain awareness of each other’s actions and locations.

### 2.3 Measure

The GS-SAP is a self-report measure assessing six dimensions of culture-related values and attitudes: Independence/Interdependence (six items,  $\alpha = .29$ ), Egalitarian/Status (six items,  $\alpha = .31$ ), Risk/Restraint (six items,  $\alpha = .36$ ), Direct/Indirect Communication (six items,  $\alpha = .37$ ), Task/Relationship (five items,  $\alpha = .09$ ), and Short-term/Long-term Orientation (three items,  $\alpha = .53$ ).

The six dimensions are based on previous cultural assessment research defining and presenting measures of similar constructs (e.g., [1], [3], [4], [8], [10], [14]). However, the items themselves differ from other efforts to measure similar constructs in that they are contextualized to assess cultural values and behaviours within international military work contexts.

### 2.4 Procedure

Participants performed the experimental task seated at individual computer terminals. Teams composed of individuals from the same nation performed the task in the same room; however, participants were shielded from their other team members such that they could not see or hear each other. Mixed-nation team members performed the task remotely from their home nation over the Internet. Team-members began by completing the GS-SAP and other individual difference measures, and then received two-hours of training focusing on communication and navigation via computer inputs. Next, participants completed several group-planning tasks to familiarize them with their unique and shared roles, and with more advanced collaboration strategies. Finally, participants completed a single hour-long scenario.

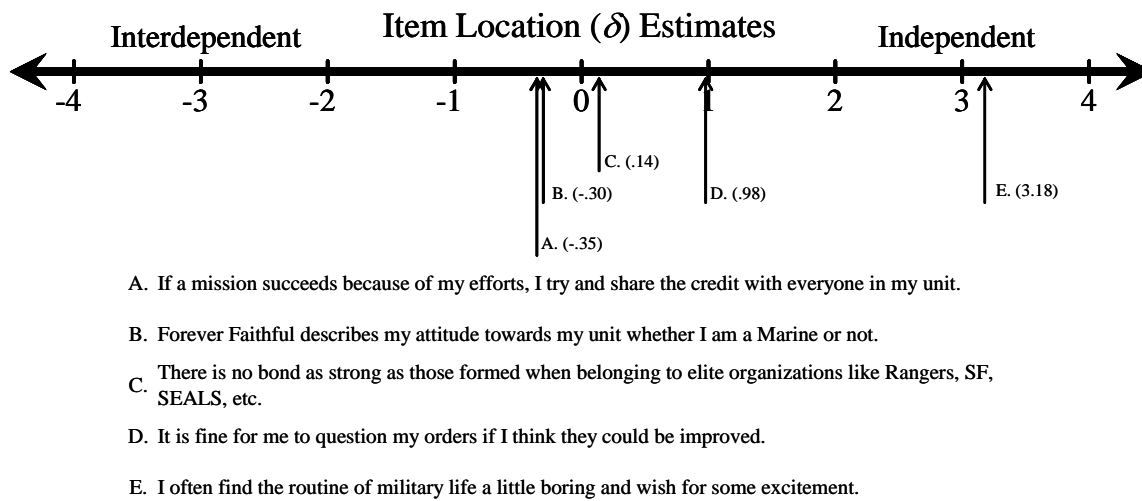
## 3.0 RESULTS

We used the GGUM2004 program to estimate GGUM item parameters for each item of the GS-SAP. The GGUM is actually one of a set of eight related unfolding IRT proposed by Roberts et al. [6] that vary in terms of which item parameters are constrained versus free to vary. The GGUM is the most general of the proposed models and allows for independent estimation of the following person and item parameters:  $\theta$  (the location of the respondent on the latent trait continuum),  $\alpha$  (item discrimination),  $\delta$  (the location of the respondent on the latent trait continuum), and  $\tau$  (the location of the subjective respondent category thresholds for the item, i.e., the points on the latent trait continuum at which the probability of endorsing a successive response category overtakes that of responding to a previous category).

Roberts et al. [6] suggested that data sets consisting of, at a minimum, responses to 15-20, six category items from at least 750 respondents were necessary to accurately recover item parameters. Thus, one potential limitation is our use of a data set drawn from a smaller sample size and consisting of fewer items per dimension. Examination of item and person fit statistics revealed acceptable fit for most items and respondents. However, for some dimensions, the number of Marginal Maximum Likelihood (MML) function iterations to estimate item parameters exceeded the default number (i.e., 10) recommended by Roberts et al. Although this could reflect the effect of a relatively small sample size and item pool on the stability of the item parameter estimates, the resulting parameters were still interpretable in terms of their content and the relative distance of the items to each other in terms of their item locations.

Item parameter results indicated that the items for each of the GS-SAP scales varied substantially in terms of their locations on their respective latent trait continua. Figures 1 – 6 show the location of each item on its respective continuum as determined by their delta parameters. The standard range of item delta and person theta values in IRT is -4 to +4. Figure 1 shows that items for the Independence/Interdependence scale

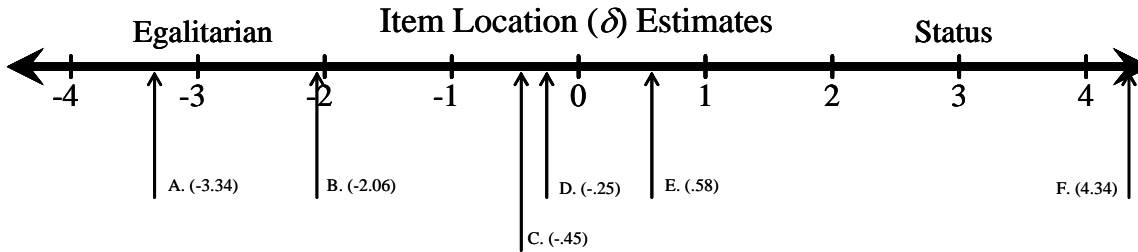
generally centred around the middle of the trait continuum, with one extreme item targeting the independence pole (“I often find the routine of military life a little boring and wish for some excitement.”). Items for the Egalitarian/Status scale were fairly evenly dispersed across the trait continuum (see Figure 2). Items for the Risk/Restraint dimension were biased towards the risk pole (see Figure 3), with one extreme item targeting the restraint pole (“I am uncomfortable adapting the plan during a mission.”). For the Direct/Indirect scale, the observed pattern was similar to that observed for the Independence/Interdependence scale, with one extreme item targeting the indirect pole (“When my superior gives an order I do not understand, I usually ask a peer what I should do rather than asking the officer.”; see Figure 4). Items for the Task/Relationship and Short-term/Long-term Orientation dimensions (Figures 5 and 6) showed the greatest degree of bipolarity, with most items clustered towards either extreme of the trait continuum. Additionally, items varied in terms of their discrimination parameters, generally showing high discrimination – 68% of the items had alphas greater than .50 and 35% had alphas greater than 1.0.



**Figure 1: Item locations: Independence/Interdependence**

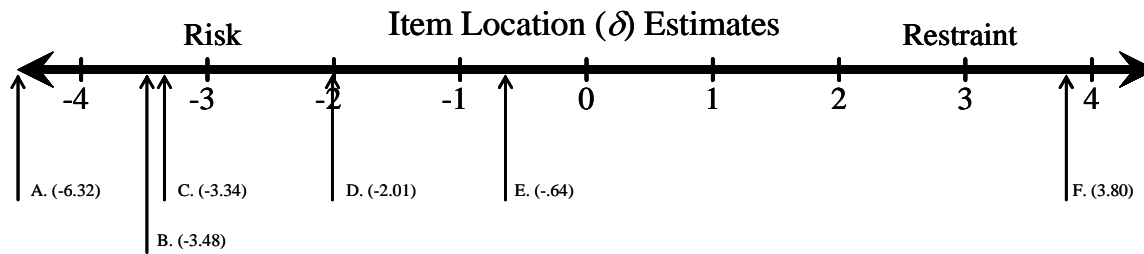
We then used the resulting item parameters as the basis for producing trait estimates of each of the GS-SAP dimensions for each respondent. IRT models provide a means for producing more accurate estimates of respondents’ standing on the trait of interest over simple additive scale methods (i.e., using the mean or sum of the responses on individual items as the respondent’s scale score) because they take into account item parameters. Thus, two individuals who have received the exact scale score based on mean responses could have two completely different IRT-based trait estimates based on the item locations or difficulties of the items to which they endorsed agreement. As with item deltas, theta values range from -4 to +4. The trait estimates were normally distributed and moderately to strongly correlated with the summed scale scores for each dimension (absolute values of the correlations between trait estimates and summed scale scores ranged from .33 to .93), as would be expected, given that the summed scores do not take into account item parameters. Notably, trait estimates for some of the dimensions (i.e., Independence/Interdependence, Direct/Indirect, and Task/Relationship) were negatively correlated to their summed score analogs, indicating that the GGUM item parameter estimation process essentially reversed the poles of the latent trait. For example, although Interdependence was intended to represent the positive end of the Independence/Interdependence dimension, item parameters for items targeting the Independent pole were calculated as positive, arbitrarily causing this to be the positive pole for the GGUM-based trait estimates. Additionally, results indicated reasonable levels of

person fit for each GS-SAP dimension. The number of individuals with questionable person fit statistics was reasonably small (i.e., 2 – 5) for all dimensions except for the Independence/Interdependence dimension, which resulted in questionable person fit statistics for 14 respondents.



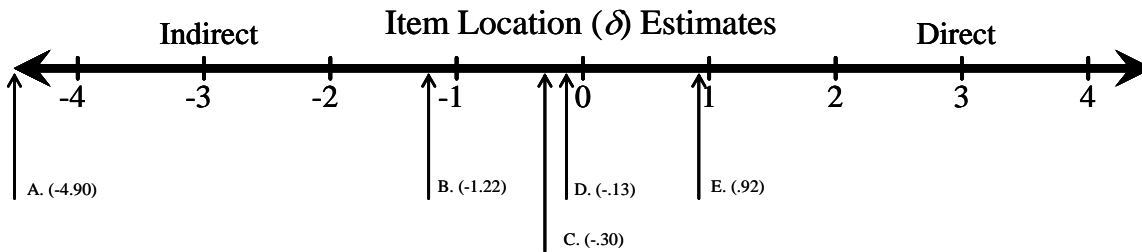
- A. Regulations restricting socializing between officers and enlisted personnel should be relaxed.
- B. I should be able to sit back and relax when interacting with my superiors.
- C. It is appropriate for me to raise my voice if the behavior of a subordinate angers me.
- D. As a leader, I should be able to give advice to subordinates about their personal lives even if they do not ask for it.
- E. When I am speaking with a subordinate, it is natural that I should control the conversation.
- F. When conversing with a superior officer I use more formal language than when talking with my peers.

**Figure 2: Item locations: Egalitarian/Status**



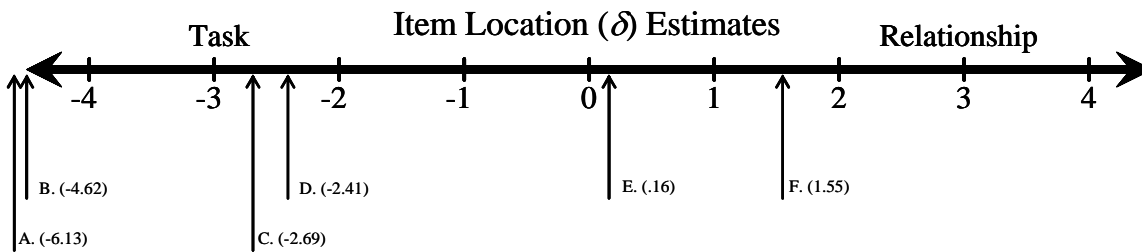
- A. It is important to know how my performance compares to others of similar rank.
- B. I like having the responsibility for the success of a mission depend entirely on me.
- C. I enjoy taking on new challenges whether I am certain I can handle them or not.
- D. If my assignment was made more demanding I am sure I could handle it.
- E. I am good at making quick decisions in ambiguous situations.
- F. I am uncomfortable adapting the plan during a mission.

**Figure 3: Item locations: Risk/Restraint**



- A. When my superior gives an order I do not understand, I usually ask a peer what I should do rather than asking the officer.
- B. When I disagree with someone, I think it is better to talk about it with a third person in order to avoid an open conflict.
- C. When someone says something, I try to figure out what they really mean.
- D. How someone says something is often more important than what they say.
- E. I speak my mind even if I disagree with my superiors.

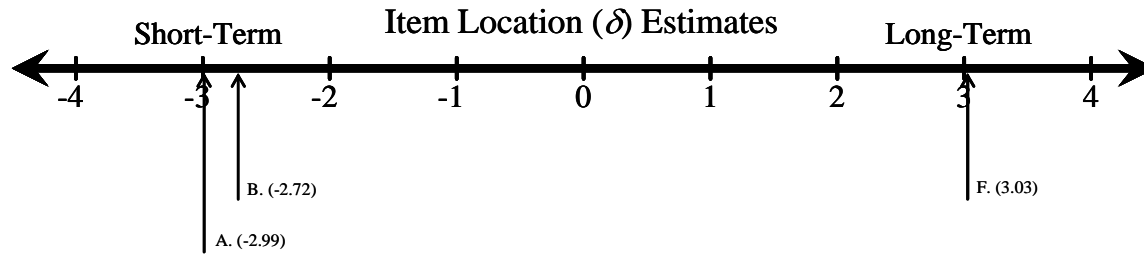
Figure 4: Item locations: Direct/Indirect Communication



- A. I cannot stay angry with another officer once I know what motivated him or her to act in a particular way.
- B. I don't like small talk during briefings.
- C. Getting along with members of my unit is more important to me than career advancement.
- D. The officer or NCO in charge of any group should make sure that all the unit members are socially acquainted.
- E. It is very important to me that my fellow officers recognize my abilities and achievements.
- F. I prefer to lead rather than to follow.

Figure 5: Item locations: Task/Relationship

In summary, our results indicate that 1) the GGUM fit the GS-SAP data reasonably well for each dimension, affording estimation of item and person parameters, 2) items varied in terms of their item locations, and, consistent with ideal-point items, were distributed across the latent trait continuum for some dimensions, and 3) trait estimates showed reasonable fit levels and were interpretable in terms of their correlations with summed score estimates.



- A. The present is all I think about, and the future can take care of itself.
- B. The future is too uncertain to make long term plans.
- C. I am good at saving money.

Figure 6: Item locations: Short-term/Long-term Orientation

## 4.0 DISCUSSION

The dominant item development and scoring framework used to assess cultural norms and values has involved the use of Likert-type items and additive scale score methods that do not consider item parameters. In contrast, our results indicate that items intended to measure cultural norms and values can show characteristics of Thurstonian or ideal-point items, varying in terms of their locations in the latent trait continuum, even though they were written in the Likert tradition of targeting the extremes of the trait continuum. Furthermore, we found that an IRT model developed specifically to score Thurstonian items, the GGUM, fit cultural assessment data reasonably well, resulting in meaningful person and item parameter estimates.

These findings complement and clarify initial psychometric investigations of the GS-SAP [2]. Initial results indicated poor coefficient alpha reliabilities for the GS-SAP dimensions. However, our results indicate that low internal consistency reliabilities would be expected, given that the items naturally varied in terms of their item locations. Low internal consistency reliabilities are a hallmark of ideal-point items, though are not necessarily an indicator of poorly performing items, and should be interpreted vis-à-vis observed item discriminations [9]. Thus, by evaluating the items within an ideal-point framework, our results offer a different perspective on the psychometric qualities of the GS-SAP dimensions, showing 1) moderate to high correspondence of individual items to their underlying construct (i.e., generally high item discriminations), and 2) substantial dispersion of items across their respective latent trait continua (i.e., substantial variability in item locations).

Our findings have broader implications for the development and validation of cultural assessments. We found that the construct validity of cultural assessments can be enhanced by adopting an ideal-point framework for item developing and scoring. Individuals of differing nationalities or ethnic backgrounds may be expected to differ subtly in the extent to which they engage in cultural behaviours or espouse cultural norms and values such as those targeted by the GS-SAP dimensions and other, related measures. Using a Thurstonian item development process and applying the appropriate psychometric model (i.e., the GGUM or one of its variants) are two supplementary ways to accurately capture this subtle variance.

In conclusion, our results provide initial evidence in support of the use of an ideal-point item development and scoring framework for cultural assessments. Such a framework is likely to offer an appropriate psychometric representation of the response process (i.e., an unfolding process) that is consistent with measures of cultural

norms. Furthermore, it is likely to improve the ability of assessments to capture subtle differences in cultural norms and values that can translate into significant performance differences, enhancing their validity and utility.

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10<sup>th</sup> INTERNATIONAL COMMAND AND CONTROL  
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THE FUTURE OF C2

Topic Category: Coalition Interoperability

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### **Leader and Team Adaptability in Multinational Coalitions (LTAMC): An International Research Project**

Multinational coalitions are a complicated assembly of leaders, teams, cultures, networks, and collaborative systems (Sutton & Pierce, 2003). This complicated assemblage of coalition partners will be required to perform as a team in complex environments that place high demands on the command and control (C2) of forces. Complex environments make adaptive performance more critical than ever. The development of adaptive performance in multinational coalitions can be rapidly advanced by the collaboration of researchers in North Atlantic Treaty Organization (NATO) and Partnership for Peace (PfP) nations. Such a group has been established under NATO's Headquarters, Supreme Allied Command Transformation (HQ SACT), Futures and Engagement Branch through the Concept Development and Experimentation (CD&E) program. Led by the U.S. Army Research Laboratory (ARL) Human Research and Engineering Directorate (HRED), the project is titled "Leader and Team Adaptability in Multinational Coalitions" or LTAMC. The group also operates concurrently as a NATO Research and Technology Organization (RTO) Human Factors and Medicine (HFM) Panel exploratory team on a project titled "Adaptability in Coalition Teamwork" or ACT. The combined CD&E – HFM effort follows the CD&E process and is reported as a project for both CD&E and HFM. This paper presents the LTAMC/ACT program of research.

Theoretical frameworks and models integrating culture to multinational teams and team leadership are limited, but growing. The need exists to leverage what is known about culture, teams, training, and leadership in order to provide a model of coalition teamwork and develop methods and information systems that recognize the importance of political, economic, social, and environmental factors in addition to military strategy (NATO, 1991, 1999). This paper introduces an international research team of NATO coalition partners conducting experiments on both a national and a multinational basis to provide evidentiary data on the impact of culture on teamwork for multicultural teams performing C2 functions. These efforts provide a valuable opportunity for the international research community to synchronize efforts to develop adaptive leaders and teams, an essential component in the development of the NATO Response Force (NRF).

#### **Background**

In March 2003, ARL HRED submitted a white paper for consideration as a potential NATO CD&E project. Its aim was to improve the ability of NRF headquarters staff to better perform C2 functions through the understanding of culturally based cognitive differences that impact multicultural teamwork. The RTO HFM Panel became interested in the project September 2003 when the ARL HRED program of multicultural research was presented to Dr. Robert Foster, Office of the Secretary of Defense (OSD) and member of the HFM Panel. In October 2003, a Technical Activity Proposal was submitted to the HFM Panel resulting in the creation of Exploratory Team (ET) 049. ET-049 was recently nominated for transition to a Research Task Group. The concept was approved as a NATO CD&E project in December 2003.

An exploratory meeting to determine international interest in the project was convened by Mr. Van Edelmann (NATO CD&E Project Lead Analyst and Co-chair), and Dr. Janet Sutton (ARL HRED Project Lead and Co-chair) February 2004 at NATO Headquarters in Brussels, Belgium. Eight nations and HQ

SACT sent representatives to this meeting. The nations were Canada, Germany, Greece, Norway, Sweden, Turkey, the United Kingdom and the United States. During this exploratory meeting, the project plan was developed. Canada, Norway, Sweden and the United States formally joined the project team while Greece and the United Kingdom opted to participate as observers.

This combined CD&E – HFM project is referred to as Leader and Team Adaptability in Multinational Coalitions or LTAMC. Since the project’s inception, the LTAMC team has met seven times, either face-to-face or by WebEx, and collected data at one NATO exercise. The LTAMC project is unique in that its purpose is to conduct national and multinational experiments in order to advance science in the domain of adaptability. The impact of culture on teamwork is the primary focus. Effort includes developing a conceptual model of cultural adaptability for military operations, developing methods for experimentation (e.g. experimental design, reference scenarios, and process and outcome measures), establishing national and international testbeds, and identifying products for use by participating nations that are designed to improve leader and team adaptability in multicultural environments.

The following organizations have attended at least one meeting:

USA	- Army Research Laboratory (ARL) (Lead) - Army Research Institute (ARI) - Air Force Research Laboratory (AFRL) - Naval Air Orlando Training and Systems (NAVAIR ORL-TSD) - Office of Naval Research (ONR)
CANADA	Canadian Forces Experimentation Centre (CFEC)
GERMANY	- IABG - University of Applied Sciences, Koblenz-Remagen
GREECE	HNDGN, Joint Doctrines Branch
NORWAY	- Royal Norwegian Ministry of Defense - Norwegian Defence International Centre - Norwegian Defence Research Establishment
SWEDEN	Swedish Defence Research Agency (FOI)
TURKEY	Office of the Turkish Military Rep to NATO
UK	Defence Science and Technology Laboratory (DSTL)
NATO	- HQ SACT Concept Development and Experimentation (CD&E) - RTO HFM

Membership is open to research psychologists and military specialists from Alliance and PfP nations with interest and expertise in the study of adaptability, culture, teams, problem solving, decision making, risk assessment, uncertainty management, leadership, and transformation.

Research and experimentation information is shared with all project team members and any NATO and PfP nations. Although the project is currently unclassified, it may be necessary during concept development and experimentation to classify information. If this is the case, a NATO security classification will be assigned to the information or data. Each nation on the project team is responsible for financing its own personnel contributions, administrative costs, and research facilities. NATO funding is available for some projects.

### **LTAMC Project Team**

The following individuals comprise the core group of the LTAMC project team. Team members are briefly introduced in this text. Names appear alphabetically after project leads, Mr. Edelmann and Dr. Sutton.

*Van Edelmann, NATO HQ SACT Project Officer*

Mr. Edelmann has been an analyst with the CD&E Cell and now the Futures and Engagement Branch within HQ SACT for four years. As the HQ SACT Project Officer for LTAMC, Van provides NATO and HQ SACT guidance to the team, aids in CD&E planning, co-chairs project meetings with Dr. Sutton, and manages the project's NATO experimentation funds.

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*Janet L. Sutton, ARL HRED Project Lead and Co-chair*

Janet Sutton is a Research Psychologist for ARL HRED. She offices at Fort Sill, OK where she maintains a program of research on developing adaptability in leaders and teams in addition to providing human factors support to the US Army Field Artillery School and the Depth and Simultaneous Attack Battle Lab. Dr. Sutton's primary research areas of interest are decision-making and teamwork in military command and control. Her focus is on development of methods and systems to promote rapid formation of effective teams performing command and control functions at the operations level in Joint, Interagency, and Multinational (JIM) environments. She holds a doctoral degree in Experimental Psychology from Texas Tech University in Lubbock, Texas.

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*Anne-Lisé Bjornstad*

Anne-Lisé Bjornstad is a research psychologist in the Division for Information Management at the Norwegian Defence Research Establishment (FFI). Her main research interests are within the areas of cross-cultural psychology, organizational psychology, decision making and group psychology. Her work at FFI has ranged from theoretical analyses, building of analytical models, to conducting empirical and experimental research. Ms. Bjornstad is a member of the "Norwegian Organizational Society" (NOS) and the Norwegian Society for Research Psychologists (NPS). She is involved in a number of activities and

forums related to the development and analyses of the NEC-concept in Norway. She holds a “Cand.Polit” degree (i.e. extended master’s degree) in psychology from the University of Trondheim, Norway (NTNU).

*Joan Johnston*

Joan Johnston joined NAVAIR Orlando Training Systems Division in 1990, advancing to Senior Research Psychologist, where she is responsible for managing military training systems research programs that address tactical decision making under stress and team performance assessment and training. Dr. Johnston is also the principal investigator for an Office of Secretary of Defense international cooperation program on Leadership, Commander's Intent, and Operational Readiness in a Net-Centric environment. Dr. Johnston received her Ph.D. in Industrial/Organizational Psychology from the University of South Florida.

*Michael P. Letsky*

Mike Letsky has worked for the Defense Department since 1967 in various capacities involved with missile engineering, operations research modeling and human factors research management. At one time, he provided Operations Research analysis for the development of Navy manpower determination models for the Office of the DCNO (MPT). In 1980 Dr. Letsky became the Chief of Advanced Development Planning at the Army Research Institute within the Army's Deputy Chief of Staff for Personnel before becoming the Research Management Advisor to N1/CNP. In 1998 Dr Letsky moved to the Office of Naval Research to become Program Manager of the Collaboration and Knowledge Management Program. The program is research based and primarily funds academic grants seeking to understand team cognition and team performance. The focus of the program is on knowledge building and problem solving in naturalistic decision making situations. Research transition targets include ad-hoc, distributed teams, consisting of multi-cultural or multi-disciplinary team members responding to time-stressed scenarios and uncertain data sources. Dr. Letsky received his DBA in Operations Research from George Washington University.

