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ICT-enabled Evaluation of Intense Collaboration Capabilities

Peter Evdokiou and Rudi Vernik (Defence Science and Technology Organisation, AUS)

Abstract

The evaluation of Command and Control capabilities in support of teams engaged in intense collaborative activities such as planning can be problematic, particularly where these teams are distributed and supported by a range of Information and Communications Technologies (ICT). This article discusses these challenges within the context of experimentation activities undertaken within an Australian Joint Headquarters. An ICT-enabled evaluation approach has been trialed to address some of the inherent problems. A new integrated evaluation capability called TeamScope has been developed to support these types of evaluation situations.

Introduction

The ubiquity of ICT in modern C2 environments creates significant challenges for those involved in undertaking evaluations of C2 capabilities. These environments use a host of technologies such as video teleconferencing, collaboration tools such as text chat, and multiple personal and group displays. New types of integrated capabilities are emerging where technologies become more interwoven with human activities, and where technologies themselves are pushed into the backdrop of natural interactions (Vernik et al. 2003; Weiser 1991).

The work of C2 staff is also changing, both in terms of the dynamic nature of operational situations and in the intensity and complexity of the activities that they need to perform. For example, C2 teams

are often involved in multiple concurrent operations, must quickly understand and react to information provided by multiple sources, and must collaborate over distance with a variety of other people including subject matter experts, other operational components, and non-military agencies. These work settings clearly fit within the definition of intense collaboration which refers to the high level and frequency of interactions needed for initiating and sustaining joint action and mutual awareness, the flux of activities, the need to deal with uncertainly, and the complexities of the work situation which involves simultaneous discussion and tight coupling (Kumar et al. 2005).

The socio-technical nature of new and emerging C2 capabilities, together with the complexities inherent in today's C2 work settings, creates significant challenges for those responsible for developing and evaluating future systems. Traditional evaluation approaches based on direct observation and manual recording fail to account for the situational dynamics, particularly when dealing with geographically distributed teams. Moreover, the analysis of the vast amounts of multi-media data, such as video, often captured during evaluations is exceedingly time consuming and fails to capture some of the underlying and largely invisible technology-supported interactions that people have between themselves, the information they use, and their environments.

The intended contributions of this article are as follows: An Evaluation Reference Model is defined which provides a contextual basis to aid in establishing a common understanding of the concepts, challenges, and approaches that need to be considered when planning and conducting evaluations involving teams engaged in intense collaborative activities and supported by advanced ICT capabilities. Within this contextual framework, the article describes and discusses an ICT-enabled evaluation approach which takes advantage of the deployed ICT infrastructure as a means of dealing with a range of difficulties and challenges inherent in the evaluation of future C2

capabilities. A new evaluation system called TeamScope is described which supports the capture, analysis, and visualization of multimedia evaluation data during ICT-enabled Evaluation sessions.

The approach taken in this article is to first provide an example which encompasses the types of work settings and capabilities that are the focus of this article. The example is based on domain (or field) experimentation that was undertaken to evaluate new integrated collaboration capabilities in support of distributed war-gaming activities. The inherent challenges are discussed by way of a contextual model which defines a set of underlying concepts and related terminology. This is followed by a description of the ICT-enabled evaluation approach and a synopsis of the experiences in using the approach to date. TeamScope is then presented as a way of analyzing and using the wealth of data that can be captured using this approach. The article concludes with a summary of the work to date and thoughts for future work.

An Example – Distributed War-gaming

This section describes an evaluation activity that was undertaken to understand and evaluate how future systems might be deployed and used to support distributed C2 teams engaged in intense collaborative activities. This example is used to help set the context for the article and to aid the discussions. The focus of the evaluation was a new integrated collaboration capability called Braccetto which was developed and evaluated as part of a national R&D programme. An overview discussion of the Braccetto system is provided followed with a definition of the experimentation context for the activity and outline the approach that was taken, with a particular focus on the use of ICT-enabled evaluation.

The Braccetto System

Braccetto was a project conducted as part of a national R&D programme called the HxI Initiative (Vernik et al. 2007) which focused on ICT-Augmented Human Interactivity. This initiative was led by three of Australia's major publicly funded research organizations: Commonwealth Science and Industrial Research Organisation (CSIRO), Defence Science Technology Organisation (DSTO) and National ICT Australia (NICTA). The Braccetto project focused on enhancing the ability of teams to work collaboratively across a distance.

Braccetto developed new composable Collaborative Telepresence WorkStation systems (CTWs) that can be rapidly deployed and adapted to support teams engaged in intense collaborations (Schremmer et al. 2007). The CTWs comprise large multi-touch LCD computer-controlled displays which can be easily packed for fast transport and rapidly set up in various configurations and orientations as shown in Figure1. The Braccetto software infrastructure was based on DSTO's LiveSpaces Operating Environment (Phillips 2008) and included telepresence components from CSIRO and mixed presence groupware applications from NICTA. This provided a highly integrated system that supports team activities through the use of advanced telepresence services, coordination and collaboration services, and enhanced interaction services.

(a) **(b)**

Figure 1. Braccetto Composable Collaboration System (a) shows how the systems are deployed. (b) shows a Braccetto system set up for a particular task based on a combination of 4 interactive surfaces.

The LiveSpaces Operating Environment uses a distributed coordination and collaboration bus as a universal construct to manage events and information across the CTWs. This approach allows the rapid set up and deployment of a highly integrated capability using a range of off-the-self applications together with a range of LiveSpaces interaction and collaboration features such as LivePoint ubiquitous cursor control, screen forwarding, and the Sticker awareness, notification, and awareness service (Phillips 2008). LiveSpaces Meta Application services can be used to orchestrate and automate particular functions such as the initialization of the systems and can be used to provide automated multimedia presentations (Vernik et al. 2004). Of particular interest for this article, is the ability of LiveSpaces to automatically capture and provide a rich account of how people are interacting with the systems, contextual information such as what was displayed at particular points in time, and information on technology-enabled interactions between people through mechanisms such as chat.

Experimentation Context

Planning of military operations requires specialist teams of people engaged in intense collaborative activities, often to strict deadlines and constraints. The orchestration and synchronization of activities within and between multiple teams is particularly challenging, especially where several geographically distributed teams must work together towards common goals. One of the Braccetto domain experimentation activities studied the use of the CTWs as a basis for providing enhanced support for highly interactive and intense activities that form part of the planning process. The war-game is one of these activities. It plays a major part of the Course of Action Analysis (COA), and takes place after the Course of Action Development (COAD) and before the Decision and Execution phases. This activity requires teams of planners and domain experts to enact the plan in real time to test and improve the plan.

War-gaming is typically conducted using three teams: the red team representing the enemy and led by a red commander, a blue team representing the friendly forces and led by a blue commander, and a white team representing the adjudicators and coordinators of the war-game. The white team also includes Subject Matter Experts (SMEs) who, when required, provide valuable input in areas such as law, health, logistics, intelligence, engineering and the like. Given the intensity of this activity, war-gaming is traditionally conducted in a single geographic location with collocated teams, having direct awareness of each other's discussions and actions. The primary intent of the war-game is to tease out the issues and any unforeseen challenges in each of the selected COAs. However, this is not ideal since it is not always possible to have all the required people available at a particular geographic location.

Setup and Focus of Evaluation Activities

The main focus of the evaluation activity was to study the amount and type of workspace awareness information required by a distributed team of military planners whilst conducting an intense distributed war-game scenario with the support of advanced CTWs, groupware, and domain specific applications.

(Gutwin and Greenberg 2002) propose a descriptive theory of workspace awareness focusing on distributed teams supported by collaboration technologies such as groupware. The theory defines a three-part framework that defines elements of knowledge which relate to workspace awareness, perceptual mechanisms used to maintain awareness, and the ways that people use awareness in collaboration. The framework organizes and extends previous research on awareness. This theoretical framework was selected and used as the basis of the experimentation.