*Fred Lichacz*

Fred Lichacz is an Experimental Psychologist with the Canadian Forces Experimentation Centre (CFEC) in Ottawa, Canada, where he provides human factors support to CFEC’s mission of leading the exploration of emerging joint operational concepts and the experimentation of capabilities supporting Canadian Forces transformation. His primary research interests focus on decision-making in both individual and team settings. He has developed and maintained a research program that focuses on the relationship between situation awareness and confidence within complex, distributed information-sharing environments. This work has been applied to the effects of sleep loss on performance, visual search, Uninhabited Aerial Vehicle operations, and distributed C2 settings. Dr. Lichacz received his doctoral degree in Cognitive Psychology from Carleton University in Ottawa, Canada.

*Linda G. Pierce*

Linda Pierce began her Army career as a research psychologist at Fort Sill, OK in 1989 and is currently Chief of the Soldier Performance Division of ARL HRED. The Division scientists and practitioners conduct basic and applied research to improve the acquisition of army systems from concept exploration to system evaluation and fielding. Dr. Pierce's primary research areas of interest are decision-making and teamwork in military C2. She has worked to develop simulation-based methods and measures for leader and team learning and to evaluate human performance in conceptual systems, influencing the design of systems and operational procedures. Dr. Pierce managed the Cognitive Engineering of the Digital Battlefield Science and Technology Objective (CE STO) that resulted in models, methods, and tools to improve battle command. She holds a doctoral degree in Industrial and Organizational Psychology from Texas Tech University in Lubbock, Texas.

*Sharon Riedel*

Sharon Riedel is a Senior Research Psychologist with the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). She works with the Leader Development Research Unit branch of ARI, located at Ft. Leavenworth, Kansas, where her work involves research on critical thinking skills for military leaders and teams, and facilitating the effective performance of multinational teams and team leaders through training. Dr. Riedel also participates on the NATO HFM-120/RTG, Exploration of the Areas of Multinational Operations and Inter-Cultural Factors. In addition to numerous scientific and professional publications, she is the co-author, with Leonard Adelman, of the book, *Handbook for the Evaluation of Knowledge Based Systems: Conceptual Framework and Compendium of Methods*, published by Kluwer Academic Publishing. Dr. Riedel holds a Ph.D. in Experimental Psychology from Southern Illinois University, with an emphasis in social psychology and measurement.

*Rik Warren*

Rik Warren is an Air Force Research Laboratory (AFRL) Human Effectiveness (HE) Research Psychologist where he has studied general problems of aviation vision, cockpit automation, crew resource management, and decision making. He has participated in studies and workshops to define, refine, shape, and determine the AFRL/HE research portfolio and to ensure that the portfolio is responsive to the needs of the Air Force. Recently, he took on the responsibility for managing the AFRL culture and cognition programs for the purpose of validating mathematical models of culture and adversarial decision making to be used in predicting the effects of Air Force operations. Dr. Warren's other professional activities include editorial board memberships on the journals "Ecological Psychology" and "The International Journal of Aviation Psychology." He is a member of the Psychonomic Society, Sigma Xi, and the International Society for Cross-Cultural Psychology. He holds a PhD from Cornell University where he studied perception and psycholinguistics.

*Arne Worm*

LTC Arne Worm, PhD, is currently assigned to a senior researcher position at the Swedish Defense Research Agency, where he directs research and development in the C4ISR domains. His core research areas are computerized automation, human-machine interaction, control theory, mathematical modeling, cybernetics, cognitive systems engineering, distributed team decision making, and team training. Major application areas



are command, control, communications and intelligence support of joint and combined military operations and emergency management. Dr. Worm holds a PhD in Systems Engineering and Human-Machine Interaction, supported by the Supreme Commander of the Swedish Armed Forces and the National Foundation for Strategic Research.

### **Program of Research**

Experimentation is required to capture knowledge about cultural factors for use in military modeling and simulation, system design, personnel selection, and officer training for the full range of military operations. Experimental venues for the LTAMC collaborative research effort include the NATO Allied Warrior 04 and 05 exercises, the Joint Force Command (JFCOM) Multinational Experiment 4 (MNE4), and a series of national and multinational experiments. These venues are described below.

#### *NATO Allied Warrior Exercises*

Allied Warrior 2004 (AW04) was the first time experimentation was sanctioned by Strategic Allied Command Europe (SACEUR) to be integrated as part of a major NATO Command Post Exercise (CPX) (NATO 2003b). It was an exercise designed to certify the NATO Response Force 4 (NRF 4) capability for the six-month period starting January 2005. In accordance with the overall NRF Military Concept (NATO 2003c) joint NRF C2, embedded in Strategic Command HQ, Joint Force Command (JFC) HQ, and Command Control HQs must provide a high degree of interoperability and the capability to rapidly plan and prepare for deployment during an emerging crisis, as well as the capability to operate as a stand-alone initial entry force for up to 30 days.

The HQs for NRF 4 demonstrated this capability during the planning and conduct of a simulated Crisis Response Operations (CRO) down to the Combined Joint Force Land Component Command (CJFLCC) HQ level. Activities at the joint level included pre-mission training, practicing crisis response planning procedures, mounting the NRF CJFLCC HQ for deployment and establishing the Deployable Joint Task Force (DJTF) and NRF CJFLCC HQs and C2 structure in a theatre of operations beyond NATO's Area of Responsibility (NATO, 2003d). In addition the operation was conducted in an asymmetrical and Nuclear, Biological, and Chemical (NBC) threat environment to exercise and certify the integration and support of the Multinational (MN) Chemical, Biological, Radiological, Nuclear (CBRN) Defence (Def) Battalion (Bn) and the NBC Joint Assessment Team (JAT) (NATO, 2003a). AW04 was the key milestone to certify Combat Readiness for the NRF CJFLCC HQ of the NRF for the six-month period starting January 2005.

At AW04, LTAMC researchers collected data on cultural dimensions, cognitive styles, personality, and organizational issues (see Table 1). Participants were the 76-member DJTF headquarters staff, representing 13 nations. Multiple analyses have been run to-date and a working meeting of the LTAMC team is scheduled for April 2005 to review results and discuss implications for multinational teams performing command and control functions at the operational level, after which a report will be prepared. Members of the LTAMC project will also collect data at Allied Warrior 2005 (AW05). For AW05 the Deployable-Combined Joint Task Force (D-CJTF) headquarters operations center will be established in Lisbon, Portugal. The purpose of this Allied Command Operations exercise is to certify the NRF capabilities for the period July 2005 – June 2006.

### *Multinational Experiment 4*

The intent of MNE4 is to assess the military utility of Effects Based Operations (EBO) and related concepts. Relevant to the LTAMC project is that elements of a NATO DJTF will be linked (using the Combined Federated Battle Lab Network) to a “virtual” Static Joint Task Force (SJTF) Headquarters. Thus, MNE4 provides a rich environment in which to study the influences of culture, cognitive style, personality, and organizational structure on leadership, teams, and teamwork. It is likely that instruments used to collect data in this venue will be modified from those previously used in AW04 based on findings from that event.

### *National Experimentation*

In addition to continued experimentation in NATO and JFCOM venues, LTAMC researchers will also investigate the impact of culture on teamwork in both national and multinational venues. Specifically, a single experimental design will be executed in all LTAMC participating nations to build a baseline of responses from homogenous military teams. Then, that design will be executed with heterogeneous teams comprised of military officers from nations participating in the baseline experimentation. The purpose of this effort is directly linked to the LTAMC charter to enable rapid formation of culturally adaptable multinational teams performing C2 functions for the NRF.

The national and multinational experiments discussed above will be executed using a research testbed built around a commercial off the shelf (COTS) computer game, *Neverwinter Nights*<sup>TM</sup>. This game-based testbed, under development by BBN Technologies, and funded by the United States Department of Defense Modeling and Simulation Office (DMSO), is designed to satisfy the need for an inexpensive, standardized, research instrument able to explore basic research questions on teamwork skills, situation awareness, decision making, task effectiveness, adaptability, and the impacts of personality and cultural traits on these issues. Figure 1 shows a screen shot from the game-based testbed.

Key features of the testbed include:

- Multiplayer capability, both across a local-area-network and the Internet.
- Authoring tools enabling researchers to construct their own scenarios.
- Hooks to facilitate entity control by computational models of human performance.
- Teammates and opponents playable by either humans or human-behavior models.
- Automated data capture mechanisms to collect data for post-experiment analysis.
- Multiple data collection opportunities, including during planning, game execution, and out-of-game surveys.

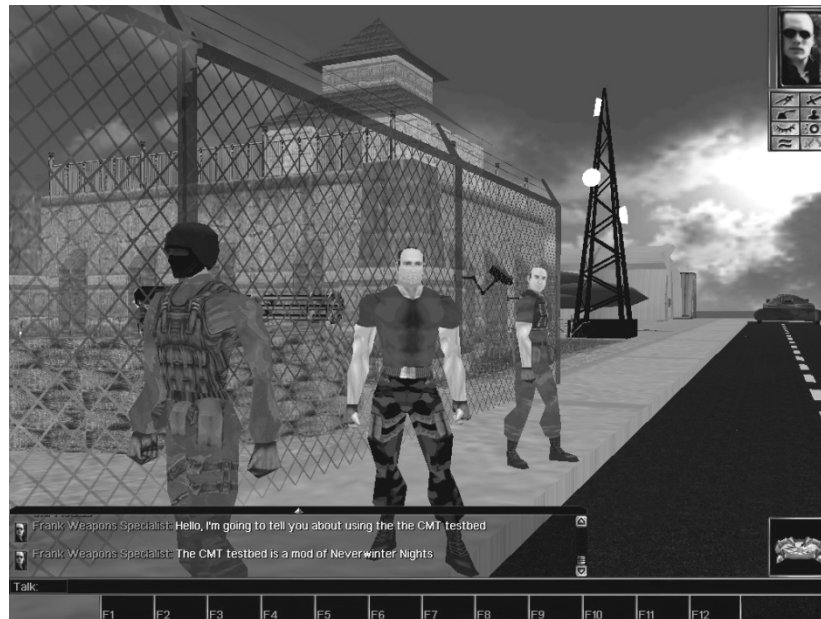


Figure 1. Screenshot illustrating the game-based testbed

The game-based testbed provides an immersive environment in which participants' actions and behaviors can be observed, and related data can be collected automatically. In the experimental scenarios, game play can range from fairly linear and well constrained to much more open and unconstrained, allowing the experimenter to have extensive control over the behavioral latitude available to participants. For more information on the game-based testbed, see (Warren, Sutton, Diller, Ferguson, & Leung, 2004). The tool is scheduled to be delivered to the LTAMC team at the June 2005 planning meeting.

### Instruments

Data has been collected for cultural influences on behavior, cognitive style, personality, and organizational variables via questionnaires, observation, and semi-structured interview, and an on-line self-assessment and training tool using the scales listed in Table 1.

Measure	Subscales	Developed By
NCS: Need for Cognitive Certainty		Bar-Tal, Y. (September 1993; 1994).
AACS: Ability to Achieve Cognitive Certainty		Bar-Tal, Y. (September 1993; 1994).
URS: Uncertainty Response Scale	<ul style="list-style-type: none"> <li>• Emotional Uncertainty (EU)</li> <li>• Desire for Change (DC)</li> <li>• Cognitive Uncertainty (CU)</li> </ul>	Greco & Roger, 2001
PNS: Personal Need for Structure	<ul style="list-style-type: none"> <li>• Desire for Structure</li> <li>• Response to Lack of Structure</li> </ul>	Thompson, Naccarato, Parker, & Moskowitz, 1992
PFI: Personal Fear of Invalidity		Thompson, Naccarato, Parker, & Moskowitz, 1992
ICAPS:	<ul style="list-style-type: none"> <li>• Cultural Adjustment</li> <li>• Emotion Regulation</li> <li>• Openness</li> <li>• Flexibility</li> <li>• Critical Thinking</li> </ul>	Matsumoto & LeRoux, 2003
NEO-FFI: NEO Five Factory Inventory	<ul style="list-style-type: none"> <li>• Neuroticism</li> <li>• Extroversion</li> <li>• Openness</li> <li>• Agreeableness</li> <li>• Conscientiousness</li> </ul>	Costa & McCrae, 1989, 1992
Organization-focused semi-structured interviews	<ul style="list-style-type: none"> <li>• Organization and processes</li> <li>• Group roles and identity</li> <li>• Information-sharing</li> <li>• Decision-making</li> <li>• Language</li> <li>• Culture</li> </ul>	Bjornstad, A.L. 2004/2005 (On-going development of questionnaire)
Globesmart <sup>®</sup> SAP: Self-Assessment Profile and Cultural Awareness Training	<ul style="list-style-type: none"> <li>• Independent/Interdependent</li> <li>• Egalitarian/Status</li> <li>• Risk/Restraint</li> <li>• Task/Relationship</li> <li>• Short-Term/Long-Term</li> </ul>	Meridian Resources Associates, 2004; Matsumoto, 2004

Table 1. Instruments used for AW04 Following is a brief description of each instrument:

The *Need for Cognitive Structure* (NCS) scale is a 20-item scale that assesses the extent of an individual's preference for using cognitive structuring to achieve certainty. Higher scores on the NCS reflect a greater preference for using schemas, scripts, and past experiences to make a decision (i.e., a greater need for cognitive structure). Lower scores on the NCS reflect a greater preference for using more complex decision strategies (hypothesis generation, analysis) to make a decision; that is, formulate a hypothesis, evaluate present and past information, make a decision and continually re-evaluate that decision when new information arises.

The *Ability to Achieve Cognitive Structure* (AACS) scale is a 24-item scale that assesses the extent to which individuals are able to apply information processes that are consistent with their need for cognitive structure. Higher scores indicate a greater ability to apply information processes that are consistent with an individual's level of NCS. The expression of an individual's level of NCS and AACS may be impacted by their level of stress.

The *Uncertainty Response Scale* (URS) is a 48-item scale that was designed to predict individual differences in coping with uncertainty. The URS is comprised of three factors, Emotional Uncertainty (EU), Desire for Change (DC), and Cognitive Uncertainty (CU). EU is the degree to which an individual responds to uncertainty with anxiety and sadness. DC is the degree to which an individual enjoys novelty, uncertainty and change. CU is the degree to which an individual prefers order, planning and structure in an uncertain environment. Higher scores indicate greater tendency toward maladaptive responses to uncertainty (EU), greater enjoyment of the unknown (DC), and greater preference for control under uncertain conditions (CU).

The *Personal Need for Structure* (PNS) scale is a 12-item scale. High scores indicate a preference for clarity and structure in most situations, with ambiguity and gray areas proving troubling and uncomfortable. Individuals scoring high on this dimension show a tendency to rely on previously existing stereotypes of target individuals when the target individual's recent behavior was ambiguous or inconsistent with their prior history. High scoring individuals have been shown to fulfill commitments earlier, attesting to the characteristic response to time pressure. Two contributing factors to PNS are the desire for structure (i.e., preference for situations, activities that are structured and predictable) and response to lack of structure (i.e., experienced anxiety and/or discomfort when structure is perceived to be missing from situations encountered).

The *Personal Fear of Invalidity* (PFI) 14-item scale measures one's tendency to react to decision making by being concerned with the possibility of making errors. Heightened concern may lead to vacillation between options, which can be associated with longer response latencies, lessened subjective judgmental confidence, and possible evaluation apprehension. Prior research (Thompson, Naccarto, Parker & Moskowitz, 1998) has suggested that there is a moderately positive correlation between PNS and PFI. High PNS and PFI might be expected to work in tandem in cases where one seeks out structure in order to clarify what is required in a situation, thereby lowering the likelihood of making an error. That is, one effective means of dealing with anxiety is to provide structure.

The *ICAPS* 55-item scale was developed by Dr. David Matsumoto, San Francisco State University. It measures the following five factors: Cultural Adjustment, Emotion Regulation, Need for Openness, Flexibility, and Critical Thinking. This tool was instrumental in the creation of the Globesmart® online

cultural adaptability assessment and training tool used at AW04. Data collected using ICAPS will significantly contribute to building a tool to enable cultural adaptability.

The *NEO-Five Factor Inventory* (NEO-FFI) is a shortened version of the NEO-PI, designed to give quick, reliable and valid measures of the five domains of adult personality:

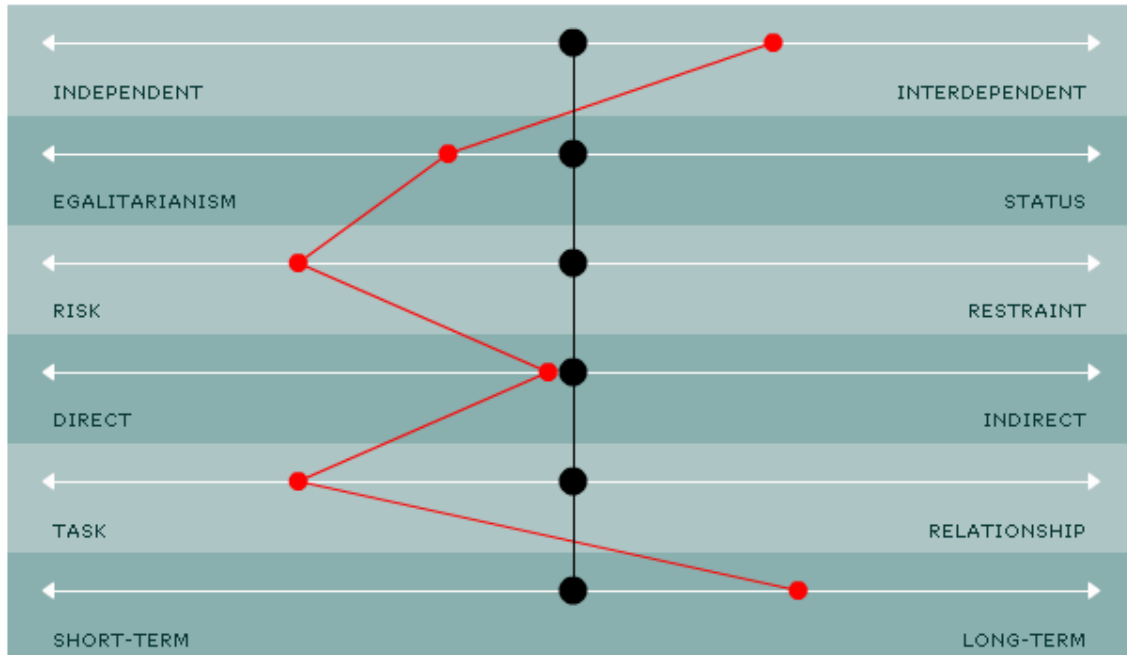
- (1) Neuroticism. Low scores are indicative of one's emotional resilience, calmness, stability, confidence, and independence, whereas high scores indicate a tendency to be anxious, fearful, sensitive, and self-critical.
- (2) Extroversion includes interpersonally based traits such as sociability, assertiveness, dominance, and the tendency to be outgoing, which are reflected in high scores, versus low scores which reflect one's tendency to be reserved, aloof, shy, and solemn.
- (3) Openness. High scores in this personality domain reflect tendencies to be intellectually complex, insightful, original, curious and studious. Low scores reflect tendencies toward illogical thinking and narrow-mindedness.
- (4) Agreeableness refers to tendencies to be tolerant, cooperative, and warm as reflected in high scores versus malicious, harsh, irritable, and insincere as reflected by low scores.
- (5) Conscientiousness refers to traits such as thoroughness, persistence, predictability, rigidity, and dependability as indicated by high scores and potential carelessness, absent-mindedness, forgetfulness, and erratic behavior as indicated by low scores.

*Semi-structured interviews* constituted the first step in the development of questionnaires to measure organizational variables thought to be of importance for cross-cultural cooperation and function in military headquarters. For example: Are there differences depending on culture, organizational structure or roles, language proficiency or inter-group relations? How do organizational variables (e.g., level of hierarchy, level of centralization and decentralization (self-organization), and flexibility between centralization and decentralization) affect intra- and inter-team cooperation, in terms of information-sharing and decision-making? How does the organization affect roles, group processes, and, in turn, cooperation?

The final instrument used for data collection is a *web-based self-assessment tool* that identifies behavioral tendencies associated with six dimensions descriptive of culturally based biases that leaders and team members bring to a mission. These biases, or dimensions, can be characterized as national differences in values along a continuum. Theoretical endpoints of the six dimensions assessed can be labeled (1) independent – interdependent, (2) egalitarianism – status, (3) risk – restraint, (4) direct – indirect communication, (5) task – relationship, and (6) short-term – long-term time focus. These dimensions reflect basic culturally-based values or orientation identified in the culture literature (e.g., Hofstede, 1980; Schwartz, 1992; Triandis, 1989; Trompenaars & Hampden-Turner, 1998). The name of the web-based tool utilized in AW04 is *GlobeSmart*<sup>®</sup>.

Globesmart<sup>®</sup> is a tool developed by Meridian Resources Associates, San Francisco, California that provides business personnel with quick and easy access to extensive knowledge on how to conduct business effectively with people from 40 countries. At the core of Globesmart<sup>®</sup> is a 36-item Self-Assessment Profile (SAP) tool. Individuals using Globesmart<sup>®</sup> complete the SAP, after which the program plots a personal profile for the individual along the six dimensions. For example, the tool will plot to what degree the individual is independent, has an egalitarian relationship pattern, is risk tolerant, has a direct communication style, is task-oriented, and is short-term- oriented (see Figure 2). Individuals

can compare their own personal profiles with the average profile for any of the countries in the Globesmart® database. It is understood that while individuals of the same nationality have similar behavior patterns associated with the six dimensions, their behaviors vary by degree depending on where an individual's values fall along a given continuum. Analysis of the data collected via Globesmart® on nearly 200 industry teams shows clear cultural patterns supported by high levels of reliability and validity of the survey instruments (Gundling, March 2004; Matsumoto, 2003).



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Figure 2. Example of a Globesmart® Profile

The Globesmart® tool was selected because it provides a framework for development of an innovative, self-directed, web-based tool to enable cultural adaptability in staff officers performing C2 functions in Joint, Interagency, and Multinational (JIM) environments. The concept for creating a tool that goes beyond just raising cultural awareness was validated with a multinational pool of officers conducting a peacekeeping at Stabilization Force headquarters (HQ SFOR) at Camp Butmir, Bosnia-Herzegovina (Sutton, 2003). This tool, named Training Adaptable Coalition Teamwork (TACT), is currently under development by Meridian Resources Associates in conjunction with Dr. David Matsumoto. Its design will enable officers to navigate the challenges of culture during information exchange involving: team tasks, goals and mission, response sequencing, time and position coordination, load balancing, matching resources to task requirements, adjusting activities in response to errors and omissions, and general activity monitoring.

**Next Steps**

A report of AW04 results is being prepared. In that report, implications of findings for multicultural C2 operations will be discussed. Preliminary analyses of some of the data revealed a three-factor model that describes the relationship between the cultural adaptability, cognitive style, and personality variables under study.

Supported by both HQ SACT and the RTO HFM Panel, it is projected that the LTAMC project will contribute significantly to the body of knowledge in the domain of adaptability. With a primary focus on the impact of culture on teamwork, LTAMC research to develop a conceptual model of cultural adaptability for military operations and an applicable tool will ultimately enable the effective functioning of NRF headquarters teams and other Coalition teams in Joint, Interagency, and Multinational environments.



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## **Enabling Cultural Adaptability**

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### ***ABSTRACT***

*Military staff performing command and control functions require a unique set of skills when working in a multinational environment that are not typically taught in national or NATO training venues. It is vital to be able to navigate the challenges of culture during information exchange regarding team tasks, goals and mission, response sequencing, time and position coordination, load balancing, matching resources to task requirements, adjusting activities in response to errors and omissions, and general activity monitoring. Lack of skill in multicultural teamwork has been found to be an unnecessary weakness in military staffs, specifically at the Joint Task Force level. This paper presents a technology solution: a web-based tool named “GLOBESMART® COMMANDER” currently under development by the U.S. Army Research Laboratory Human Research and Engineering Directorate and MeridianEaton Global, an international consulting company.*

### **1.0 INTRODUCTION**

Multinational alliances in war or peace are the way of the future. For example, alliances Bosnia-Herzegovina, Kosovo, Afghanistan, and Iraq are representative of this transformation. No where is the cultural diversity inherent in multinational teams more prevalent than at the operations level. Task forces executing Commander’s intent in the performance of critical command and control functions in a multinational environment often have the capacity for more creative approaches to problem solving, but they can also experience difficulties in coordination, aligning team members to complete tasks, and error-checking. In these culturally diverse groups, failure to understand the impact of culture on thoughts and behaviour often results in distrust, confused priorities, frustration, misunderstanding, even conflicting goals. Extended deployments may magnify problems rooted in culture, resulting in increased experienced stress by individuals on those deployments.