In the experimental setup the Blue and Red teams were operating from two separate locations within an operational headquarters. The White team was dispatched to operate at DSTO facilities some 1200 kilometers away. The Blue and White teams were set up with Braccetto CTWs and the Red team operated from a Command Battlelab, one of the LiveSpaces facilities that had been established at the headquarters as part of the Command TeamNets project (Vernik 2010). The establishment of the resulting networked collaboration environment was straight forward since both Braccetto and TeamNets are based on the LiveSpaces Operating Environment. Several tools and awareness capabilities were available to the teams including a real-time telepresence system based on Access Grid 2.1 video teleconferencing (AccessGrid 2010; Childers et al. 2000; Stevens et al. 2003), the Sticker web chat application (Fitzpatrick et al. 1999; Phillips 2008), a collaborative map-based war-gaming application called J-SWAT (Menadue et al. 2009; Millikan et

al. 2005), and a time-line tool and synchronization matrix developed using off-the self office applications. Figure 2 shows how the environment was arranged for the Blue Commander.

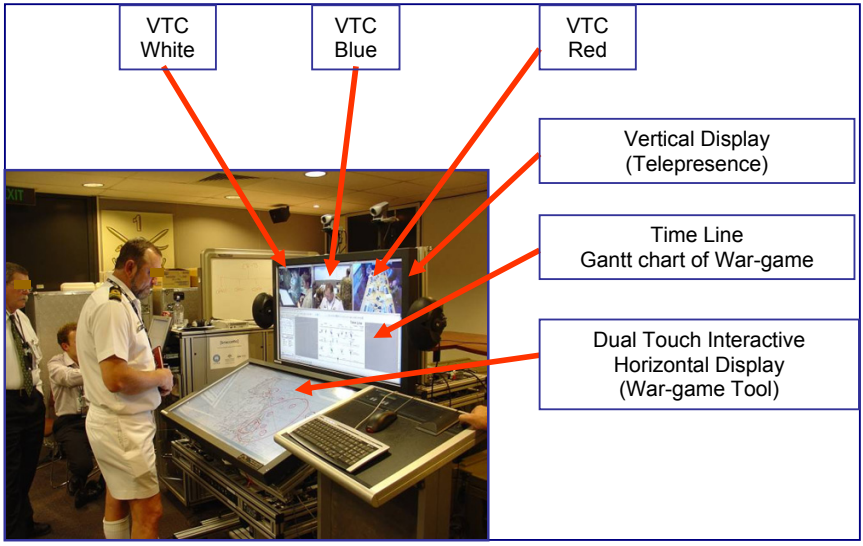

Figure 2. Set up for War-gaming Field Experimentation

As part of the set up, the LiveSpaces capabilities were used to instrument and capture a rich set of information on how the teams collaborated with each other, the information they were using, and their environments. Also, a LiveSpaces application was developed to allow analysts at the various locations to record their observations in relation to the data that was being automatically captured. This provided us with a preliminary ICT-enabled evaluation capability. Video capture was also used to provide additional information to the analysts. A set of questionnaires was developed and used to capture participant profiles and to support follow-up interviews of participants in relation to their workspace and team awareness based on the (Gutwin and Greenberg 2002) framework. This data was consolidated into the evaluation instrument shown in Appendix A. An enabling technology questionnaire was also administered to the

analysts. In addition to studying awareness aspects, two questionnaires were administered during the course of the activity to capture the impact of the new capabilities on group "flow" (Csikszentmihalyi 1990).

Given this example, a discussion of some of the more contextual and conceptual aspects is provided to help motivate and ground the ensuing discussions on ICT-enabled Evaluation.

Evaluation Contexts and Challenges

There is often considerable confusion about the question of evaluation. There are certainly many definitions and arguments about what evaluation is and what methods should be employed. In its broadest sense, evaluation is about "the systematic collection and analysis of evidence in order to improve understanding of and to make judgments about, the object being evaluated" (EvaluationWiki 2007). However, the "object" is not always easy to define. For example, is it a thing, a person, a system, or a combination of these? Also, the purpose of an evaluation is often unclear. People often talk about the need to evaluate a technology to see if it is fit for purpose. But, is it just the technology, or does the focus of the evaluation need to also consider associated work practices? And what about the criteria that assessments are made against? Are the criteria well understood, do they have any theoretical basis, and what evidence is required to be captured if judgments are to be made about the effectiveness of some new approach?