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**2.0 IMPACT OF CULTURE ON TEAMWORK**

Culture is the totality of socially transmitted behaviour patterns, arts, institutions, and all other products of human work and thought typical of a population or community at any given time [1]. It is the acquired knowledge used to interpret experience, form values, create attitudes and influence behaviour. Values are basic convictions that people have regarding what is right and wrong, good and bad, important and unimportant. Values are relatively stable, not subject to sudden shifts or impulses of the moment, and serve as a standard for judging the behaviour of others. The ability to adapt, as necessary, to differences in cultural influences on behaviour is a key success factor for effective multinational team.

Culture impacts teamwork in various ways. Members of the military in any NATO country belong to organizations with related command structures and share some experiences in common. However, they also tend to behave in ways that are consistent with cultural norms for their own country. Several decades of research have led to the identification of dimensions of culture that shape individual behaviours; these behaviours affect team performance in both civilian and military settings. Table 1 presents six of the most commonly referenced cultural dimensions along with brief references to their practical implications.

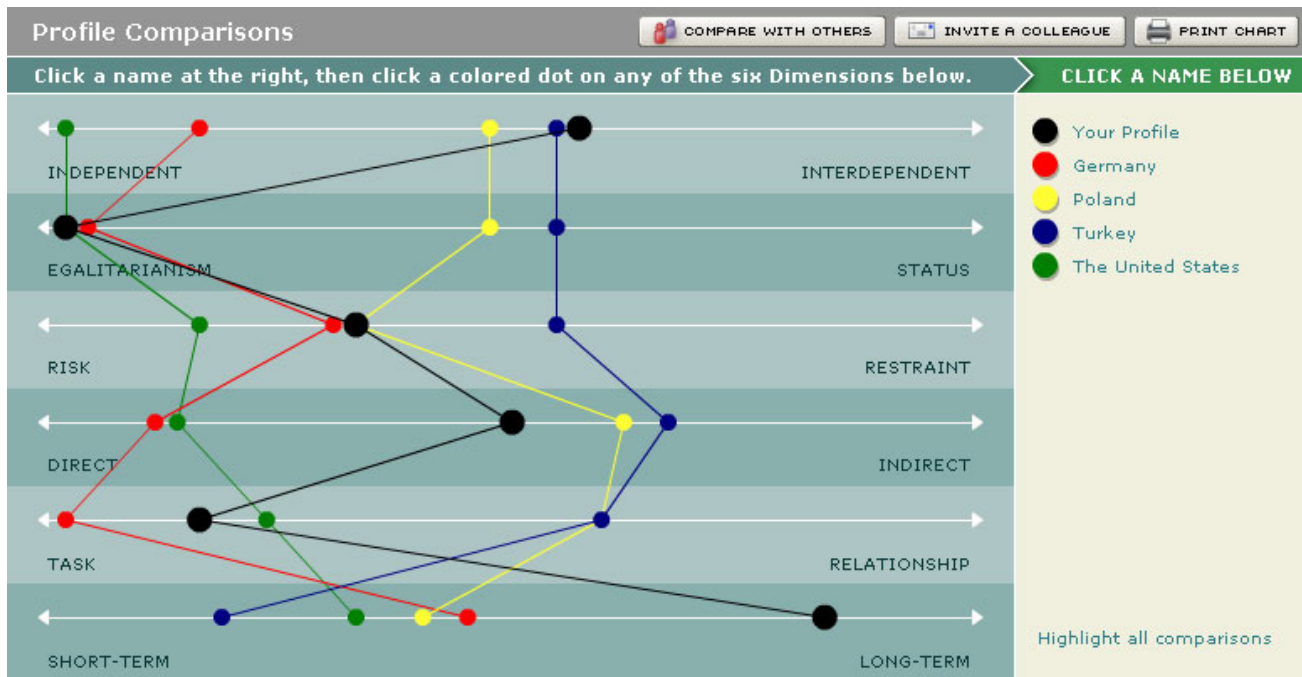
<u>Dimension</u>	<u>Practical Implications</u>
1. Independence/Interdependence:	Shapes a preference for individual initiative and action, or for a more group-oriented approach emphasizes the interests of the team as a whole
2. Egalitarianism/Status:	Shapes a preference for mutual consultation in decision-making, or for greater deference to rank and hierarchy
3. Risk/Restraint:	Shapes a preference for rapid action and risk-taking, or for more cautious and calculated actions based on ample information
4. Direct/Indirect:	Shapes a preference for open and explicit communication, or for careful attention paid to context or to implicit meanings in a given message
5. Task/Relationship:	Shapes a preference for immediate attention to getting the job done, or for establishing strong and trusting personal relationships first
6. Short-term/Long-term:	Shapes a preference for making choices based upon a narrow time horizon, or for considering the impact that choices will have over a longer span of time

Table 1. Six Key Dimensions of National Culture

It is important to stress that there are positive and negative aspects of both ends of the spectrum for each cultural dimension, and there is not a judgment attached to either extreme. Depending upon the situation that a team encounters, any of these cultural perspectives could be useful. The challenge for multicultural teams is to fully leverage the diverse perspectives of their members while also being able to reach closure and move to action when this is required. Recent data on multicultural teams confirm that such teams experience particular difficulty with areas such as establishing an effective decision-making process, giving and receiving critical feedback in a constructive manner, and creating procedures for resolving problems among team members [2].

Using several NATO countries as examples, national norms for the same six cultural dimensions are

contrasted in Figure 1. The black circles represent points on the six continuums where an individual’s culturally based behaviour may fall.



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Figure 1. Profiles for a sample of NATO countries

Members of operational level multicultural teams that include this kind of wide range of perspectives can benefit from assistance in understanding the cultural norms of other members on the team. They can also benefit from recommendations for how to adapt their own personal styles to work most effectively with other team members.

### 3.0 GLOBESMART® COMMANDER

The concept for creating a tool that went beyond just raising cultural awareness was validated with a multinational pool of officers conducting peacekeeping at Stabilization Force headquarters (HQ SFOR), Camp Butmir, Bosnia-Herzegovina [3] [4]. There, research conducted by the U.S. Army Research Laboratory (ARL) Human Research and Engineering Directorate (HRED) found the inability to adapt to cultural differences among headquarters staff to be a critical barrier to effective teamwork [5]. As a result, ARL HRED partnered with MeridianEaton Global, in conjunction with Dr. David Matsumoto at San Francisco State University, CA, USA, to develop a tool, GLOBESMART® COMMANDER (*GS Commander*), designed to provide military staff performing command and control functions the necessary skills to adapt, as needed, to cultural influences on teamwork at the operations level. The utility of *GS Commander* for a multinational headquarters staff was validated with the Allied Warrior 2004 (AW04) Deployable Joint Task Force (DJTF) staff [6].

The *GS Commander* program includes ten learning modules. These modules introduce the topic of cultural differences, provide an orientation to each of the six dimensions of culture, and also cover several aspects of multicultural teamwork that correspond with the “Forming,” “Storming,” and “Norming” phases of team activity identified by Bruce Tuckman [7]. The standard outline for all of the modules incorporates the following five steps:

## ENABLING CULTURAL ADAPTABILITY

- Step 1 contains a brief survey and personal profile. Users respond to a short set of survey questions that result in the display of their personal profile for a particular cultural dimension, helping them to become more aware of their own preferred styles.
- Step 2 is a scenario that illustrates an unproductive interaction based on cultural differences. This segment includes a narrative that provides a fuller description of the cultural dimension under discussion in a particular module and contrasting behaviours that could result from an orientation towards one end of the cultural spectrum or the other. The narrative allows users to listen to perspectives from the characters in the video scene just presented that represent each side of a given dimension. Checkbox exercises are included for users to confirm their understanding of the lesson.
- Step 3 shows an animated display of country profiles. This segment helps users to seek out the country profiles for NATO allies they may be working with, and begin to consider contrasts between their personal styles and the norms for these other countries.
- Step 4 provides recommendations for working with different behavioural styles. Follow-on exercises offer opportunities for practice in recognizing other styles and suggestions for how to integrate them into a productive team effort through mutual style-switching and adaptation.
- Step 5 offers an opportunity for *GS Commander* users who are already in contact with members of other national groups to develop an action plan. This feature makes it possible to take key lessons from the program and apply them directly to upcoming tasks or activities.

Shown below in Figure 2 is a screen shot that illustrates some of the information provided to a *GS Commander* user in Step 2, described above. Information on this page is found in the Communication Styles module. The continuum of behavior associated with Direct and Indirect communication styles appears as a double-pointed arrow. The two dots appearing on the bar reflect a point on a theoretical behavioural continuum where individuals with a strong Direct or Indirect style, respectively, would be placed.

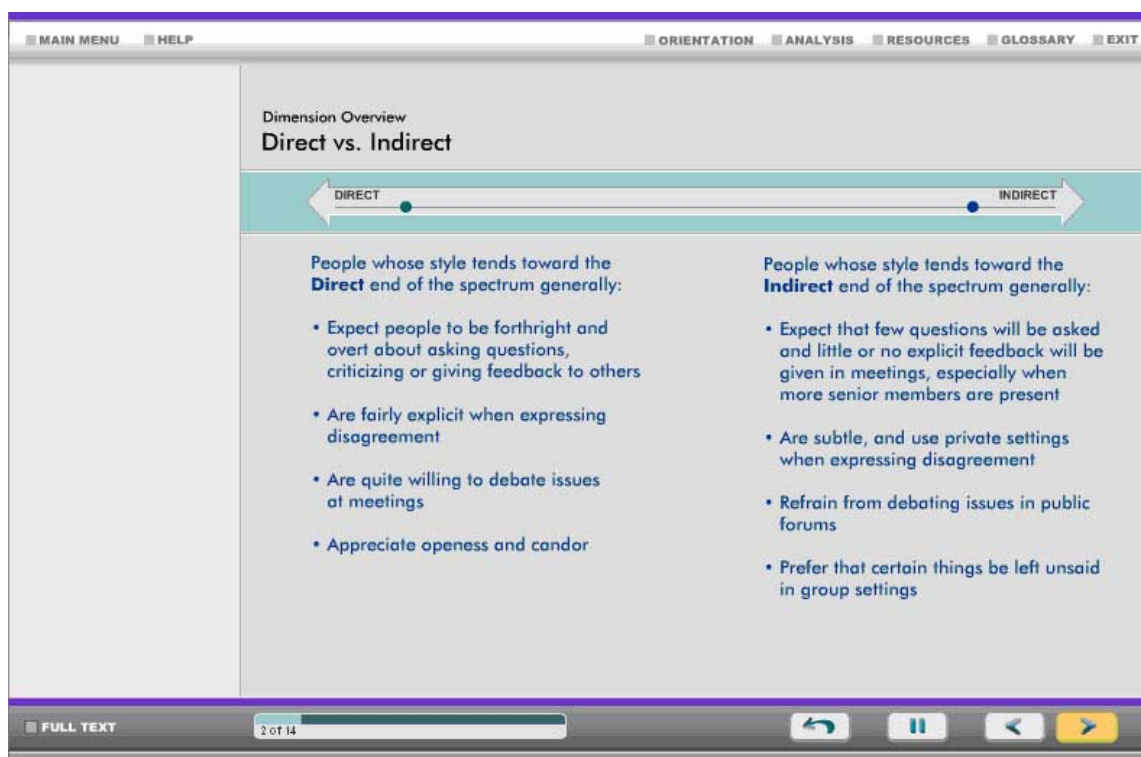


Figure 2. Direct and Indirect communication styles

A drag-and-drop exercise on how best to obtain information from individuals with different communication styles than the user is shown in Figure 3. Again, the double-pointed arrow shows the continuum of behavior associated with Direct and Indirect styles. This time, however, the one dot appearing on that continuum shows the user’s own communication style based on the personal profile created in Step 1. Users are presented with four possible ways to adapt their style to that of others. One at a time, they can drag a suggested style-change to the appropriate column. Feedback is provided both when user placements are correct or incorrect.

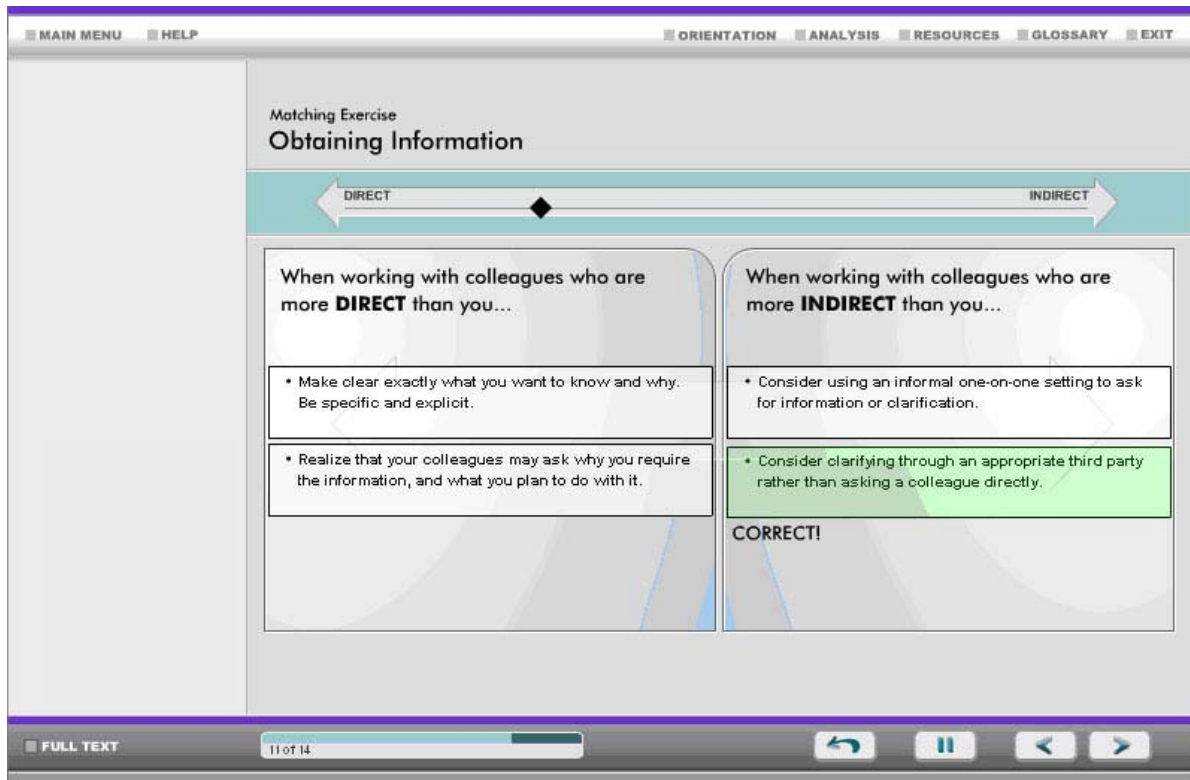


Figure 3. Working with different communications styles

## 4.0 BENEFITS

### 4.1 Technology Solution

Whether implemented as an intranet (internal to military firewalls) or as an internet tool (accessible on the worldwide web), a web-based tool offers many advantages: for example, ease of administration and data capture, and the ability to reach a larger training audience than would be available through the traditional classroom venue. The embedded self-assessment profile is unique in its ability to provide immediate feedback to users as well as its ability to access a data base of country profiles for comparison purposes.

Further, a web-based solution means that the user data can be collected and analyzed quickly, knowledge gaps

## ENABLING CULTURAL ADAPTABILITY

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across branches of service, rank, gender, and other demographics can be easily identified, and supplemental targeted information can be accessed to address those gaps. With the data capture feature of *GS Commander*, instructors, researchers, and leaders of multicultural staffs will be able to objectively assess the ability of individuals and teams to culturally adapt. Finally, the tool includes a user-friendly backend administration system that allows ongoing maintenance, modifications, and development.

### 4.1.1 Military Payoff

Little is known about how to rapidly form and support multinational headquarters staff over extended deployment because research and development has primarily focused on fighting and winning wars. However, ARL HRED research at HQ SFOR and at HQ DJTF during AW04 provided a rich source of information on issues associated with the impact of cultural diversity on teamwork that had not been addressed in national or NATO training venues. In-depth interviews conducted by MeridianEaton Global with officers experienced in multinational staff assignments around the world have provided, and continue to provide, realistic, relevant content designed specifically for officers preparing for short-term or extended deployment in a multicultural environment. Thus, *GS Commander* can facilitate a shortened learning curve for working at the Joint Task Force level. Additionally, unique to *GS Commander* is its application for Commanders and principal staff to assess, and possibly predict, behavior of team members. When potential problems in team composition are identified through analysis of the individual and team profiles created by the embedded survey, steps can be taken to minimize, avoid, or address issues before they negatively impact the mission.

## 5.0 FUTURE CONSIDERATIONS

### 5.1 Science and Technology Gaps

We have identified three science and technology gaps associated with *GS Commander*:

- *GS Commander* can be leveraged to provide recommendations for system requirements that address unmet or, as yet, unidentified needs of multicultural teams at the Joint Task Force level,
- *GS Commander* functionality can be expanded to address threats to information sharing and decision making performance on interagency task forces, and
- *GS Commander* embedded survey tool can be used to identify cultural profiles for the purpose of populating cultural variables in a multitude of existing decision making models, where assigned weights are currently based on educated guess rather than real data from real people.

### 5.11 The GLOBESMART® SOLDIER

Experience with *GS Commander* can be leveraged to create a tool that bridges gaps in cultural differences between coalition forces and Iraqis that they encounter on a daily basis. MeridianEaton Global proposes a training/decision aid that will, upon implementation, immediately benefit troops in Iraq.

Pre-deployment training has generally been limited to raising cultural awareness about Iraqi customs, religion, and history and understanding the physicality of cultural differences (e.g., time, space, and gestures). What is lacking is a means to prepare (and to provide ongoing support for) leaders and Soldiers by helping them to understand culturally based cognitive biases that influence not only Iraqi behaviour, but their own behaviour as well (e.g., risk-taking, activity orientation, or perceptions of inter-relationship power). These biases, when not understood, can impede progress toward mission goals. Proposed is a 24/7 online reference tool, "GLOBESMART® SOLDIER (*GS Soldier*)," with information on critical topics identified by "boots-on-the-



ground” Soldiers that would provide military personnel with quick and easy access to extensive knowledge on how to interact effectively with Iraqis. This tool could be developed and fielded within nine months with appropriate funding.

*GS Soldier* design would contribute significantly to:

- Faster and more effective training of Iraqi military personnel,
- Avoidance of unnecessary misunderstandings with Iraqi counterparts in the government, clerical, or civilian areas, and
- More rapid transition to Iraqi autonomy and self-government.

A further advantage of this tool is that the groundwork would be laid so that *GS Soldier* could be rapidly scaleable to other countries. In the longer term, military personnel could also have access to a similar set of benefits for other strategic locations such as Afghanistan, Kuwait and Sudan (assuming access to appropriate information and interviewees).

## **6.0 RELEVANCE**

The need exists to leverage what is known about culture, teams, training, and leadership in order to provide a model of coalition teamwork. First, the NATO Strategic Concept provides an integrated military structure necessary to sustain the NATO Alliance based on cooperation and coordination agreements, including collective force planning, common operational planning, and multinational formations [8] [9]. These agreements depend on the ability of leaders and teams to adapt to uncertain and complex conditions. Multinational staffs increase uncertainty and introduce complexity into performance of command and control functions. Second, the Combined Joint Task Force (CJTF) Concept was established for a multinational, multi-service deployable task force generated primarily for humanitarian relief and peacekeeping. The demands on leaders and teams within CJTF are recognized as considerable, resulting in a nucleus of core staffs established within the NATO military command structure. The CJTF Concept implies the existence of adaptable leaders and teams. Third, the Prague Summit Declaration [10] began the process of accession to join the Alliance, with Bulgaria, Estonia, Latvia, Lithuania, Romania, Slovakia, and Slovenia to begin accession talks. The introduction of new cultures and militaries to the NATO family requires leaders and teams to accommodate to the new entrants. Fourth, the NATO Response Force (NRF), consisting of a technologically advanced, flexible, deployable, interoperable and sustainable force, was created. This force will be a catalyst in improving the Alliance’s peacekeeping capabilities, but again, will challenge leaders and teams to recognize the effect of cultural diversity on teamwork.

## **7.0 SUMMARY**

Significant cultural differences have been found to interfere with mission success when cultural knowledge is lacking [11]. The inability to adapt, as necessary, to the influences of culture on thoughts and behaviour can result in imperfect situational awareness, which can lead to inaccurate situation assessment, and flawed or delayed decision making. We propose that cultural adaptability is critical to mission success in multicultural military environments, particularly at the operations level. Cultural adaptability includes the ability to recognize the influences of culture on teamwork, understand how best to act and react to those influences, and most importantly, take action by choosing to adapt. Mere exposure to other cultures over a long-duration deployment does not guarantee performance improvement.

The performance of multicultural teams on extended deployment can be enhanced through understanding

common cultural differences between team members from different NATO countries and exposure to practical strategies for adapting to those differences. *GS Commander* will enable users to learn rapidly and immediately apply the knowledge acquired to their daily work.

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## Predictive Modelling of Personality Traits – Implications for Selection of Operational Personnel<sup>73</sup>

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### **ABSTRACT**

*A series of factors have impact on teamwork in coalitions. Individual differences in personality traits represent powerful factors that, in interaction with culturally based cognitive biases, influence collaboration and performance. By means of factor analyses, multidimensional scaling, and modeling ad modum LISREL, 17 personality measures have been reduced to models of three interrelated factors. From initial model analyses, we found that the co-variances between variables were explained by a sequential relation between the factors Emotional Stability, Adaptability, and Need for Structure. An interpretation of the model is that if you have a high rating in Emotional Stability, your rating in Adaptability will be high. And, if your rating is high in Adaptability, your rating in Need for Structure is low. In a second series of validation analyses the initial model was confirmed. An alternative model to the sequential was proposed. In this model Emotional Stability directly affects Need for Structure and Adaptability. Confirmative analyses of the alternative model showed that this model has the same fit as the sequential. We have tested the fit of the models when using two of the main markers of each factor, and we found an almost perfect fit of the sequential as well as the alternative model. Accordingly, six of the measures used can represent the models adequately. Our conclusion is that the subjects can be ordered or classified with respect to the three factors by means of six measures. Four trait dimensions of the 'Big Five' are markers of our factors Emotional Stability and Adaptability, and the interaction between two fundamental dimensions behind the 'Big five' is in accordance with these two factors of our model. Emotional Stability and Adaptability are fundamental aspects in selection of personnel working under stressful conditions with high stakes and risks. By mean of the factors found and validated, we*

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<sup>73</sup> The work on predictive modelling has been supported by U.S Air Force European Office of Aerospace Research and Development (EOARD).

*have reliable and practicable measures of basic aspects predicting the performance and co-operative ability of personnel working in coalitions.*

## **1.0 INTRODUCTION**

A series of factors have impact on teamwork and performance in coalitions. Individual differences in personality traits represent aspects that, in interaction with culturally based cognitive biases, we believe influence collaboration and performance. Especially personality traits reflecting aspects of emotional stability have, since long, been considered important in selection of personnel working under high psychological stress, task load and risk. Selection of e.g. military pilots by means of personality traits as well as intellectual, perceptual and motor skills was introduced as early as during World War I. Similar procedures for selection were then developed and introduced in the army and naval branches. Procedures for selection with respect to operator and team performance in command and control environments are of a later date and in progress.

Selection of military operators has been extensively discussed in the scientific literature. Several meta-analyses have shown that personality traits, in spite of their considerable face validity, have a restricted predictive power on operational performance as compared to job sample tasks. In general terms, we can conclude that personality measures have a common variance of about 10 to 20 percent with different performance criteria [96]. The corresponding values for job sample tasks are about 30 to 40 percent [99]. On the other hand, personality or trait measures are easily administered and, in many situations, the most practicable and *the* remaining possibility to predict and optimize operational performance. Accordingly, an optimal combination of personality and task-related measures gives the best predictive power in selection of operators.

To cite the steering program for the task group *Leader and Team Adaptability in Multinational Coalitions*, a “*complicated assemblage of coalition partners will be required to perform as a team in complex environments that place high demands on the command and control of forces. This complex environment makes **adaptive performance** more critical than ever, yet the presence of **adaptable leaders** and **teams** continues to be elusive*” [100].

## **1.1 Methods, Assumptions, Procedures**

### **1.1.1 Factor Analysis (FA)**

#### *1.1.1.1 Rationale.*

Factor analysis is an analytical technique that makes possible the reduction of a larger number of interrelated manifest variables to a smaller number of latent variables or factors. The FA technique is based on the co-variation between manifest measured variables, and the goal of the technique is to achieve a parsimonious and simplified description by using the smallest number of explanatory concepts needed to explain the maximum amount of common variance in a correlation matrix (i.e., a table showing the inter-correlations among the variables to be factored). The factors can be considered as hypothetical constructs laying behind and explaining the co-variation between their markers, and the constructs find their manifest expression in their markers.

The factor extraction procedures can be divided into *exploratory and confirmative* (hypo-thesis testing) methods. Explorative solutions cannot be generalised to populations. Generalisation requires replications in new samples. Factor solutions from confirmative methods of factor extraction, on the other hand, can be generalised from a sample to a population of subjects.

The exploratory methods as *principal factors analysis* assume populations of subjects and variables, and provide descriptive solutions. Principal FA (also called common FA) is the method preferred when analysis of common variance is desired. Principal FA is a practicable tool for generation of hypotheses about factor structures to be analysed further and confirmed in future research [101] [102] [103] [104].

From inferential and confirmatory methods as *maximum likelihood FA*, on the other hand, generalisations to other members of the population are possible. *LISREL* (analysis of linear structural relationships) is a practicable tool for confirmation and generalisation of factor structures [105] [106] [107] [108].

### **1.1.2 Structural Equation Modelling (LISREL)**

#### *1.1.2.2 Rationale*

In the LISREL model, the linear structural relationship and the factor structure are combined into one comprehensive model applicable to observational studies. The model allows 1) multiple latent constructs indicated by observable explanatory variables, 2) recursive and non-recursive relationships between constructs, and 3) multiple latent constructs indicated by observable response variables. The connections between the latent constructs compose the structural equation model; the relationships between the latent constructs and their observable indicators or outcomes compose the factor models. All parts of the comprehensive model may be represented in a path diagram and all factor loadings and structural relationships appear as coefficients of the path. LISREL gives a series of Goodness of Fit measures of the whole model [106]. Examples of psychological models are given in [108] [109] and [110].

### **1.1.3 Multidimensional Scaling (MDS)**

#### *1.1.3.1 Rationale.*

MultiDimensional Scaling (MDS) is a procedure for fitting a set of objects or variables in a space (or plane) such that the distances between the objects correspond as close as possible to a given set of similarities or dissimilarities between the objects. Similarities can be measured directly or derived indirectly from e.g., correlation matrices [111] [112]. Usually MDS can fit an appropriate model in fewer dimensions than can FA. Furthermore, MDS provides a dimensional model even if a linear relationship between distances and dissimilarities cannot be assumed. As compared to other multivariate techniques MDS is easy to use and the statistical assumptions are mostly easy to fulfil. In contrast to FA no statistical distribution assumptions are necessary, even if some metric conditions must be satisfied.

### **1.1.4 Assumptions and Data**

#### *1.1.4.1 Assumptions.*

Results of research on the impact of individual and cultural factors on adaptive performance can be used to address personnel selection, modelling and simulation, and training, resulting in development of new measurement scales designed to assess the impact of culture on teamwork and new training tools designed to turn cultural diversity into mission strengths.[113]

#### 1.1.4.2 Instruments.

Besides a demographic questionnaire a large number of questionnaires or measurement scales tapping different cognitive aspects as well as mental states and traits have been answered by the participants of NATO's Allied Warrior 2004 (AW04), and Allied Warrior 2005 (AW05) exercises.

Seven instruments comprised of seventeen distinct measures tapping different emotional and cognitive states and traits, formed the base for a series of data reduction and modelling analyses. The measures are named as follows: *Personal Need for Structure (PNS)* [114], *Personal Fear of Invalidity (PFI)* [114], *Need for Cognitive Structure (NCS)* [115], *Ability to Achieve Cognitive Structure (AACS)* [115], *Uncertainty Response Scale (URS)* [116], *Intercultural Potential Adjustment Scale (ICAPS)* [117], and the *NEO-FFI Personality Inventory* [118]. The URS has three subscales measuring *Emotional Uncertainty*, *Cognitive Uncertainty*, and *Desire for Change*. The ICAPS has five subscales measuring *Cultural Adjustment*, *Emotion Regulation*, *Need for Openness*, *Flexibility*, and *Critical Thinking*. The NEO-FFI has five subscales measuring *Neuroticism*, *Extroversion*, *Openness Agreeableness*, and *Consciousness*. All instruments have been validated in other studies, and their reliabilities have been scrutinized.

## 2.0 ANALYSES AND RESULTS

As a first step of analyses based on data from AW04, the linear relationships between the measures by means of product moment correlations were calculated<sup>74</sup>. This matrix of correlations was then used as input in explorative principal factors analyses with oblique<sup>75</sup> rotation of factors. Rotation of factors results in a more even variance distribution, and in a more interpretable and simple factor structure.

From the analysis we found that 54 percent of the total variance<sup>76</sup> between the manifest variables could be explained by means of three latent variables or factors. Two practicable criteria for optimisation of number of factors, Kaiser's criterion and Cattell's scree-test were used [101] [104] [104]. Kaiser's criterion states that, only factors with 'eigenvalues' greater than 1.0 should be retained. Cattell's scree-test identifies the number of factors that can be extracted before the amount of unique and error variance begins to dominate over the amount of common and true variance. Both criteria indicated a three factors solution as optimal.

Figure 1 presents the three tentative groupings of variables into factors. Two of the instruments used, '*Critical Thinking*', and '*Agreeableness*', had low or insignificant amount of common variance with the other measures, and were therefore excluded from further analyses.

Our tentative interpretation of this first grouping is that the measures '*Neuroticism*', '*Ability to Achieve Cognitive Structure*', '*Fear of Invalidity*', '*Openness I*', '*Conscientiousness*', and '*Emotional Uncertainty*' represent a factor or latent variable named **Emotional Stability**. Multidimensional analyses show that the variables '*Neuroticism*', '*Emotional Uncertainty*', and '*Fear of Invalidity*' represent the core of the factor.

An interpretation of the second grouping is that the measures '*Emotion Regulation*', '*Inter-cultural Adjustment Potential*', '*Openness II*', '*Desire for Change*', and '*Extroversion*' represent a factor named

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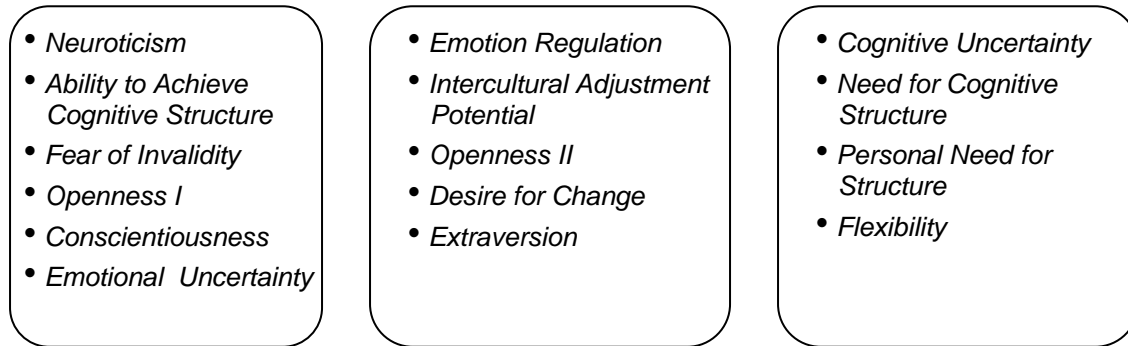
<sup>74</sup> Optimal estimates of correlations were extracted by means of PRELIS, a sub-routine to LISREL.

<sup>75</sup> In oblique rotation factors are free to correlate.

<sup>76</sup> The total variance is the sum of common variance, unique variance, and error variance.

**Adaptability.** Dimensional analyses showed that ‘*Openness II*’ was an outlier and that the other measures represent the central aspects of the factor.

The interpretation of the third grouping is that the measures ‘*Cognitive Uncertainty*’, ‘*Need for Cognitive Structure*’, ‘*Personal Need for Structure*’, and ‘*Flexibility*’ represent a factor named **Need for Structure**. Multidimensional analyses indicated that ‘*Flexibility*’ was an outlier and that the other variables represent the core of the factor.



**Figure 1: Groupings of variables from explorative factor analyses of the 17 measures. Fifteen out of 17 measures (88 %) are represented in the groupings or factors. Fifty-four percent of the common variance between the measures is explained by the three factors.**

The three factors structure from the exploratory analysis was used as a hypothesis in confirmative factor analyses ad modum LISREL. From the Goodness of Fit Statistics (GFI) of the confirmative analyses, we found that a three factors model significantly explains the co-variances between the manifest variables. The Weighted Least Squares Chi-Square equals 72.03 and has a p-value of 0.20<sup>77</sup>. The standardized Root Mean square Residual (RMR) equals 0.093, the Goodness of Fit Index (GFI) equal to = 0.84, and the Adjusted Goodness of Fit Index (AGFI) equal to 0.73.

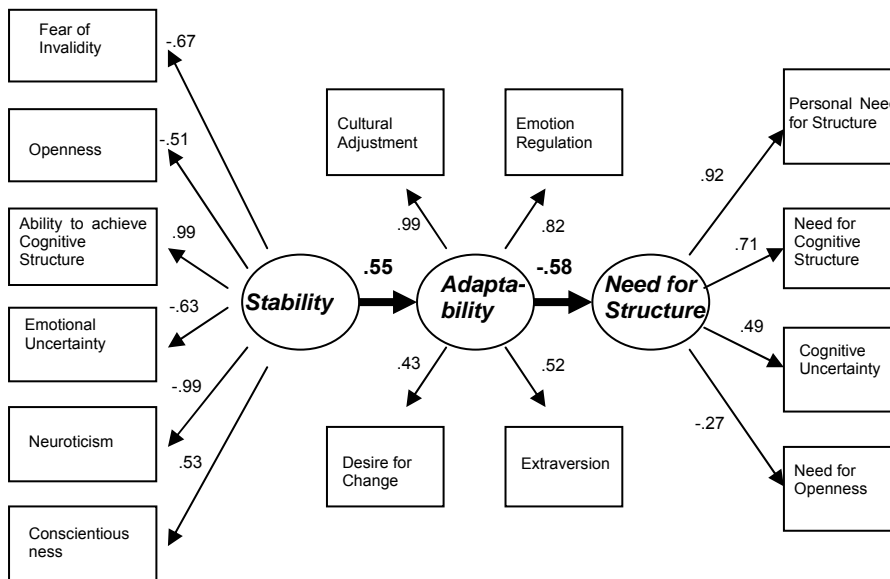
In contrast to the explorative analyses, significant relationships were found between the three factors. These relationships were used in an attempt to build a causal structural model explaining the co-variances between the manifest variables by means of the inter-related factors.

When we scrutinized the factor structure of the confirmative analysis we found that the factors **Emotional Stability** and **Adaptability** correlated, and that factors **Adaptability** and **Need for Structure** correlated, respectively. This means that **Adaptability** relates to both **Emotional Stability** and **Need for Structure**. Accordingly, **Adaptability** seems to be a mediator between the other two factors.

Accordingly, we tested and confirmed a three factors structural model by means of LISREL. In this model factor **Emotional Stability** precedes **Adaptability**, and **Adaptability**, in its turn, precedes **Need for Structure**. The final model from these analyses is presented in figure 2.

<sup>77</sup> High p-values indicate that the factor model exhaustively explains the co-variances between the markers.

As can be seen from figure 2 the three factors can be ordered in a sequence, in which *Adaptability* is a mediator between factors *Stability* and *Need for structure*. There are no direct effects from *Stability* to *Need for structure*, but a significant indirect effect. The Weighted Least Squares Chi-Square equals 80.54 and has a p-value of 0.093. The standardized Root Mean square Residual (RMR) equals 0.14, the Goodness of Fit Index (GFI) equal to = 0.82, and the Adjusted Goodness of Fit Index (AGFI) equal to 0.70. All loadings are significant ( $p < .05$ ). The fit of the model is acceptable<sup>78</sup>.



**Figure 2: A structural LISREL model of the relationships between *Emotional Stability*, *Adaptability*, and *Need for Structure*. The Goodness of Fit Index (GFI) = 0.82. All effects (thick arrows) and factor loadings (thin arrows) are significant ( $p < .05$ ).**

Our interpretation of the model is that if you have a high rating in Emotional Stability i.e. low scores in fear of invalidity, neuroticism, openness, and emotional uncertainty as well as high scores in ability to achieve cognitive structure, and in conscientiousness, your rating in Adaptability will be high, i.e. you will have high scores in emotional regulation, cultural adjustment, desire for change, and extraversion. And, if your rating is high in Adaptability, you will have low scores on personal need for structure, cognitive need for structure as well as cognitive uncertainty, i.e., your rating in Need for Structure is low. Figure 3 summarizes the sequential relationships between the three factors.

<sup>78</sup> The manifest variable ‘Openness II’ was found insignificant and was excluded from the structural model.



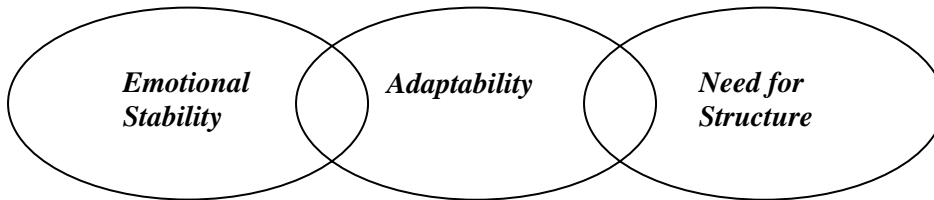


Figure 3: The sequential relationships between Emotional Stability, Adaptability, and Need for Structure.

In a second series of analyses, data from AW05 was added. In order to analyze to what extent data from AW05 was similar to the data from AW04, the correlation structures (i.e. the internal relations between the variables of the two studies, respectively) were compared. Figure 4 illustrates the correlation between the two structures.

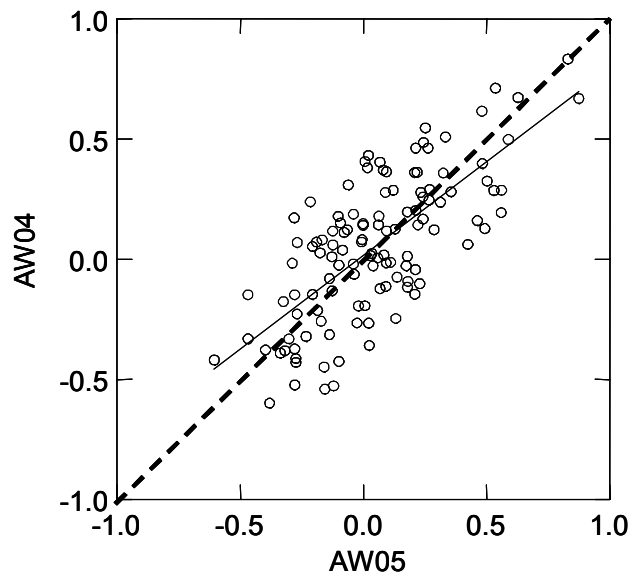


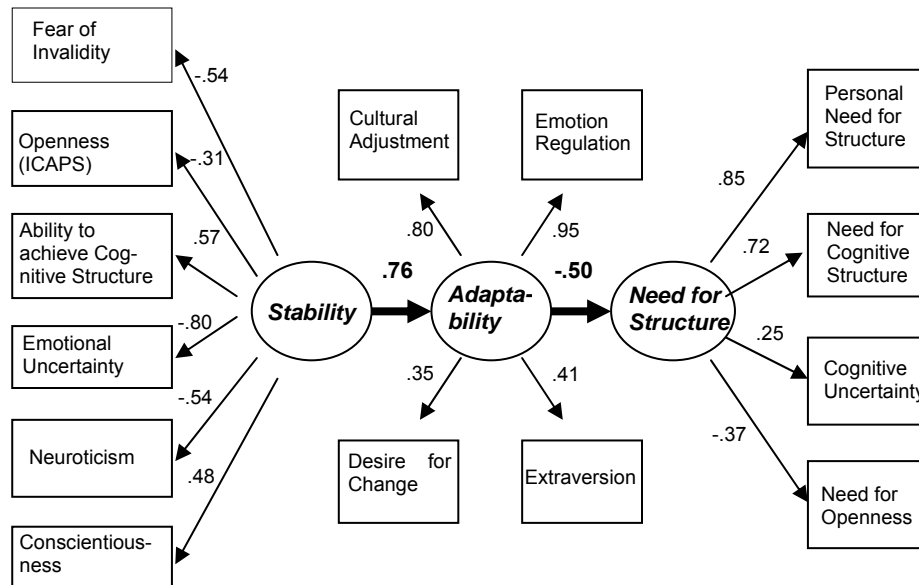
Figure 4: The relationship between the correlation structures (inter-variable correlations) from AW04 and AW05. The correlation ( $r$ ) is .72, ( $p > .01$ ). The common variance ( $R^2$ ) is 52 percent.

The proportion of common variance between the two structures was .52. Accordingly, the similarity between the rank-orders of the correlations from AW04 and AW05 is significant ( $p > .01$ ) and high. As can be seen from the figure, the variance of the AW05-distribution of correlations tends to be greater than the AW04-distribution.

Our conclusion from the finding of a close similarity between the databases from AW04 and AW05 was that the three factor model based on data from AW 04 could be tested on data aggregated from AW04 and AW05.

Accordingly, the addition of the data from AW05 represents a test of the validity of the model in an extended sample. The number of subjects from the two exercises was 155.

Figure 5 presents the three factors structural model based on data from AW04 **and** AW05. The Weighted Least Squares Chi-Square equals 85.11 and has a p-value of 0.03. The standardized Root Mean square Residual (RMR) equals 0.10, the Goodness of Fit Index (GFI) equal to = 0.85, and the Adjusted Goodness of Fit Index (AGFI) equal to 0.75. All loadings are significant ( $p < .05$ ).

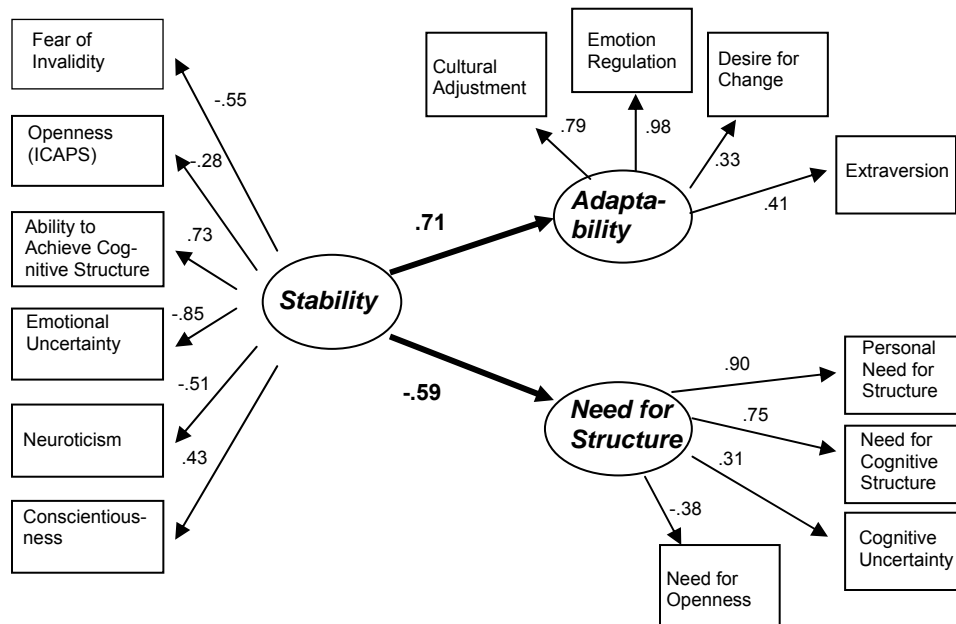


**Figure 5: A structural LISREL model of the relationships between *Emotional Stability*, *Adaptability*, and *Need for Structure*. The Goodness of Fit Index (GFI) = 0.85. All effects (thick arrows) and factor loadings (thin arrows) are significant ( $p < .05$ ).**

Our conclusion is that the fit of the model is acceptable, and that the data from AW05 support and validate the model based on data from AW04.

From the explorative as well as from the confirmative analyses we have found a three factors model in which the factors are ordered sequentially (*Stability* affects *Adaptability*, and *Adaptability*, in its turn, affects *Need for Structure*). However, from discussions within the research group an alternative solution was suggested. In this model *Emotional Stability* will directly affect *Need for Structure* as well as *Adaptability*.

From LISREL-analyses we found that the fit of this model was as good as the fit of the original model. The Weighted Least Squares Chi-Square equals 82.89 and has a p-value of 0.04. The standardized Root Mean square Residual (RMR) equals 0.11, the Goodness of Fit Index (GFI) equal to = 0.85, and the Adjusted Goodness of Fit Index (AGFI) equal to 0.75. All loadings are significant ( $p < .05$ ). Figure 6 presents the model in which *Emotional Stability* directly affects *Adaptability* and *Need for Structure*.



**Figure 6: A structural LISREL model representing the direct effects of *Emotional Stability* on *Adaptability*, and *Need for Structure*, respectively. The Goodness of Fit Index (GFI) = 0.85. All effects (thick arrows) and factor loadings (thin arrows) are significant ( $p < .05$ ).**

Accordingly, we have two models of equal fit. The models explain the same amount of common variance, they confirm the structures to the same extent, and they can both be generalized to the population of subjects. To determine which of the models that is to be preferred is both a theoretical and practical matter. Obviously, both can be used as complementary models.

The models of figures 5 and 6 are based on 14 markers. We have also tested the fit of the model when using two of the main markers of each factor (i.e. altogether six measures). By using the main markers we are optimizing the relationship between the proportion of variance explained and the number of measures used. Figure 7 presents this optimized model.

The Weighted Least Squares Chi-Square of the optimized model equals 4.09 and has a p-value of 0.76. The standardized root mean square residual (RMR) equals 0.04, the Goodness of Fit Index (GFI) equal to = 0.98, and the Adjusted Goodness of Fit Index (AGFI) equal to 0.94. All loadings and weights are significant ( $p < .01$ ). The fit of the model is almost perfect.

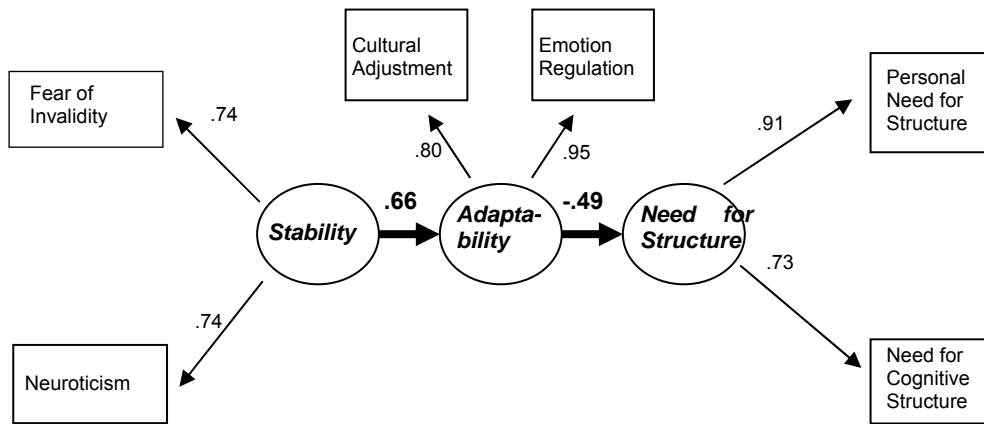


Figure 7: A structural LISREL model of the relationships between *Emotional Stability*, *Adaptability*, and *Need for Structure*. The model is based on six main manifest variables. The Goodness of Fit Index (GFI) = 0.98. All effects (thick arrows) and factor loadings (thin arrows) are significant ( $p < .01$ ).

The alternative model (in which *Emotional Stability* directly affects *Need for Structure* as well as *Adaptability*) has also been analyzed by using six main markers. Figure 8 presents the alternative and optimized model.

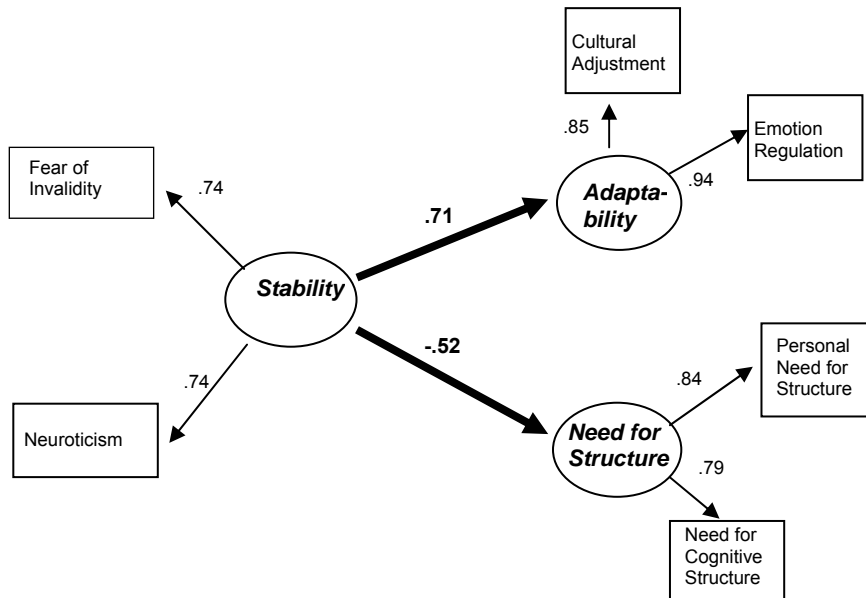
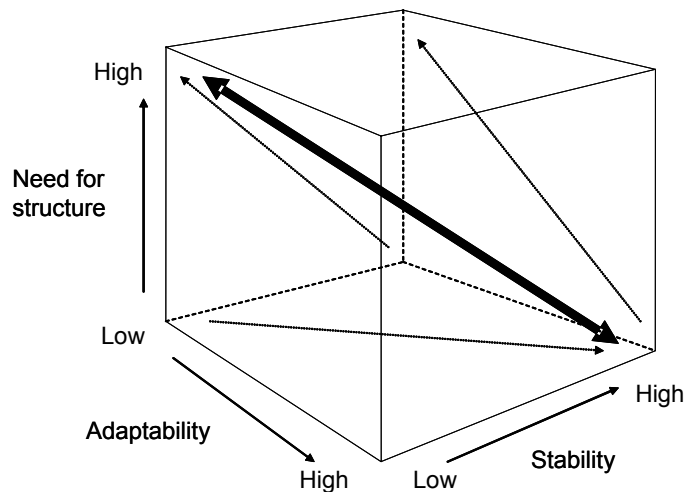


Figure 8: A  
 structural LISREL model representing the direct effects of *Emotional Stability* on *Adaptability*, and *Need for Structure*, respectively. The model is based on six main manifest variables. The Goodness of Fit Index (GFI) = 0.97. All effects (thick arrows) and factor loadings (thin arrows) are significant ( $p < .01$ ).

The Weighted Least Squares Chi-Square of the alternative and optimized model equals 7.02 and has a p-value of 0.43. The standardized root mean square residual (RMR) equals 0.05, the Goodness of Fit Index (GFI) equal to = 0.97, and the Adjusted Goodness of Fit Index (AGFI) equal to 0.90. All loadings and weights are significant ( $p < .01$ ). The fit of the alternative optimized model is almost perfect.

When comparing the factors of the large models represented by 14 markers with the factors of the small models represented by six markers we found that the correlations between the stability factors was .89, the adaptability factors .76, and the need for structure factors .90. Accordingly, the common variances for the factors were 79, 58, and 81 percent, respectively.

As illustrated in figure 9, the structural model can be visualized in a Euclidean space, of which the three dimensions represent the factors *Emotional Stability*, *Adaptability*, and *Need for Structure*, respectively.



**Figure 9: A representation of the structural model in a Euclidean space. The three dimensions indicate the factors *Stability*, *Adaptability*, and *Need for Structure*. The double headed arrow illustrates a goodness of fit continuum.**

The vector or arrow from the lower right to the upper left corner of the cube, illustrates a continuum from high *Stability*, high *Adaptability*, and low *Need for Structure* to low *Stability*, low *Adaptability*, and high *Need for Structure*. We consider the integrated continuum to indicate a 'personality goodness of fit index' of importance for prediction of operational performance.

### 3.0 DISCUSSION

By means of factor analyses, multidimensional scaling, and modelling ad modum LISREL, 17 personality measures have been reduced to models of three interrelated latent variables or factors.

From the explorative analyses we hypothesized a three factors model as an optimal solution. From these analyses we found that 15 of 17 measures (82 %) have an acceptable communality (i.e. significant co-variances with the other measures) for confirmative analyses. From the confirmative analyses we found that a model of three interrelated factors significantly explains the co-variances between the manifest variables.

From the initial structural model analyses (data from AW04) we confirmed that the co-variances between the variables were thoroughly explained by a sequential relation between the factors *Emotional Stability*, *Adaptability*, and *Need for Structure*. We also found that the structural model can be generalized to the population.

An interpretation of the model is that if you have a high rating in *Emotional Stability* i.e. low scores in fear of invalidity, neuroticism, openness, and emotional uncertainty as well as high scores in ability to achieve cognitive structure, and in conscientiousness, your rating in *Adaptability* will be high, i.e. you will have high scores in emotional regulation, cultural adjustment, desire for change, and extraversion. And, if your rating is high in *Adaptability*, you will have low scores on personal need for structure, cognitive need for structure as well as cognitive uncertainty, i.e., your rating in *Need for Structure* is low.

In a second series of analyses data from AW04 **and** AW05 were used. Our conclusion from these analyses is that the data from AW05 support and validate the model based on data from AW04.

From discussions within the research group an alternative solution was suggested. In this model *Emotional Stability* directly affects *Need for Structure* and *Adaptability*. Confirmative analyses of the alternative model showed that this structural model has the same fit as the sequential.

Accordingly, we have two structural models of equal and acceptable fit. The structural models explain the same amount of common variance between the measures, they confirm the structures to the same extent, and they can both be generalized to the population of subjects. To determine which of the models that is to be preferred is both a theoretical and practical matter. Obviously, both can be used as complementary models.

We have tested the fit of the models when using two of the main markers of each factor (i.e. in all six measures). From these analyses we found an almost perfect fit of the sequential as well as the alternative model. Accordingly, six of the measures used can represent the models adequately.

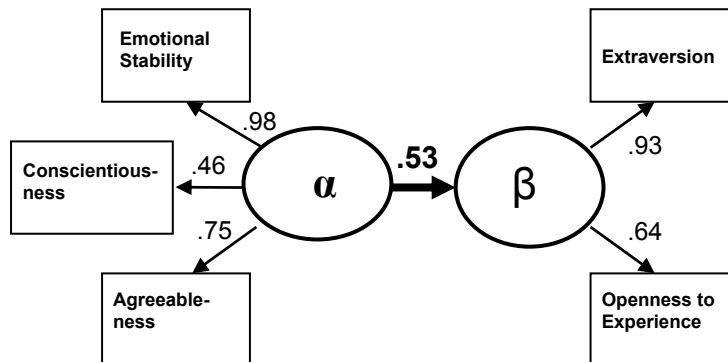
Our conclusion is that the subjects can be reliably ordered or classified with respect to the three, factors by means of six measures. To use these six measures is an economic way of getting information representing all of the measures.

When scrutinizing the proportion of variance accounted for by the factors we found that *Emotional Stability* explains more variance than the other two factors. This is, of course, a reflection of the psychological content of the measures analysed, but it also reflects the prominence of the stability concept. The aspects representing emotional stability are related to operator performance and, since long, of central importance in e.g. selection of military pilots and conscripts.

Unlike many other situations of measurement, each measure has a proved reliability and validity, and most of them are, in themselves, personality factors. In fact, four trait dimensions of the 'Big Five' (Emotional Stability, Conscientiousness, Extraversion, and Openness to Experience) are represented in our analyses **Error! Reference source not found.** This 'inborn' part of reliability and validity gives additional strength to the quality of the indices for the three factors and the structural models found. From a statistical point of view,

*Emotional Stability*, *Adaptability*, and *Need for Structure* are second order factors (i.e. factors of factors). The fact of the matter that the factors have specific and logical relations to each other in the model strengthens further their construct validity.

Digman [113] has performed a series of confirmative factor analyses of the ‘Big Five’ dimensions (Agreeableness, Conscientiousness, Emotional Stability, Extraversion, and Intellect or Openness to Experience). In all analyses a two factors solution was con-firmed. As can be seen from figure 10, the trait dimensions Agreeableness, Conscientiousness, and Emotional Stability were markers of the first factor, called  $\alpha$ , and the dimensions Extraversion, and Intellect were markers for the second factor called  $\beta$ . As can also be seen, the factor *Emotional Stability* of our analyses is comparable to Digman’s factor  $\alpha$ , and our factor *Adaptability* is close to his  $\beta$ -factor. Digman considers his two factors to be orthogonal or un-correlated. However, in our re-analyses of Digman’s data we found factor  $\alpha$  and factor  $\beta$  to be correlated in the same way as *Emotional Stability* and *Adaptability* are in our models.



**Figure 10: A structural LISREL model representing the direct effects of  $\alpha$  (*Emotional Stability*) on  $\beta$  (*Adaptability*). The model is based on six main manifest variables. The Goodness of Fit Index (GFI) = 0.97. All effects (thick arrows) and factor loadings (thin arrows) are significant ( $p < .01$ ).**

Accordingly, from our re-analyses of the ‘Big Five’ dimensions, we can conclude that, from a statistical point of view, the ‘Big Five’ dimensions can be thoroughly explained in terms of two factors (close to ours *Emotional Stability* and *Adaptability*) and their relation.

## 4.0 CONCLUSIONS

What are the implications of the structural models for leader and team adaptability? *Emotional Stability* and *Adaptability* are fundamental aspects in selection of personnel working under stressful conditions with high stakes and risks. With high emotional stability your cognitive performance (information handling and decision making) can stand high stress levels longer without deterioration. With high ability to adapt you are better at handling complex and ambiguous information and situations. We have in other modelling studies [109] found that emotional coping processes will increase and interfere with problem solving coping processes when the challenge (the combination of risk- and complexity aspects) of a task increases. Sooner or later emotional coping dominates with deteriorated decision making as a consequence. Emotional stability counteracts and delays emotional coping. There are similarities between the effects of emotional stability and the effects of

training – both delay emotional coping and support problem solving coping processes. It is not for nothing that emotional stability and intense training since long form corner stones for effective military operations.

Accordingly, there is strong evidence of relationships between stress tolerance or emotional stability and aspects of cognitive performance under high information load and psychological stress. Consequently, the factors of the models have a predictive potential in the recruitment of personnel to e.g. exposed or critical positions in C<sup>2</sup>-systems. The reliability of the factors of the models increases the predictive power further, and, accordingly, the measures can be applied in situations where a few are accessible for a specific position.

We have mentioned that the validity and reliability of our factors are manifest and high as compared to specific and singular personality measures. However, even so, the predictive power of the measures or factors is not perfect. Furthermore, there is no one to one relationship between the personality measures and cognitive performance under stress and strain. On the other hand, from a statistical point of view, the probabilities of successful performance increase as a function of increased emotional stability and adaptability.

It is also of importance to notice that experience in and training of specific situations counteract interfering effects of personality factors. Personality traits can, partly, represent states, and, accordingly, change as a function of situation and surrounding factors. In the analyses of EW04 data we found a relationship between a demographic factor reflecting native background and experience and mental stability. However, this relationship was not found when the EW05 data was added.

In the databases analyzed, we have no data on performance aspects as mental workload, situational awareness, and operational performance, and, accordingly we were not able to directly relate performance to our stability- and adaptability measures. Information load, situational awareness as well as performance are central aspects in command and control situations. If we can relate these performance-related criterion variables to the personality traits of our models, and to states or moods as stress and activation, the map will be more complete. To that end, our next step is to use the model in C<sup>2</sup> – studies at the Swedish Armed Forces Joint Concept Development and Experimentation Center.

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# **Mixed- & Homogeneous-Culture Military Team Performance**

## **On a Simulated Mission:**

### **Effects of Age, Computer-Game Experience & English Proficiency**

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#### **ABSTRACT**

*In order to investigate the performance of mixed- versus homogeneous-culture military teams, the NATO RTO Research Task Group (HFM-138/RTG) on “Adaptability in Multinational Coalitions” conducted a computer-game experiment involving a modern urban search-for-contraband. Using the Situation Authorable Behavior Research Environment (SABRE), the study used a scenario which required planning, resource allocation, situation awareness, communication, and coordination for good performance. Good performance also required maintaining the good-will of the local populace who could provide useful tips or, the opposite, misinformation to the searchers. Fifty-six 4-person teams of NATO officers each from five nations received training on the game-play, planned for, and conducted their mission. The main hypothesis was that homogeneous-culture teams would perform better than mixed-culture teams. Contrary to expectations, performance was not a simple function of cultural composition. This paper examines the role of age, computer-game experience, and English proficiency as confounding variables in explaining the results. A key finding is that differences among national groups disappear when the effects of the confounds are removed, but the mixed-culture teams now have the best performance. Some reasons for these findings and the implications for military selection, training, and procedures are discussed.*

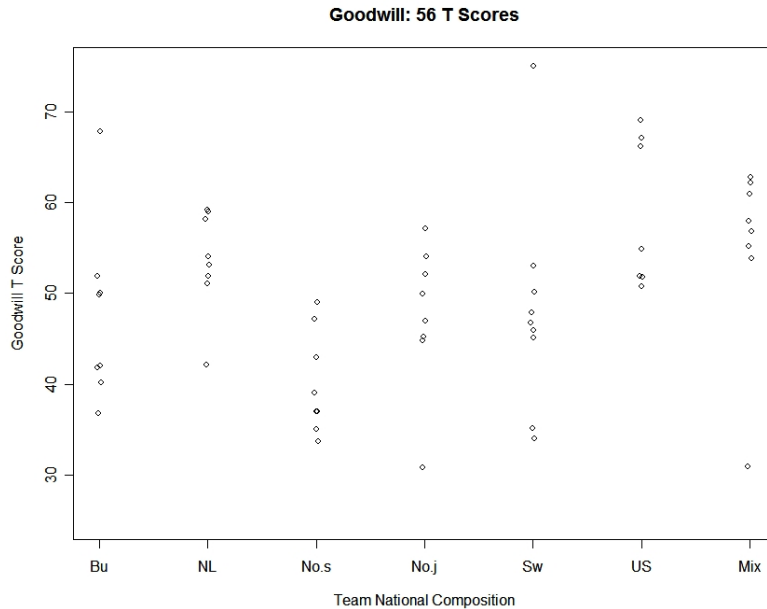
#### **1.0 INTRODUCTION**

In order to investigate the performance of mixed- versus homogeneous-culture four-person military teams, the NATO RTO Human Factors and Medicine Panel Research Task Group (HFM-138/RTG) on “Adaptability in Multinational Coalitions” conducted a computer game-based experiment (NATO RTO HFM-138/RTG, 2008). Using the Situation Authorable Behavior Research Environment (SABRE) (Warren et al., 2004; Leung, Diller, & Ferguson, 2005), BBN Technologies Inc. developed a modern urban search-for-contraband scenario specifically tailored for this NATO experiment (Warren et al., 2005) which required planning, resource allocation, situation awareness, communication, and coordination for good performance. Good performance also required maintaining the good-will of the local populace who could provide useful tips or, the opposite, misinformation to the searchers.

The principal hypothesis was: Homogeneous-culture teams (i.e., teams whose members are all from the same

nation) perform better than mixed culture teams (i.e., teams whose members are from different nations).

Contrary to expectations, performance, as indexed by several different metrics, was not a simple function of culture composition. Most surprisingly, homogeneous-culture teams were not generally better than mixed-culture teams. These results are well-illustrated in Figure 1 which shows the relative performance of all 56 teams, grouped by national or mixed-culture composition, on the main performance metric (to be discussed further below).



**Figure 1: Team “goodwill” performance T-scores (Mean = 50; SD = 10) for each of the 56 teams grouped by national composition. Key: Bulgaria (Bu), The Netherlands (NL), Norway-senior age**

Several non-cultural factors might have contributed to the pattern of results:

- Within teams, participants were of similar ranks/grades and thus similar in age. But between teams, ranks/grades and thus, age and experience, could differ. Relative seniority can be an advantage in a complex task requiring planning. But, relative juniority can be associated with computer-game experience and thus be an advantage.
- The task required playing a complex computer game using many different procedures for communication, movement, and sundry actions. In spite of a two-hour training session, there might be some effect of computer-game experience in achieving a level of mastery permitting participants to concentrate on the task at hand rather than game-play technicalities.
- The game-play was all in English (using keyboard-only communication, so this was monitored and ensured). Hence, in a multi-national population, proficiency in English could affect performance.

We (NATO RTO HFM-138/RTG) anticipated that the two factors of computer game-play experience and English proficiency, in particular, might act as moderator, mediating, or confounding variables and, hence, we collected several relevant questions about each in a pre-game questionnaire. Age and rank data was also

collected. As discussed later, it was not possible to select participants with either matching levels or controlled variation in these three factors.

Thus, the purpose of this paper is to explore these possible non-cultural alternative explanations for our pattern of results and to partial-out their effects, if any, using linear regression techniques. (Analysis of Covariance (ANCOVA) is an alternative approach and is treated in the Discussion section.) Another purpose is to discuss possible non-trivial implications for coalition military team selection, training, and procedures.

## 2.0 METHOD, ABRIDGED

Before turning to the analysis, I briefly review some details of the experiment. A full description is in NATO RTO HFM-138/RTG (2008).

### 2.1 Participants & Teams

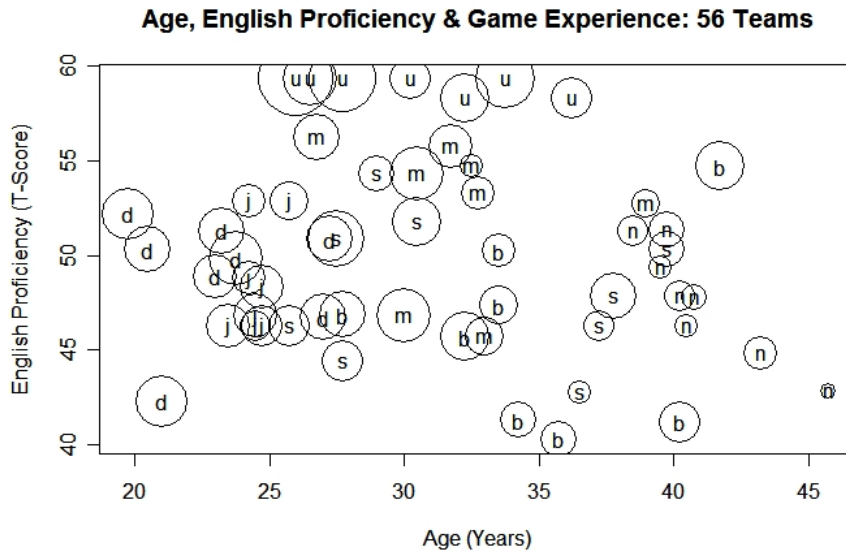
All 224 participants were volunteers and officers from five NATO nations: Bulgaria, The Netherlands, Norway, Sweden, and the United States. In total, there were 56 teams of 4 persons each: 8 from Bulgaria, 8 from The Netherlands, 16 from Norway, 9 from Sweden, and 7 from the United States. Eight of the Norwegian teams consisted of junior officers or cadets; the 8 other teams were more senior. Hence, some analyses below treat these as two separate “culture” groups: No.j and No.s for “junior” and “senior.” Eight additional 4-person teams, the mixed-culture teams, were formed having a composition of one person each from different nations.

Within each team, officers had to be no more than one rank/grade apart, but there was no required specific rank for all teams. No age requirements were set although the imposed similarity of ranks acted to keep ages within a team somewhat similar. Details of the age distributions appear in the age analysis section below.

No requirements were set for computer-game experience nor was game-experience controlled for in the study. However, due to the obvious possible effect on the results, several questions about gaming experience were asked in pre-game-play questionnaires. Details of the gaming-experience distributions appear in the gaming-experience analysis section below.

All had to speak and write English, but no specific proficiency criterion beyond NATO minimums was set. Several questions relating to English proficiency were asked in a pre-game questionnaire. Details of the proficiency distributions appear in the English proficiency analysis section below.

The result of these selection constraints and procedures is that age, English proficiency, and computer-game experience were not independent of each other or national composition. *A few demographic values were missing. Estimated values were included in the current analyses.* Figure 2 is a bubble chart of the three demographic factors with the national composition of each team indicated. Distinct non-balanced non-factorially-crossed patterns can be seen: For example, all seven American teams form a cluster located at the high end of English proficiency and at the middle of the age scale. The bubbles indicate that the Americans also have relatively high levels of computer-game experience. The Dutch teams form another cluster located at the younger end of the age scale and also show high levels of computer-game experience. The senior Norwegian teams, in contrast, form a cluster at the upper end of the age scale and show low levels of computer-game experience.



**Figure 2: Demographic profiles of the 56 teams. Game experience is proportional to bubble size. Letters indicate national composition of the teams: Bulgaria (b), The Netherlands (d), Norway-senior age (n), Norway-junior age (j), Sweden (s), United States (u), mixed culture (m).**

## 2.2 The Computer Game & Scenario

Details of the computer game and scenario are in NATO RTO HFM-138/138 (2008), Warren et al. (2004), and Warren et al. (2005). Essentially, teams were to find contraband caches hidden in a modern urban environment. The four human players are represented by “avatars” in the game-space. As they explore the cityscape, they meet some of the local populace (played by non-human “non-player characters” or NPC's). Some of the local populace provide “tips” about contraband or suspicious activity. Some of the local populace are truthful, some are not. Teams gain points by finding weapons caches and performing goodwill side-quests for the local populace. Teams lose points for opening empty suspected locations and angering the local populace by how they interact with them.

## 2.3 Procedure

Each team member was seated at a computer terminal. Same-nation teams were in the same room in their home nation but were visually and auditorily shielded from their other team members. Mixed-nation team members were always in their home nation and played the game over the Internet.

The game is a complex but very absorbing and immersive. Team-members received two-hours of training and learned how to communicate with each other using their computer keyboards. Keyboards and the computer screens were the only means of communication and information sharing. This forced all communication to be in English. It also means that every keystroke was recorded and available for future analysis.

Game-play involved planning, resource allocation, situation awareness, communication, and coordination. Game-play was monitored by a server-computer and almost all activity was recorded. In addition to the game-play, questionnaires were filled-out using the computer. During the game-play, there were probes from a

“superior officer” to determine situation awareness at three different times.

## 2.4 Design & Performance Metrics

The primary independent variable was the homogeneous- versus mixed-culture composition of the 56 teams.

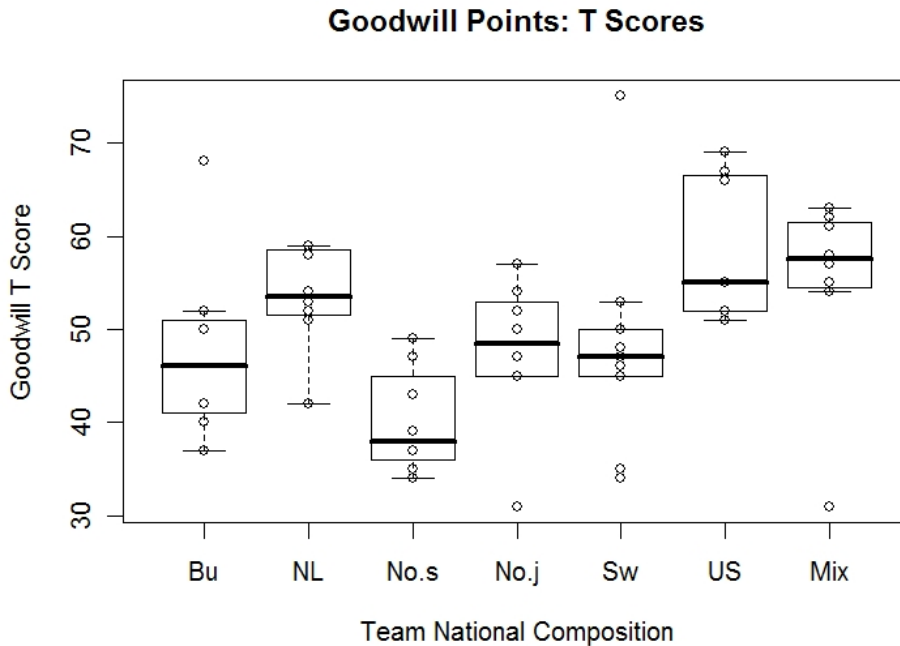
Answers to the pre-game questionnaire were post-game processed to form metrics for game-play experience and English proficiency.

The primary dependent variable was a *team* composite “goodwill” score. Goodwill points were awarded to individual players for such things as finding weapons caches and performing side quests. Points were subtracted for such things as angering the local populace and by opening empty crates. Although we have scores for each of 224 individual players, the four scores *within* a team are not independent of each other. This is because, for example, as one member of a team found a weapons cache, there necessarily was one less cache available for the other team members to find. But another reason is that teams were free to form their own search procedures and that meant that team members could be specialists. Communications Officers and coordinators might find no weapons and have very low scores. Those with weapon sensors would tend to have higher scores. What ultimately matters is how the *team as a whole* did. We thus used the sum of the four individual scores as the team metric. Since the raw scores have no inherent meaning, and to enable ready comparison of relative performance, I rescaled the raw team scores as *T-scores* which are simply re-scaled standardized z-scores with a mean of 50 and a standard deviation of 10 and which preserve the shape of the original distributions.

## 3.0 SELECTED PERFORMANCE RESULTS & DISCUSSION

Figure 1 showed the mean overall game-play performance for each of the 56 teams grouped by various culture compositions. As pointed out earlier, there is no simple function of cultural composition evident.

To aid in interpreting the data in Figure 1, Figure 3 shows the same 56 composite goodwill scores but with box plots superposed on the score-dots and with the jitter removed. The box plots help the eye remove the influence of outliers from interpretations while at the same time keeping the outliers in mind.



**Figure 3: Overall game-play performance T-score (i.e., Mean = 50, SD = 10) for each of 56 teams grouped by national composition. Key: Bulgaria (Bu), The Netherlands (NL), Norway-senior age (No.s), Norway-junior age (No.j), Sweden (Sw), & the United States (US), Mixed culture (Mix). Same data as in Figure 1 but with jitter removed and box plots superposed on culture groups.**

Several features of Figure 3 are relevant to our three variables of interest:

- Just comparing the two Norwegian sets of teams of junior versus senior officers shows a clear performance difference. All things being equal, we might expect the more senior teams to perform better, the results are just the opposite: The younger teams general perform better. Since it would be very counter-intuitive that military experience was not a positive factor, it is reasonable to suppose that an artifact---such as game-play experience---is operating. Thus we suspect that younger teams have more computer-game play experience.
- Note that even in a set of 8 scores it is possible to have outliers as can be seen in the Swedish scores.
- Once the very low-performing mixed-culture team is seen as an outlier, the overall relatively good performance of the mixed-teams is obvious: Although 5 homogeneous-culture teams out of 56 had better performance, the remaining 7 mixed-culture teams all had performance scores above the grand mean. This generally superior performance runs counter to expectations.
- As presumed native speakers of English and as the only native speakers of English, the American teams were expected to have an advantage in playing an English-only game. Figure 3 does show the overall relatively good performance of the American teams, but there are several non-American teams with equal or greater performance than individual American teams. The American teams also showed the most variability in performance as evidenced by the Inter-Quartile Ranges seen in the box plots.



The above points are suggestive.

The plan for analyzing the effects of age, computer-game experience, and English proficiency is to look at each individually in turn and then to look at them in combination.

#### 4.0 ANALYSIS: AGE

This section presents the age profiles for the 56 teams, and the relationship of age and performance.

##### 4.1 Age profiles

The 56 team mean ages ranged from 19.75 to 45.75 years. The median, mean, and SD team ages were 30.50, 31.25, and 6.62 years.

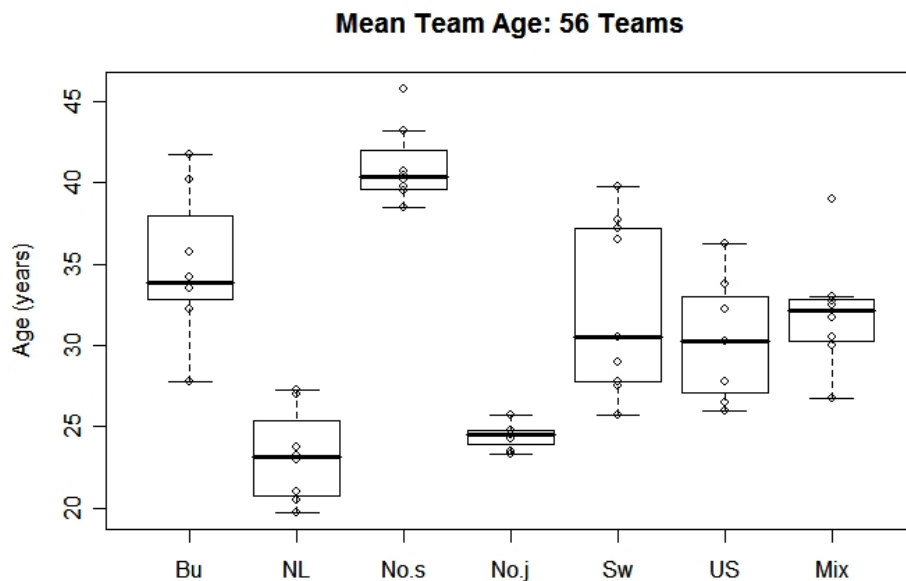


Figure 4: Mean age of each of 56 teams grouped by national composition. Key: Bulgaria (Bu), The Netherlands (NL), Norway-senior age (No.s), Norway-junior age (No.j), Sweden (Sw), & the United States (US), Mixed culture (Mix).

Figure 4 plots the 56 team age means grouped by national composition with box plots superposed on the culture groupings.

As can be seen in Figure 4, the team-age distributions varied considerably by national composition. Most striking is the large difference between the senior and junior Norwegian groups---justifying the labels “junior” and “senior.” The Norwegian senior group is the oldest *as a group* and the Dutch group is the youngest. The mixed-culture teams, in particular, are squarely intermediate in age.

### 4.2 Age & Performance Relationships

Figure 5 is a scatterplot of age versus performance for all 56 teams.

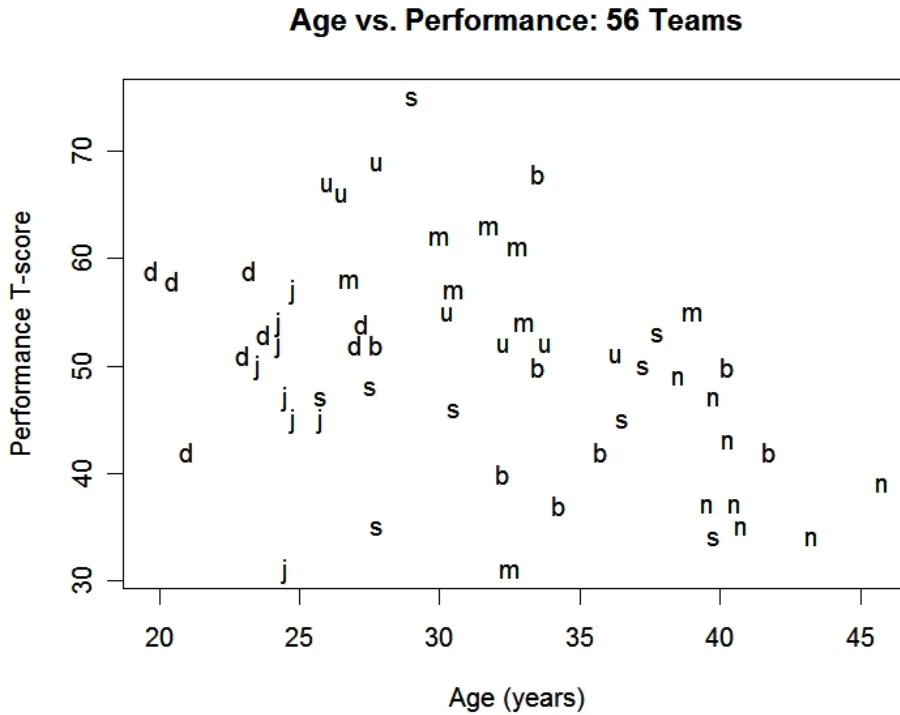


Figure 5: Age versus performance of the 56 teams. Points are coded for national composition of the teams: b: Bulgaria, d: Dutch (The Netherlands), j: Norway(junior teams), n: Norway(senior teams), s: Sweden, u: United States, m: mixed.

Quantitatively, the negative linear correlation between age and performance seen in Figure 5 is moderate and accounts for 15% of the variance ( $r(54) = -.387$ ,  $r^2 = .1499$ ,  $F(1,54) = 9.52$ ,  $p = .003$ ). The best-fitting linear equation for predicting (team) goodwill performance is

$$\text{Goodwill.T.score} = -.5895 * \text{age} + 68.3641 \tag{Eq. 1}$$

Usually, a prediction equation with an  $r^2=.15$  would be considered poor, but in this case it indicates a relatively weak effect of age on performance---which in our case is desirable.

### 4.3 Age-Adjusted Performance

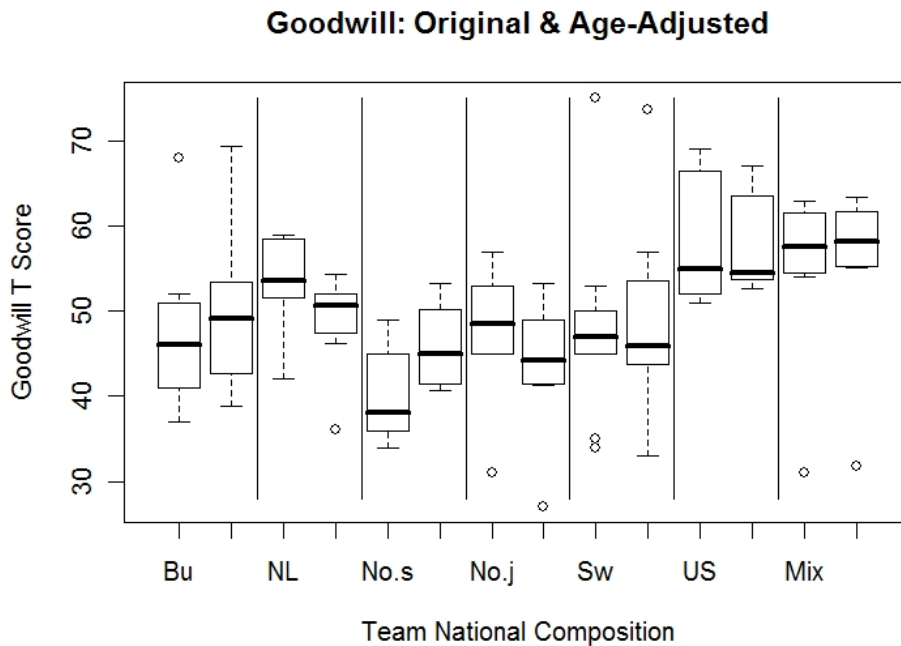
The negative linear correlation between age and performance can be used to remove the effects of age and leave us with an “age-free” performance index.

This is accomplished by a two-step process: First, subtracting the performance values predicted using Eq. 1 from the original team performance T-scores leaves us with the residual “errors” of the linear prediction of

performance using age. The residuals have a mean = 0 (by design) and an SD = 9.30 (empirically).

But the residual “error” in this case is actually goodwill performance---*less the effects of age*---provided we restore the original mean of 50 to all the residuals. This second step (adding 50 to the residuals) results in the age-effect-adjusted performance “T-scores.” T-score is in quotes here since the SD has been left as 9.30 instead of being enlarged to 10 (as is needed for a true T-score).

The age-effect-adjusted or age-free T-scores are shown in Figure 6. To make the comparison with the unadjusted scores easier, Figure 6 also shows corresponding boxplots from Figure 3.



**Figure 6: Team performance before and after age-effect adjustment. Original scores on left & adjusted scores on right within each culture sub-panel.**

As shown in Figure 6, removal of the negative effect of age on performance raises the adjusted performance scores of the Bulgarian and senior Norwegian teams as a whole since they tended to be older in age. Another result is the adjusted performance of the junior Norwegian teams (as a whole) is lowered and the senior and junior Norwegian teams are more equal on adjusted performance. There is little difference between the performance and adjusted performance scores of the Swedish, American, and Mixed teams (again, considered as groups) since their ages tended to be in the middle of the age distribution.

## 5.0 ANALYSIS: COMPUTER-GAME EXPERIENCE

This section presents the computer-game experience of the participants and then treats the relationship of game-experience and performance. But unlike the section on age, a metric for computer-game experience had

to first be developed.

## 5.1 Development of a Computer-game Experience Metric

This section only briefly treats the game-experience metric used in the analyses. For details of the metric and its development, see Warren (2008). Since the NATO RTO HFM-138/RTG Study Group anticipated game experience might be a factor, 14 computer and game experience questions were included in the pre-game survey asking about simple usage of games and “chatting” to advanced aspects such as developing “mods” for games. From these, I selected 10 questions in order to develop a game-experience metric:

Questions were scored as sub-scales for each person. Since performance is only meaningful on a team basis, team scores on each of the 9 sub-scales were formed by simply taking means over the 4 members for each of the 56 teams. As can be expected, the resulting sub-scales correlate to varying degrees with each other and also with the overall performance (goodwill) metric.

The composite experience metric which best correlates with performance can be sought using non-linear and smooth regression techniques (Venables & Ripley, 2002). However, I combined the sub-scales into a composite gaming experience metric using simple multiple linear regression and allowed an intercept term for a better fit. This yielded a metric with a correlation with team performance of  $r(54) = .538$  and accounting for 28.9% of the variance.

The resulting 56 predicted values using the linear weights have two different interpretations: First, the predictive model being fit is:

$$\text{predicted goodwill.T.score} = \text{Sum}(\text{weight}_i * \text{sub.scale.score}_i) + \text{intercept} \quad \text{Eq. 2}$$

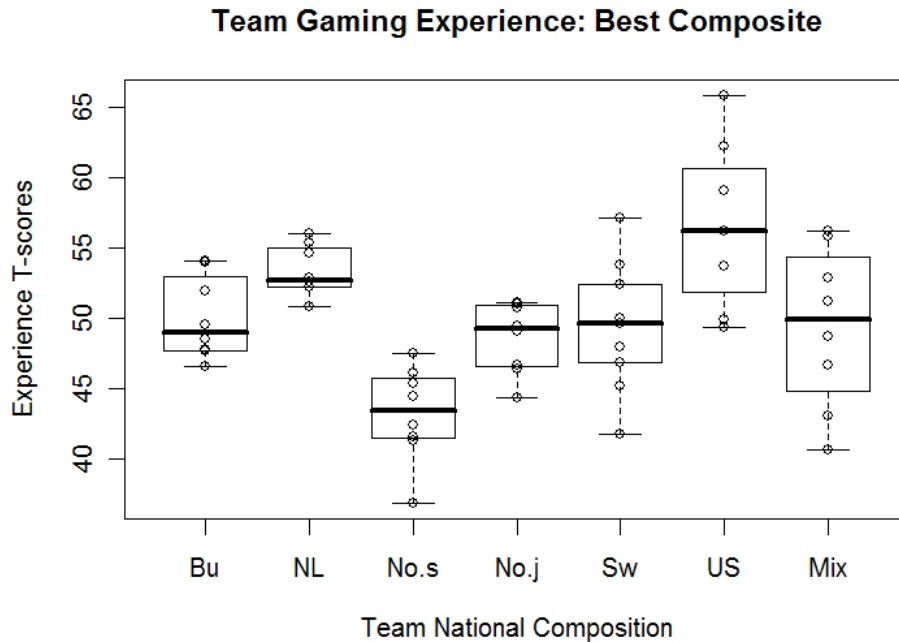
so the resulting values are predicted (goodwill) performance (T-scores) as indicated by the left-side of Eq. 2. But, the right-side of Eq. 2 is a just weighted sum of sub-scale scores and such a weighted sum is exactly what we mean by a composite gaming-experience metric. (The intercept term is just an additive constant.) Hence, *the predicted performance scores also serve as our composite-experience scores.*

Similar to what was noted for Eq. 1 for predicting performance from age which accounted for 15% of the variance, a prediction equation accounting for just 29% of the variance would normally be considered poor. But in this case it indicates a weak to moderate effect of gaming experience on performance---and in our case, the weaker the effect the better.

## 5.2 Gaming-experience profiles

The 56 team mean composite gaming-experience scores ranged from 36.89 to 65.78. The median, mean, and SD team scores were 49.74, 49.95, and 5.42.

As was the case for age, there are wide differences in the experience distributions of the national-composition groups.



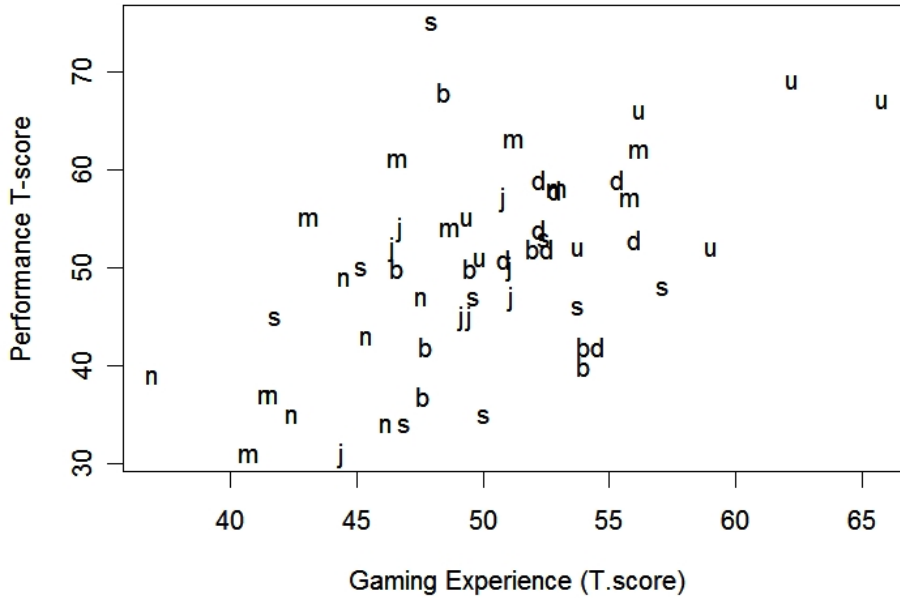
**Figure 7: Composite gaming experience: 56 teams** Composite gaming-experience of each of 56 teams grouped by national composition. Key: Bulgaria (Bu), The Netherlands (NL), Norway-senior age (No.s), Norway-junior age (No.j), Sweden (Sw), & the United States (US), Mixed culture (Mix). Boxplots are superposed on datapoints.

Figure 7 plots the 56 team gaming-experience means grouped by national composition with box plots superposed on the culture groupings. As can be seen in Figure 8, the team-experience distributions varied considerable by national composition. The Norwegian senior group had the least gaming-experience *as a group* and the Americans the most. The mixed-culture teams, in particular, are squarely intermediate in experience.

### 5.3 Experience & Performance Relationship

Nations with more gaming experience tend to perform better than nation with less experience. This is consistent with the overall correlation of composite-experience with performance for the 56 teams which is shown as a scatterplot in Figure 8.

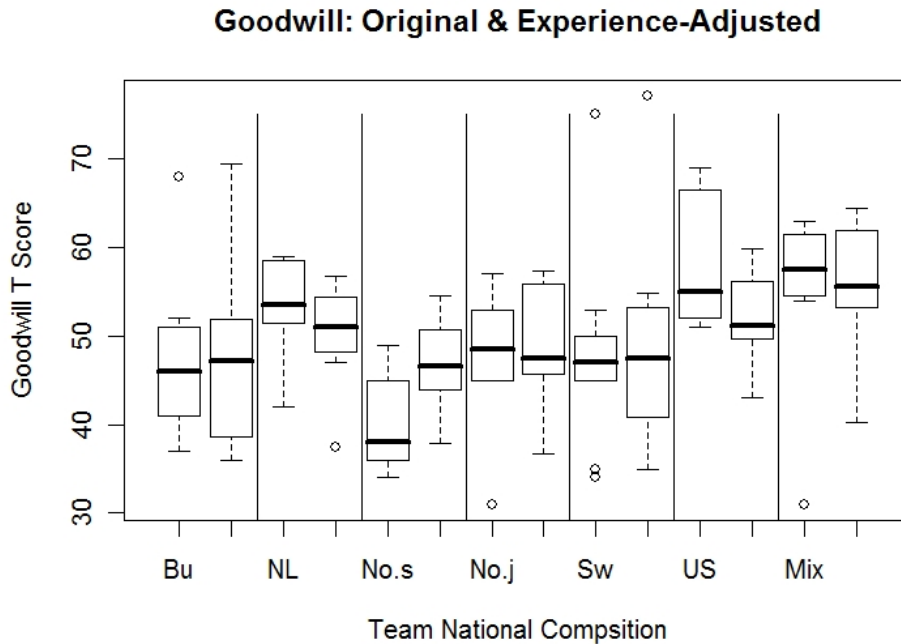
**Gaming Experience vs. Performance: 56 Teams**



**Figure 8: Gaming-Experience versus performance of the 56 teams. Points are coded for national composition of the teams: b: Bulgaria, d: Dutch (The Netherlands), j: Norway(junior teams), n: Norway(senior teams), s: Sweden, u: United States, m: mixed.**

**5.4 Gaming-experience adjusted performance**

The positive linear correlation between gaming-experience and performance can be used to remove the effects of experience and leave us with an “experience-free” measure of performance. The procedure is the same one used in extracting an age-free performance measure. Since the experience scores are also the predicted performance scores in the multiple regression of the 9 experience sub-scales with performance, the residual “errors” formed by subtracting predicted performance from actual performance are then simply performance scores less the effects of experience. These residual performance or experience-free scores, as residuals, have a mean of 0 (by design) and an SD = 8.50. By adding 50 to all the residuals, we obtain a distribution with mean=50 and SD=8.50 --- a distribution of experience-free adjusted performance T-scores. These are shown in Figure 9 along with corresponding original performance boxplots from Figure 3 to make comparisons easier.



**Figure 9: Team performance before and after removal of effect of gaming experience. Original scores on left & adjusted scores on right within culture sub-panels.**

As can be seen in Figure 9, removal of the positive effect of prior gaming experience tends to equalize the performance of the teams considered as cultural groups. Most noticeable is the increase in the adjusted performance score of the senior Norwegian teams since they had the least gaming experience as a group. Also, the relative performance of the American teams is adjusted downward since they tended to have the most gaming experience as a group.

## 6.0 ANALYSIS: ENGLISH PROFICIENCY

This analysis paralleled that for gaming experience:

### 6.1 An English proficiency metric

I developed an English proficiency metric and prediction equation using responses on a pre-game questionnaire. For details, see Warren (2008). The resulting correlation of English proficiency and team performance was  $r(54) = .5049$  ( $t(54)=4.30$ ,  $p=.00007$ ) and accounts for 25.5% of the variance. As with gaming, *the predicted performance scores also serve as the composite English-proficiency scores.*

As noted earlier for Eqs. 1 and 2 for age and gaming experience, a prediction equation accounting for 25% of the variance would normally be considered poor. But in this case it indicates a weak to moderate effect of English proficiency on performance---and again, the weaker the effect the better.

## 6.2 English proficiency profiles

The 56 team mean composite English-proficiency scores ranged from 36.89 to 65.78. The median, mean, and SD team scores were 49.74, 49.95, and 5.42.

As was the case for age and gaming experience, there are wide differences in the English proficiency distributions of the national-composition groups.

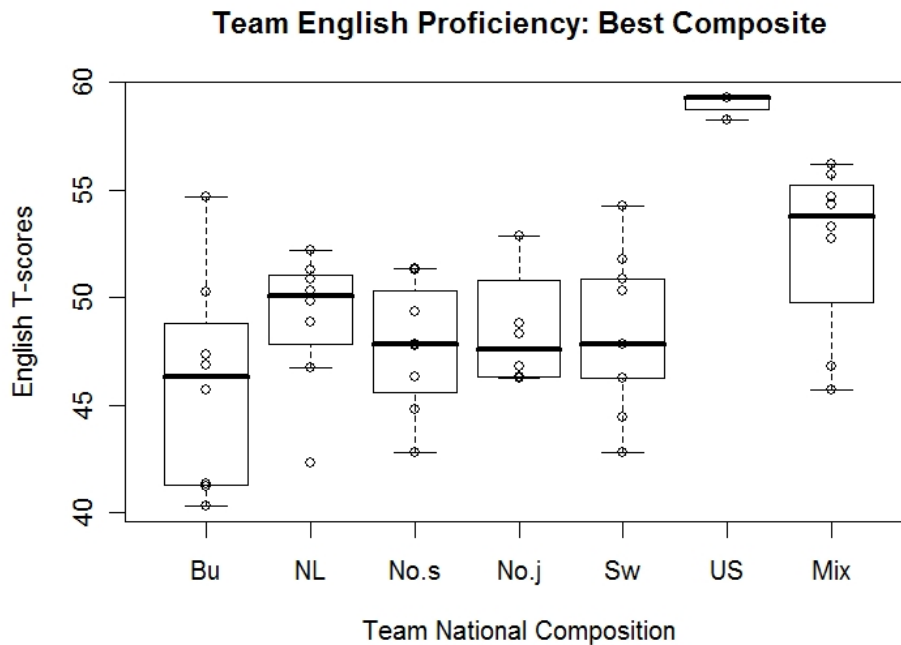


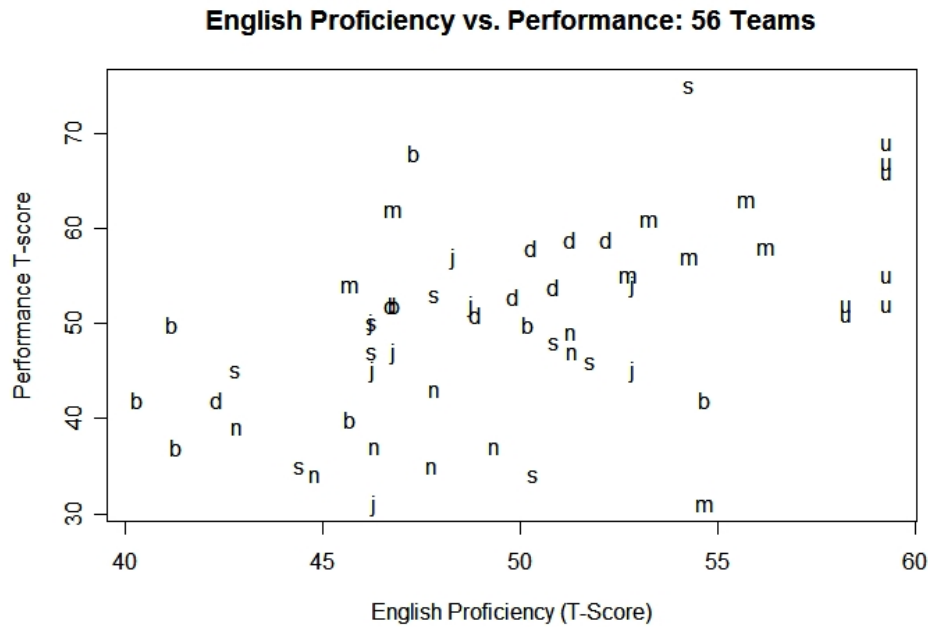
Figure 10: English proficiency of each of 56 teams grouped by national composition. Adjusted T-scores (Mean=50, SD=5.09). Key: Bulgaria (Bu), The Netherlands (NL), Norway-senior age (No.s), Norway-junior age (No.j), Sweden (Sw), & the United States (US), Mixed culture (Mix). Boxplots are superposed on datapoints.

Figure 10 plots the 56 team English-proficiency mean adjusted T-scores grouped by national composition with box plots superposed on the culture groupings. As can be seen in Figure 10, the team-proficiency distributions varied considerable by national composition. The Bulgarians had the least English proficiency as a group and the Americans the most. The mixed-culture teams, in particular, are relatively proficient.

## 6.3 English Proficiency & Performance Relationships

Nations with more proficiency tend to perform better than nations with less proficiency. This is consistent with the overall correlation of composite English proficiency with performance for the 56 teams which is shown as a scatterplot in Figure 11.





**Figure 11: English proficiency versus performance of the 56 teams. Points are coded for national composition of the teams: b: Bulgaria, d: Dutch (The Netherlands), j: Norway(junior teams), n: Norway(senior teams), s: Sweden, u: United States, m: mixed.**

#### 6.4 English-proficiency-adjusted performance

The positive linear correlation between English proficiency and performance can be used to remove the effects of experience and leave us with an “English-proficiency-free” measure of performance. The procedure is the same one used in extracting the age-free performance and gaming-experience-free measures. Since the proficiency scores are also the predicted performance scores in the multiple regression of the 3 proficiency sub-scales with performance, the residual “errors” formed by subtracting predicted performance from actual performance are then simply performance scores less the effects of English proficiency. These residual performance or proficiency-free scores, as residuals, have a mean of 0 (by design) and an SD = 8.70. By adding 50 to all the residuals, we obtain a distribution with mean=50 and SD=8.70 --- a distribution of English-proficiency-free adjusted performance T-scores. These are shown in Figure 12, and to make comparisons easier, alongside the original performance scores.

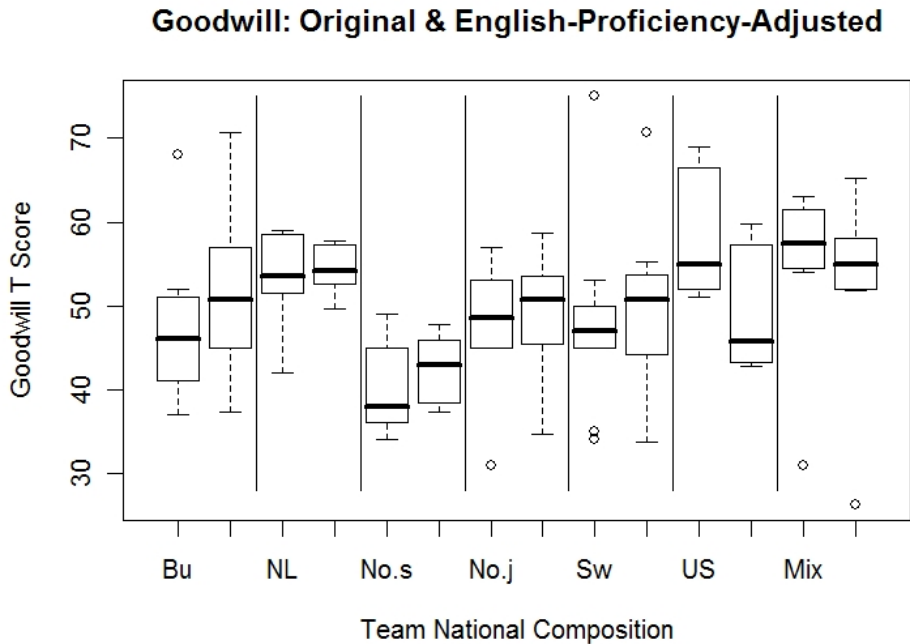


Figure 12: Team performance BEFORE & AFTER adjusting for English proficiency. Original scores on left & adjusted scores on right within culture sub-panels.

As can be seen in Figure 12, removal of the positive effect of English proficiency tends to equalize the performance of the teams considered as cultural groups. The performance of the Bulgarian and senior Norwegian groups have been adjusted upwards since they had relatively less English proficiency than the other groups. The relative performance of the American and Mixed-culture groups is adjusted downward since they tended to have the most English proficiency as groups. This pattern is similar to that found for gaming experience although the magnitude of the adjustments is less since the correlation of performance with English proficiency is less that with gaming experience.

### 7.0 ANALYSIS: AGE, GAMING & ENGLISH COMPOSITE EFFECTS

In the previous sections, the effects of age, gaming experience, and English proficiency on performance were assessed individually. In each case, a single effect was subtracted from overall performance to yield performance scores free of any effect of the specific chosen factor. But the resulting performance scores, although free of the effects of one confounding factor, still contain effects due to the other confounding factors.

In this section, the compound effect of all three confounding factors acting together are assessed and these compound effects are then subtracted from the original performance scores. The result is a measure of performance that is free of any effects of all three confounding factors acting simultaneously. As discussed below, these metrics are not independent of each other and have high intercorrelations.

### 7.1 Best-linear confound-free game-performance metric

As was the case for age, gaming experience, and English proficiency assessed individually, I used simple linear multiple regression to find the best composite linear predictor of performance and which thus has the maximum correlation with performance. An intercept term was allowed for a better fit.

As before, *the predicted performance scores also serve as the composite English-proficiency scores*. The resulting linear correlation of the aggregate confounding factors and performance yields a “grand” correlation of  $r(54) = .6352$  ( $t(54)=6.04, p=1.4E-7$ ) and accounts for 40% of the variance in performance compared to 15%, 25%, and 29% for age, English proficiency, and gaming experience respectively treated individually. As previously noted, a prediction equation accounting for 40% of the variance would normally be considered poor. But in this case it indicates a moderate effect of the combined confounds on performance---and again, the weaker the effect the better.

### 7.2 Scale intercorrelations

The grand confound composite scores and the sub-components of age, gaming experience, and English proficiency correlate to varying degrees with each other and also with the overall performance (goodwill) metric. Table 1 shows these correlations based on the scores of the 56 teams. To better assess the strength of association, Table 2 presents the squares of these correlations. Column 1 is of particular interest as it summarizes the variance of the performance scores accounted by the confounding factors singly and in grand combination. The factor accounts for less than the sum of its three components since the component confound are themselves intercorrelated. Of note is the large negative correlation of gaming experience and age ( $p < .001$  as are all first-column correlations). Also of interest is the insignificant correlation of English proficiency and age.

**Table 1**

**Grand Inter-Correlation of Confounds & Performance Based on Mean Scores of 56 Teams**

<i>Scale</i>	<i>Gdw</i>	<i>G.Exp</i>	<i>English</i>	<i>Age</i>	<i>Grand</i>
Goodwill	1.00	.54	.50	-.39	.64
Gaming Experience	.54	1.00	.43	-.53	.85
English Proficiency	.50	.43	1.00	-.15	.79
Age	-.39	-.53	-.15	1.00	-.61
<b>Grand Composite</b>	.64	.79	.85	-.61	1.00

Critical value:  $r(54) = .263, p=.05$ ;  $r(54) = .341, p=.01$

Table 2

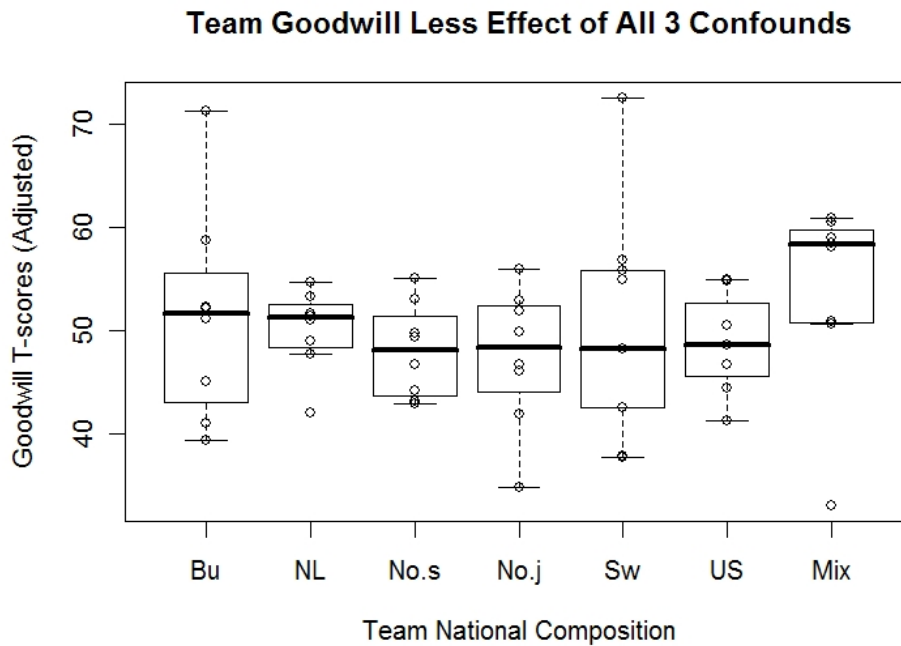
Performance Variance Accounted By Confounds Based on Mean Scores of 56 Teams

<i>Scale</i>	<i>Gdw</i>	<i>G.Exp</i>	<i>English</i>	<i>Age</i>	<i>Grand</i>
Goodwill	1.00	.29	.25	.15	.40
Gaming Experience	.29	1.00	.18	.28	.72
English Proficiency	.25	.18	1.00	.02	.63
Age	.15	.28	.02	1.00	.37
<b>Grand Composite</b>	.40	.72	.63	.37	1.00

### 7.3 All-Confounds adjusted performance

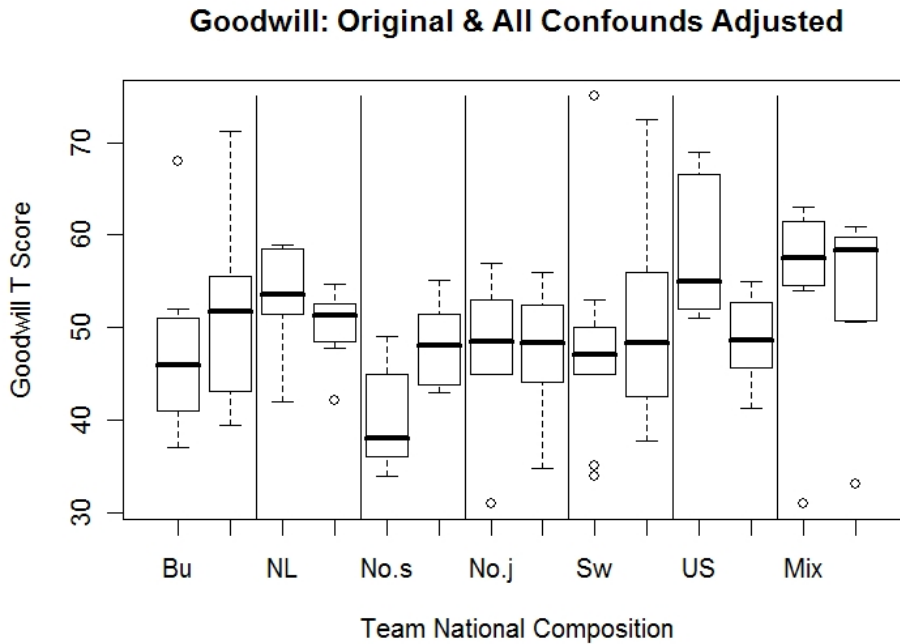
The linear relation between the grand composite confounds “factor” and performance can be used to remove the effects of all three confounds and leave us with a “confound-free” measure of performance. The procedure is the same one used in extracting the previous individual confounding factor effects.

The residual “errors” formed by subtracting predicted performance (using the grand confound factor as the predictors) from actual performance are then simply performance scores less the effects of all 3 confounds. These residual performance or confound-free scores, as residuals, have a mean of 0 (by design) and an SD = 7.87. By adding 50 to all the residuals, we obtain a distribution with mean=50 and SD=7.87 --- a distribution of confound-free performance adjusted T-scores. These are shown in Figure 13, and to make comparisons easier, again in Figure 14 alongside the original performance scores.



**Figure 13: Game-play performance less effects of all 3 confounds (Adjusted T-scores, i.e., Mean = 50, SD = 7.87) for each of 56 teams grouped by national composition. Key: Bulgaria (Bu), The Netherlands (NL), Norway-senior age (No.s), Norway-junior age (No.j), Sweden (Sw), & the United States (US), Mixed culture (Mix). Compare with Figure 3. Box plots superposed on culture groups.**

As can be seen in Figure 13, removal of the composite effect of all three confounds tends to equalize the performance of the (non-mixed) national teams considered as cultural groups. In fact, the central tendency of all six national groups is virtually the same (although there are differences in the within-group variabilities). It is interesting that the mixed culture teams as a whole now are at a performance level noticeably above the national groups. Possible reasons for this are considered in the Discussion section.



**Figure 14: Team performance BEFORE & AFTER removal of effects of all 3 confounds. Original scores on left & adjusted scores on right within culture sub-panels.**

Figure 14 shows that the biggest group-wise adjustments are those for the Bulgarian, senior Norwegian, and American groups. The performance of the Bulgarian teams *as a whole* have been adjusted upwards since they had relatively less English proficiency and game experience than the other groups. The performance of the senior Norwegian group also has been adjusted upwards primarily due to compensations for age and lack of game experience. The downwards performance adjustment of the American teams reflects compensation for native English proficiency and considerable computer-game experience.

The boxplots in Figures 13 and 14 visually, and the previous discussion in words, emphasize the relative positions and shifts of position for the national groups *considered as wholes*. That was deliberate as I wanted to focus on the general positions and shifts of the cultural groups as wholes. But we know from the outliers and other factors that not all teams within a national group conform to the pattern of their parent nation. A case in point is the particular Bulgarian team which was second in overall performance both before and after the removal of the three confound effects. This is clearly seen in Figure 15 which plots the before and after confound-removal goodwill performance of all the 56 teams. In Figure 15, vertical distance from the main diagonal indicates whether a particular team was moved upwards or downwards in performance after removal of the confound effects. Notice that some teams that were above the mean in original performance (indicated by the horizontal line) have been shifted to be even more above the mean after adjustment for confound effects. And as already pointed out for one Bulgarian team, some teams are shifted in the opposite direction from that of their parent group as a whole.

Team Performance BEFORE & AFTER Removal of 3 Confounds

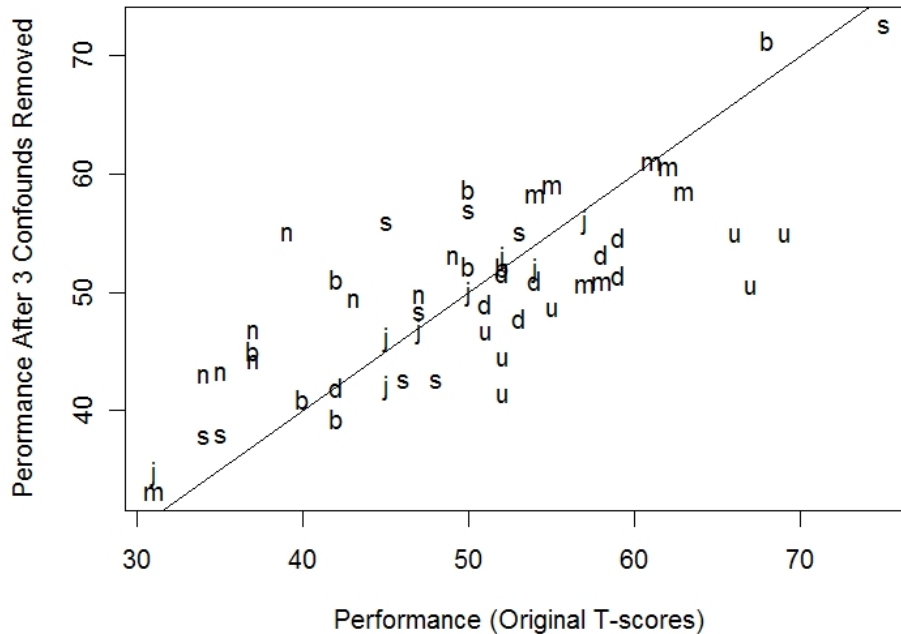


Figure 15: Scatterplot: Team performance BEFORE & AFTER removal of the effects of the 3 confounds. Vertical distance from main diagonal indicates amount of adjustment.

Both the parental group tendencies and the idiosyncratic behavior of individual teams have significance for recommendations and need to be further discussed.

## 8.0 DISCUSSION

It is reasonable to expect communication to be crucial for team members conducting a complex military task such as searching for hidden weapons in an urban environment. It is also reasonable to presume that effective communication should be easiest for people who share a common culture.

Hence, the principal hypothesis explored by the NATO RTO HFM-138/RTG study group was, as stated in the Introduction: *Homogeneous-culture teams (i.e., teams whose members are all from the same nation) perform better than mixed culture teams (i.e., teams whose members are from different nations).*

The hypothesis suggests an experimental design with a between groups factor, “Type of Team,” with just two levels, namely, teams with a homogeneous culture and teams with a mixed culture. The hypothesis does allow us to “nest” sub-levels comprised of specific national compositions within the homogeneous culture level and thus allow for national differences to emerge. But the homogeneous culture teams, as a whole, are still expected to perform better than the mixed-culture teams.

As shown by Figures 1 and 3, the results were contrary to expectations: performance was not a simple

function of team culture composition. Indeed, homogeneous-culture teams were not generally better than mixed-culture teams.

## **8.1 Questions raised by the results**

What can account for the results? One possibility is that there were sources of non-random non-systematic variation between teams other than national composition. That this is the case is illustrated by Figure 2 which shows the profiles of the 56 teams with respect to age, English proficiency, and computer-game experience. The national and mixed teams exhibit clusters that are correlated with these factors.

The purpose of the current analysis was to assess the effects of these three confounding factors singly and in combination. A second purpose was to examine the results after the removal of the effects of the confounds. A number of questions can be asked:

- How strong are the confound effects and what are their relative importance?
- Since some effects were anticipated, why were the teams not better matched or the factors included in the design of the experiment?
- What accounts for the superiority of the mixed teams after the confound effects are removed?
- How can regression and ANCOVA be used for living with confound problems?
- What are the implications of the existence of the confounds?
- Irrespective of confounds, what makes some teams better than others?

## **8.2 The confound effects & their strengths**

As shown in the first columns of Tables 1 and 2, the correlation of age and performance is negative and accounts for 15% of the variance. Next in strength is English proficiency which accounts for 25% of the variance. The strongest single effect is that of computer game experience which accounts for 29% of the variance by itself. All together, and due to the interactions among the three confounding variables, they account for 40% of the variance in performance.

The relationship of English proficiency to performance is not unexpected in a game permitting English-only communication. However, the 25% associative strength is not overwhelming and attests to the relatively high levels of English proficiency exhibited by the European participants. In fact, some of the 25% associative strength of English may be due to the 18% variance shared by English and computer-game-play experience. Hence, the “true” advantage of English proficiency might even be less.

The “contribution” of age to performance appears to be due almost entirely to its high negative correlation with gaming experience ( $r=-.53$ ). The older generation has less computer-game experience than the younger generation. Interestingly, English proficiency and age are weakly and negatively correlated ( $r=-.15$ , not significant). Hence, any discussion of the implications of gaming experience to performance must keep the relationship of age and gaming experience in mind.

The most important confound that emerges is that of computer-game-play experience. It is not the only factor which must be considered since the impact of all three confounds taken together (40%) does exceed the impact of game experience by itself (29%) by 11%. But as a single factor, it can be expected to have an effect on performance in other computer-oriented tasks regardless of the language being used (even if no English is



used whatsoever).

### **8.3 Why not use matching, counter-balancing, or factorial crossings?**

Given that the effects of English proficiency and computer-game experience were somewhat anticipated, why were these variables not deliberately counter-balanced, varied factorially or at least matched in sample selection? This is not really a question of hindsight. The simple answer is that the subject pool (NATO officers matched in rank with reasonable English proficiency) is already highly limited. Adding other constraints such as certain levels of computer-game experience would greatly diminish an already scarce resource.

Even if a large pool of people were available, another problem, as the Analyses sections show, is that metrics for English proficiency and computer-game experience are determined after the fact from questionnaires administered after people have agreed to participate. No one single question or demographic datum (such as age) can provide the necessary information on which to match people or assign them to groups in a factorial design. Assuming a large enough subject pool exists (which is not the case), some metrics for English might be argued to exist (such as scores on a standardized test of English). But there is today no largely available and universally accepted computer-game-play scale which many people would already have taken and which could be used for pre-selection or factorial assignment purposes.

Even if such a readily available gaming-skill scale existed and people's skill levels known prior to participation, there is still a major barrier impeding the assignment of participants to an elegant experimental design: If we need teams of, say, four people with certain characteristics, we schedule six people to be prudent. However, all too often just three report for the experiment! This frustrating problem of “no shows” is endemic to team research and is independent the size of the available population.

Given this problem, it is remarkable that we were able to obtain 224 officers to from 56 intact teams for the experiment.

### **8.4 Confounds, regression techniques, & ANCOVA**

Military teams are made of bright, creative, and well-trained individuals. When the team performance we are interested in researching is to be relevant to the real world, we must use complex scenarios and tasks which permit innovation and unpredictable behaviors to emerge. Further, when the teams may be geographically distributed and be comprised of members from multiple nations, confounds will be real, significant, omnipresent, and inescapable.

The researcher's task becomes not how to avoid the confounds, but rather how to gather useful information in spite of them. Since matching, counterbalancing, and factorial-crossing are not possible, we have a powerful ally in two statistical techniques: regression and the analysis of covariance (ANCOVA). ANCOVA itself is a combination of regression and analysis of variance. It capitalizes on the linear correlation of “covariates” with the dependent variable to eliminate systematic variance due to the covariates and thereby to reduce the within group error variance (Stevens, 2002).

Similar to analysis of variance, the focus is on the assessment of differences among means. Also similar to analysis of variance, ANCOVA requires that certain assumption be met. According to Stevens (2002, p. 347), ANCOVA rests on the same assumptions as ANOVA plus three additional assumptions concerning the regression aspects: (1) Linearity between the dependent variable and the covariates; (2) Homogeneity of the

regression lines, planes, or hyperplanes (depending on the number of covariates); and (3) That the covariates are measured without errors. According to Stevens, violation of the assumptions is serious. Used properly, ANCOVA is a powerful and sophisticated technique for dealing with confounds.

However, I chose to use regression techniques without ANCOVA for a number of reasons. The relatively small number of values (7 to 9) for a relatively large number of national groups (7) means that the population estimates based on the samples may have large amounts of error associated with them. The sample sizes make use of exploratory data analysis (EDA) techniques more appropriate. Another reason is that the strict assumptions of ANCOVA, such as homogeneity of regression variance and error-free measurement of the covariates, were unlikely to have been met.

In addition to the technical reasons, a key reason for not using ANCOVA in the current analysis is that the focus here is not just on differences among means, but on comparing the full distributions within and among the national groups. Differences in the variances and skews of the group distributions are as great of interest as differences in central tendency. Especially with such small national group sizes (7 to 9), attention to the presence of outliers is crucial to proper assessment.

But the point here is that both techniques, ANCOVA and exploratory regression, can be powerful allies in studying team performance in complex situations in which confounding variables are manifold and rampant.

### **8.5 Why are mixed teams superior after de-confounding?**

Figure 13 shows that the mixed teams, as a group, are superior to the homogeneous-culture groups after de-confounding. Indeed, Figure 13 shows that the median de-confounded performance score is above the 75th percentile of each of the distributions of all the other national groupings after de-confounding. This is exactly the opposite of what was expected.

Since the rationale behind the hypothesis (that communication is critical and that same-culture teams would have better communication) is still cogent, I will risk three speculations. Two are related and arise from the methodology and the third relates to possible consequences of group diversity.

The current analysis examined three possible confounds, namely, age, English proficiency, and computer-game experience. It is possible that yet two more confounds exist due to a procedural difference in the way data was collected for homogeneous culture versus mixed-culture teams:

Homogeneous-culture teams were geographically co-located and were tested in their respective home nations in the same building and often in same laboratory suite. Mixed-culture teams were geographically distributed (one person each in their home nation) and were tested over the Internet. Although all players were tested in their own cubicles and only communicated by keyboard during game play, same-site players were briefed together at the start of testing and could interact during breaks and lunch, whereas distributed-site players necessarily took their breaks and lunch apart from each other. Same-site players were instructed to not discuss the game/experiment during their breaks, but there was no way to monitor this. Further, some same-site players knew each other by virtue of working at the same site, whereas no distributed-site players knew each other before (or during) the game.

Hence, I speculate that

- Distributed-play with strangers over the Internet sets up an atmosphere engendering a sense of

seriousness of purpose and professionalism greater than that which might exist for colleagues playing at the same site.

- Since the distributed-site strangers are known to be from other nations, such a game environment might foster a sense of duty to perform at one's best out of national pride.

I emphasize that these two items are about increases in seriousness and motivation based on national pride. There is no suggestion here whatsoever that the homogeneous teams lacked seriousness or professionalism. Indeed, one of the reasons for using immersive role-play problem-solving games for research is that their very nature engenders a strong desire to perform well.

Although these putative two procedural confounds are almost untestable, they can be mitigated against in future research by testing all players over the Internet in different buildings even when they are from the same site. The identities of same-site players can be kept from each other as well.

Yet one more possible non-procedural reason for the superior performance of the mixed teams is that:

- Strangers, especially those from different nations, are likely more diverse in their backgrounds and training with respect to problem solving than team members from the same nation and even place of work. This greater cognitive diversity of the mixed teams might lead to better decision making.

The facilitating effects of group diversity on decision making are based on many studies. See Surowiecki (2004/2005) for a popular review whose title *The wisdom of crowds* captures the essence of the effect.

## 8.6 Implications of the existence of confounds

Statistically removing the effects of some confounds from the data sets does not remove the reality of the effects of such variables such as age, computer-game experience, and English proficiency on performance. Age and gaming experience differences are real. Language differences are real. And distributed operations using mixed-nation teams are real.

The current analysis does not suggest avoidance of, or “work-arounds” to, the confounds. Rather it calls for an awareness of their presence and effects so that their consequences may be consciously taken into account in team-formation, team training, team operations, and team performance assessment.

For example, tomorrow's military recruits are today playing multi-player computer games over the Internet with team members they have never met face-to-face in contradistinction to the recruits of yesterday. The skill sets and mind sets of these recruits must be taken into account and capitalized on.

## 8.7 What makes some teams better than others?

The removal of confounding effects erases differences *between* the national groups, but it does *not* remove differences *within* national groups. As can be seen in Figures 13 and 14, there is still considerable variability among the 56 teams in overall goodwill performance.

Possible motivational and team diversity reasons for the differences have already been discussed. What has not been discussed are the variables explored in the main report of NATO RTO HFM-138/RTG (2008). These include quality and quantity of mission planning, quantity of communications, quality of communication content, team organization and assignment of sub-tasks, and team situation awareness. All these variables remain pertinent to our need to understand why some teams perform better than others. Age, computer-game

experience, and English proficiency are just a part of what differentiates teams.

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## Using a Computer Game for Research on Culture and Team Adaptability: Lessons Learned From A NATO Experiment

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### **ABSTRACT**

In order to investigate the performance of mixed- versus homogeneous-culture military teams, the NATO RTO Research Task Group, HFM-138/RTG on Adaptability in Multinational Coalitions conducted an experiment using a complex, but very absorbing and immersive, computer-based role-play game using a modern urban search-for-contraband scenario. Game-play required planning, resource allocation, situation awareness, communication, and coordination for successful performance. This paper briefly describes the experiment and its results prior to discussing the lessons learned in conducting the experiment. It focuses on practical methodological and logistical implications for future research on culture and teamwork using computer games in general. It also considers deeper issues in hypothesis generation, scenario and task definition, experimental design, data analysis, and results presentation and communication.

### **1.0 THE NATO RTO HFM-138/RTG COMPUTER GAME EXPERIMENT**

Good communications is crucial for (possibly geographically distributed) team members conducting a complex military task such as searching for hidden weapons in an urban environment. It is reasonable to presume that effective communication should be easiest for people who share a common culture. Hence, the NATO Research and Technology Organization (RTO) Human Factors and Medicine Panel Research Task Group on Adaptability in Coalition Teamwork (HFM-138/RTG) conducted an experiment entitled “Leader and Team Adaptability in Multinational Coalitions (LTAMC)” to investigate the performance of mixed-versus homogeneous-culture military teams. Before we can discuss the lessons learned from this experiment, we need to briefly review its hypothesis, methods and principal results. For a more detailed treatment, see NATO RTO HFM-138/RTG (2008).

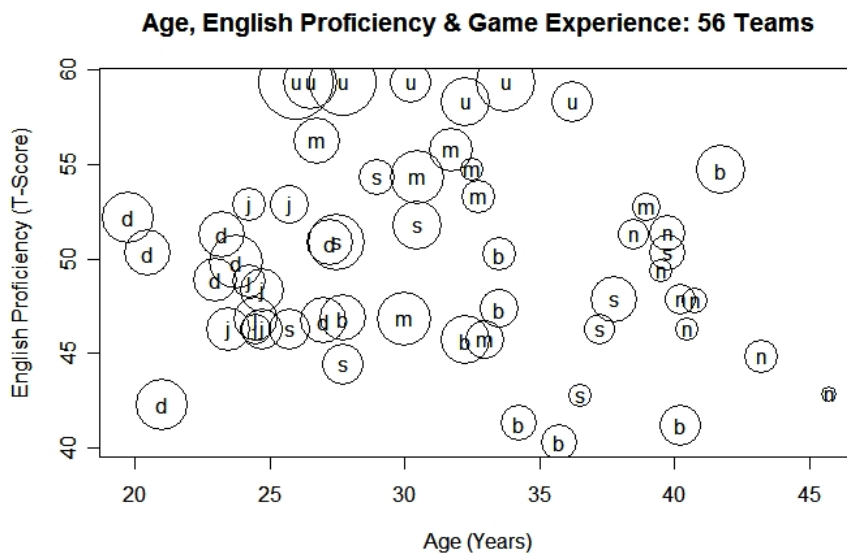
#### **1.1 Hypothesis & Scenario**

The principal hypothesis was that teams whose members are all from the same nation perform better than teams whose members are from different nations. The experiment utilized a complex, but very absorbing and immersive, computer-based role-play game using a modern urban search-for-contraband scenario specifically tailored for this NATO experiment [Leung, Diller, & Ferguson, 2005; Warren, Diller, Leung, Ferguson, & Sutton, 2005] which required planning, resource allocation, situation awareness, communication, and coordination for successful performance. Good performance also required maintaining the good-will of the local “populace” (i.e., computer-generated characters) who could provide useful or misleading information to the search team.

## 1.2 Participants

The experiment involved 56 four-person teams (224 military officers in all). In 48 of the teams, all four team members were from the same nation; in 8 of the teams, the four members were from different nations. For experimental design purposes, we have 7 national groups of 7 to 9 teams each: Bulgaria (8 teams), The Netherlands (8 teams), Norway-senior (8 teams of senior officers), Norway-junior (8 teams of junior officers), United States (7 teams), Sweden (9 teams), and Mixed nationality (8 teams).

Within each team, the members had to be no more than one rank apart. Although there was no age requirement, the rank constraint meant that team members were of comparable ages. The computer game-play was all in English and all communication was by keyboard. Hence, all participants had to have met a NATO-required level of English proficiency and a reasonable, but unspecified, level of computer experience. Post-play metrics of English proficiency and game experience were developed from responses to pre-game questionnaires. The resulting national, age, English proficiency, and game experience profiles of the 56 teams are shown in Figure 1.



**Figure 1: Demographic profiles of the 56 teams. Game experience is proportional to bubble size. Letters indicate national composition of the teams: Bulgaria (b), The Netherlands (d), Norway-senior age (n), Norway-junior age (j), Sweden (s), United States (u), mixed culture (m).**

## 1.3 Procedure & Metrics

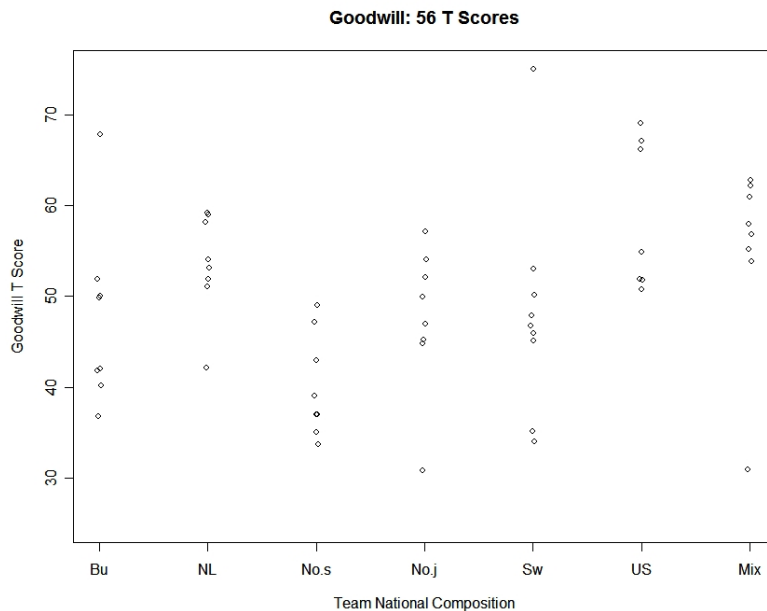
Each team member was seated at a computer terminal. Same-nation players and were visually and auditorially shielded from the others at a site in their home nation, mixed-nation players played in their own nation over the Internet. After two to three hours of training and a break, players were briefed on their mission and engaged in a planning session before actual game-play proper. The main team task was to amass as many ‘goodwill’ points as possible. Points were primarily earned by finding weapons caches and lost by angering the local populace or by opening empty crates.

Since game-play and communication was by keyboard, every keystroke was available for analysis. During the game, there were probes from a “superior officer” to determine situation awareness at

three different times. The primary dependent variable was the amount of goodwill points earned by the team. (Since team members could specialize such that a communications officer would not find any caches and a sensor operator might find several, individual scores are meaningless.) Other performance measures include the amount of communications and the degree of situation awareness.

### 1.4 Selected Results

Figure 2 shows the value of each team on the main performance metric (T-score of goodwill points) grouped by team national composition. It is clear that the mixed-nation teams are mostly in the upper-half of the performance distribution contrary to the hypothesis.



**Figure 2: Team “goodwill” performance T-scores (Mean = 50; SD = 10) for each of the 56 teams grouped by national composition. Key: Bulgaria (Bu), The Netherlands (NL), Norway-senior age (No.s), Norway-junior age (NO.j), Sweden (Sw), United States (US), Mixed-nation (Mix).**

## 2.0 LESSONS LEARNED

As the previous section suggests, the NATO RTO HFM-138/RTG experiment is conceptually simple but very complex with respect to methodological aspects such as the role-play game itself, details of the scenario, and a team’s task and options. The experiment was also complex logistically both within a session and throughout the entire experiment. In conducting the experiment, we learned numerous lessons within the broad categories of conception, the game itself, methodology, logistics & execution, and analysis.

### 2.1 Concepts, Hypotheses, & Theoretical Issues

This experiment used a complex computer game to study adaptability in multinational coalitions. This is appropriate due to the inherent and pronounced immersive quality of such games, but also due to the fact that tomorrow's military recruits are growing up playing more and more such games and developing computer and communications skills not typical of people from a generation ago. Questions about what make some teams more effective than others are difficult to answer in general, but differential computer experience adds a fresh and urgent dimension to these questions about team adaptability especially in multinational coalitions.

## **2.2 The Game & Its Characteristics**

As stated in Section 1.1, the game we used is based on a complex, very absorbing, and immersive role-play game, *Neverwinter Nights*. Using this game, BBN Technologies developed a general-purpose research tool termed SABRE (Situation Authorable Research Environment) (Warren et al. 2004). At the request of NATO HFM-138, Leung, Diller, and Ferguson (2005, also Warren et al. 2005) developed a modern search-for contraband scenario specifically tailored for this experiment. Both the general SABRE tool and the specific LTAMC scenario were extensively piloted and iteratively refined, and we learned numerous lessons in the development phase and the execution phase of the research.

- Features that permit creativity, variant behaviors: The game and task were chosen so as to permit a large degree of creativity and self-determination by the teams in how they would approach accomplishing their mission. But the more degrees of freedom given the teams and the more unstructured the task, the less control that the experimenter's have and the harder it is to interpret the various results. It should be noted that the experimental scenario was relative "static" in that there were no surprises or major incidents occurring during the game-play. The use of non-briefed events could certainly be introduced into the game, but we chose not to do so to maintain a degree of comparability in the experiment.
- Main tasks versus side quests: Although the scenario was relatively "static" as just discussed, there were some opportunities for teams to engage in "side quests" (such as helping a non-player character computer-generated girl search for a lost pet) which could garner goodwill points but which would take time away from the main task. Such side-quests do add realism and permit opportunities for non-routine decision making.
- Experimenter's viewpoint and used and unused game features: From the experimenter's viewpoint, the game can be very rich in decision making opportunities. However, a particular team might decline various opportunities or not be very creative and thus, as the game unfolds, the game can evolve into something less rich because certain avenues are not explored.
- Player's viewpoint: By observing the players and from their comments after the experiment, it is clear that the game succeeded in being immersive and absorbing. Players did not report trying to figure-out what the experiment was about, but rather quickly became fully engaged in the task at hand.
- Experimenter interaction/intervention possibilities: The underlying game (*Neverwinter Nights*) has a "dungeon-master mode" feature in which a game-master (or an experimenter) can have an invisible "avatar" (i.e., personal representative character in the game) which can interact with the game environment and other characters. We only used this feature on the rare occasions when a human player's avatar got "stuck" in a wall (there are occasional glitches since the software is very complex) to free the avatar without the human's awareness. One lesson learned is to be prepared for such events and to know how to deal with them.



- A related lesson for future research is that the dungeon-master mode can be utilized to introduce some player-action-contingent events into the game-play. For example, a door could be closed (by the unseen dungeon master) thereby trapping the human player until they radio for rescue by another player. Such in-game or in-line modifications require active monitoring and in-game intervention by an experimenter, but the possibilities are intriguing.
- Underlying & unused game features: Since the underlying game permits many behaviors which are not needed or allowed in a particular scenario (i.e., casting spells), it is important to prevent their accidental use by, for example, disabling the right-mouse button.

## **2.3 Methodology**

The game and LTAMC scenario we used is complex to learn and complex to play, but the permitted behaviors are manifold. This richness means that certain methodological aspects that are normally under an experimenter's complete control in a more traditional laboratory experiment are not-controlled or even non-controllable. Some methodological lessons we learned or special problems we encountered in conducting the study are:

### **2.3.1 Participants**

- Incomparability of subject pools: When participants come from multiple countries, it is very difficult to be sure that the subject pools are comparable. For example, a junior officer in one country might be considered a student in a second country and hence not in the pool of the second country.
- Size of subject pool: In spite of the size of many militaries, the pool of available participants can be surprisingly small. Military officers, in particular, are busy people and often have critical jobs from which they can not be spared for a block of 4 to 6 hours. When constraints are placed on the characteristics of an entire team, such as requiring a certain age range, the effective size of the pool can, and does, shrink drastically.
- Representativeness of participants to intended application: Military officers have specialized occupations and some of these are not interchangeable. A medical officer cannot be expected to perform the work of a pilot. When the pool of possible participants is small, allowance must be made to permit more people to qualify for the experiment. Unfortunately, this means that the relevance of the results to the target population could become compromised.
- Team formation: Within a country and within the same research site, some individuals might know each other and some might be strangers. But teams whose members have a common past history can be expected to function differently than teams whose members are strangers. A background question about prior knowledge of or experience with other team members should be included along with the demographic questions.
- Distributed "team" issues & considerations: When team members come from different geographic locations or even nations, there are special issues of team formation and identification with the team. This problem is compounded when the only interaction team members can have is via a keyboard. But, however cumbersome "introductions" and interactions might be among distributed teams, such teams are becoming more and more common.

- Non-player characters: The town populace was comprised of computer-generated “non-player characters” (NPC’s). The avatars of the human players could interact with the NPC’s via scripted question and answer sets. The NPC’s were programmed to make a variety of responses such as providing tips regarding the whereabouts of suspicious activity. But some NPC’s could lie (i.e., they were programmed to provide false information). NPC’s have great potential in general for research purposes. We see this area as needing more work, but one which can bring rich rewards especially as the NPC’s take on theoretically-based or empirically-grounded personality and cultural characteristics. The number, content, and veracity of messages should be addressed by any researcher.

### **2.3.2 Experimental Design**

- As discussed above, the pool of potential participants can be very small. Thus, it is imperative to use as efficient an experimental design as possible with respect to the number of necessary participants.
- The experiment must also be very efficient with respect to its time demands. Six hours makes it hard to get participants and also can be a strain on the participants. The total amount of time includes time for pre- and post-game questionnaires. These need to be kept to a minimum.
- Statistical Design, matched samples, controlled & uncontrolled variables: Another consequence of the limited subject pool is that there are few possibilities for matching subjects on extraneous variables or for assigning subjects to pre-specified levels in a factorial design on factors such as age. In a companion paper, Warren (2008) has argued that full experimenter control over all variables of interest in a complex experiment is not just difficult but actually impossible. However, this does not mean that the effects of the confounding variables such as computer-game experience, English proficiency, or other covariates cannot be assessed. Using analysis of covariance (ANCOVA) and other regression-based techniques, these effects can be measured and then be statistically partialled-out.

### **2.3.3 Procedures**

- The use of a computer game does not obviate the use of more traditional 5- or 7-point rating scales. We used both pre- and post-game questionnaires for obtaining such information as demographic data and personality and cultural profiles. But another feature that recommends use of the game is the occurrence of in-game probes. As mentioned earlier, on three occasions, a “superior officer” (wholly within the game), probed the participants with questions relating to their situation awareness. The use of in-game probes can be a powerful tool and is a supplement to the out-of-game questionnaires and the in-game situations (which are themselves tests).
- Training: different learning curves and times: There were two training phases, one in which individuals learned basic one-person actions such as moving forward, picking up objects, using a map, using one’s journal, etc., and a second phase in which an individual learned to communicate with others. People were permitted to complete basic individual-action training at their own pace. But this meant that people finished basic training at different times. Fast learners often had to wait a long while at an in-game waiting area while slower learners were still mastering basic skills. The in-game waiting area had amusing activities to keep people busy, but it could be a long time, and the amusement nature of the filler activities could contribute to a sense that the overall game was not a serious exercise.
- Training: proficiency criteria and removal concerns: Related to the problem of different people taking time to reach a sufficient level of proficiency is the question at what level to set the proficiency criteria.

Although this never occurred in the main experiment, we did have a case during piloting with non-military participants when one individual simply could not achieve sufficient skill to enable that experimental run to continue. Since this occurred during piloting, no time limit had been set, and this led to a boredom problem with the other three players. Of course, not only do such aborted sessions waste peoples' time, it can be costly in terms of money since (non-military) participants still have to be paid.

- Local testing issues: breaks etc. When testing was at one site, the procedure was to conduct pre-questionnaire completion, individual, and team testing phases before lunch. The planning and search phases were after lunch, but this raises the chances that some forgetting might take place. We now recommend that a short “refresher” training session occur after lunch.
- Distributed testing: time zones consideration: The mixed-nation testing was done over the Internet. But since the experiment spanned 6 time zones and could take 6 hours, the experiment began relatively early in the morning for the Americans and ended relatively late at night for the Europeans. The previous point's reference to “lunch” has to be modified, but the issue of the timing of breaks becomes even more important. Anything that lengthens the experiment, such as the above recommendation for a “refresher” training phase, must be carefully weighed against the effect of a long day on some people's performance.

## **2.4 Administration & Logistics**

- Subject scheduling issues: As discussed above, the size of the pool of possible participants was severely limited. One administrative difficulty that resulted from this was that of being able to schedule at least four people for a test day. It often took considerable effort on the part of the research team to locate and enlist the minimum of four people needed for a team.
- The difficulties were great enough that there were times when a session had to be canceled in advance due to either the inability to locate four participants or due to the advance cancellation by one of the volunteers. This again put a burden on the research team to contact the remaining volunteers.
- Even on days when four people had been scheduled, there was the all too common and exacerbating problem of a scheduled volunteer not appearing and thus forcing the cancellation of the session and the attendant loss of time of those who did appear for the experiment.
  - One technique for dealing with the problem of “no-shows” is to schedule more people than required. Due to our limited participant pool, this option was difficult to exercise.
  - Even if we had a large pool and could routinely “overbook” participants, overbooking does not guarantee that the required number of participants will show up. The reality of research on teams is that no-shows are all too common: If 6 people are scheduled for a four-person session, only three might show up.
  - But “overbooking” has its own problems. One problem is that if all show up for the experiment, some method has to be used to determine whom to dismiss and in such a way that the excused person is treated with respect and made to feel that their effort is still appreciated and not wasted.
  - In research without the need for a participants with highly specialized characteristics, one way to not waste any “unusable” participants who report for an experiment (either too few or too many) is to have alternate lower-priority experiments ready which can use whatever number of participants are available after due consideration for the needs of the highest priority experiment. However, this was not an option for us due to the small size of the pool of participants. Any

potential participants who could not be run even after they reported for the experiment needed to be asked to reschedule if at all possible.

- Scheduling a long experiment over an ocean: The mixed team portion of the experiment often required having an American and Bulgarian on the same team. Arranging for a short meeting across 5 or more time zones is hard, but arranging an experimental session that will take six or more hours means that the Europeans will be finishing quite late in their day and that the Americans will be starting quite early in their day. The definition of “lunch” break is thus relative and has to be taken into account when the potential participants are given details about what is being asked of them when they are solicited.
- Computer operators and local administrators: The above remarks about long experiments across an ocean also apply to the local computer operators and local experiment administrators who, by the nature of their responsibilities, must be present both before and after the participant session.
- Internet operators: The mixed team portion of the experiment also required the use of a knowledgeable team of SABRE experts and an internet operations center to “host” and coordinate the multi-site internet portion of the experiment. In order to ensure smooth operations and prevent loss of precious data, the internet operations had to be flawless. This required much advance preparation and testing of communication links and procedures. Although given scant mention in the experimental write-up and methods sections of the reports, this aspect of the experiment is crucial and required considerable effort.

## **2.5 Data Collection, Processing & Analysis**

The SABRE testbed features automatic data collection of both pre-game questionnaires and within-game activity and communications. SABRE also collates the data from the various individual team sessions and collates the data into large spreadsheet files for post-processing by various statistical packages.

- Although SABRE does provide some basic statistics, it was felt best to leave the main analyses to the various members of the experimental teams and the statistical packages they prefer. One reason for this is the large and diverse nature of the data recorded and the subsequent opportunities for post-experiment data mining. We believe that the datasets resulting from this experiment will yield rich treasures as we continue to mine them.
- With a data set resulting from the game-play and questionnaires of 224 participants, it is invariable that there will be some missing data. Since different analysts have different preferences for dealing with missing data, it is imperative that there be tight configuration management of the raw and early-processed data sets that are distributed to the various analysts. In turn, it is also important that the various analysts maintain their own processed-data file configuration management with full description of the decisions they made and the procedures they followed.

## **2.6 Drawing Conclusions & Making Recommendation**

In spite of running 224 participants, the resulting number of four-person teams was 56.

- Since our analyses are all team-centric, the conclusions are based on the relatively small number of 56 teams. As such, statistical power is weak and the conclusions must be taken with caution.

- Also, as discussed by Warren (2008), there are several confounds that also serve to temper our conclusions and recommendation such participant differences in age, computer-game experience, and English proficiency.
- However, the confounds are, to a large degree, unavoidable due to the complex nature of the participant populations. They are not deficiencies in the experimental design. Fortunately, there are statistical techniques such as ANCOVA and linear regression which can “partial out” the effects of the confounds and enable the drawing of confound-free conclusions.

### **3.0 FINAL COMMENTS & GENERAL QUESTIONS**

We have partial answers to what makes some teams perform well and others not so well. But, in general, much of what makes a team adaptable in a multinational coalition is still not fully understood. However, we believe we have demonstrated the value of using an immersive computer game to provide rich data sets to help provide such answers. As tomorrow’s military recruits become more and more experienced with complex immersive computer games than the recruits of yesterday, it becomes imperative that we study the possible impact of such experience on selection and training for tomorrow’s more computer-reliant military.

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<b>14. Abstract</b>	<p>Coalitions are the norm in today's global theatre of operations with future operations regularly consisting of multiple branches of military service, government and non-government agencies, and nations. Several decades of research have led to the identification of dimensions of culture that shape behaviour in both civilian and military settings. Depending upon the situation that a coalition team encounters, any cultural perspective could be useful. Needed are models, methods, and tools that support rapid development of effective teams comprised of individuals that: a) Understand their own culturally based biases and predisposition to action; b) Recognize the need to adapt to cultural diversity; c) Understand how to adapt; and importantly d) Choose to adapt. To address these requirements, an international team of military research scientists collaborated to study operational-level military teamwork. Field data were collected via questionnaires, observation, and semi-structured interviews on the impact of culture, organization, language, and other individual and group difference on teamwork at two Command Post Exercises in Italy and Portugal and at Allied Command Transformation HQ in USA. National resources were utilized in a complex, multi-national, distributed team laboratory experiment investigating information sharing, situation awareness, and performance on multinational teams. Findings from these activities are reported.</p>												







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