The types of situations and systems described in the Braccetto war-gaming example highlight the difficulties faced in undertaking evaluations of future C2 capabilities. The socio-technical nature of these capabilities, together with the situational complexities inherent in intense collaborative activities, particularly in cases where teams are geographically distributed, make evaluation difficult and problematic. However, failure to deal with these challenges will

have insufficient understanding and knowledge to make appropriate judgments about the way forward in relation to C2 capability development.

Previous versions of the Evaluation Reference Model shown in Figure 3 have been used to help define the context for evaluation activities in order to provide a common understanding of terminology, considerations, and challenges; particularly when dealing with R&D teams involving various research disciplines, technologists, analysts and stakeholders (Vernik et al. 2007). An updated version of the model has been included to help discuss the challenges of evaluating new C2 capabilities for intense collaborative activities and to motivate the need for new evaluation approaches such as the use of ICT-enabled Evaluation.

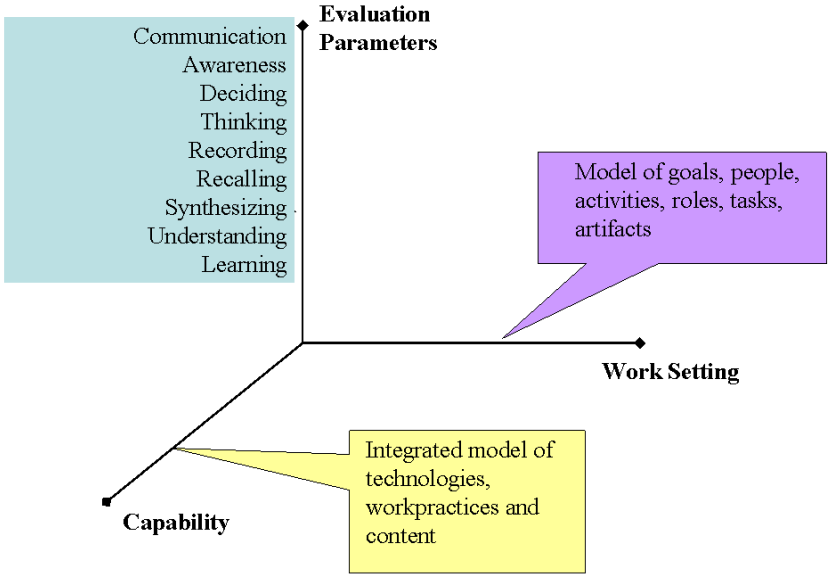

Figure 3. Evaluation Reference Model.

Individual technologies, in themselves, rarely provide advantage to people engaged in particular work activities. Most often it is a combination of technologies and work practices, together with appropriate access to required information (or content) that enhances a team's abilities to effectively achieve desired goals. In the Evaluation Reference Model shown in Figure 3, the term capability is used to define the "what" that needs to be evaluated. Capability defines the means by which users are supported within particular work contexts. This can include new tools, combinations of technologies, work practices, content, and even environmental factors such as lighting and furnishings.

Capabilities need to be considered in relation to particular work settings when addressing their utility and effectiveness. In Figure 3, a work setting is defined as a model of the goals, activities, roles, people, and tasks that define the work to be done. Ultimately, the use of capabilities within a work context needs to support the parameters or mechanisms of teamwork. Evaluation parameters help focus attention on the impact of introducing new capabilities, provide support for identifying what new capabilities might be required, support evaluation activities by identifying measurable attributes, and provide a basis for considering enhancement activities such as process improvement.

The evaluation parameters shown in Figure 3 are examples of teamwork mechanics which define the underlying cognitive and social aspects that need to be supported for effective teamwork, and include aspects such as communicating, understanding, reasoning, synthesizing, deciding, recording, recalling, and learning. Of course, there are many other parameters which need consideration for intense collaboration, particularly those that support human creativity such as visualization, invention, synthesis, imagination, insight, and problem-solving. Other parameters, such as those related to human experience in areas such as "flow" (Csikszentmihalyi 1990) are also important aspects to be considered. Although postulations can be made about a whole range of these types of parameters,

the argument is made that evaluations should be based on parameters that have a theoretic basis. For example, in the war-gaming evaluations, the particular interest was in the impact of Braccetto capabilities on distributed planning teams based on the provision of enhanced workspace and team awareness. As will be discussed later, the set of parameters evaluated were based on the theoretical foundations provided by (Pinelle et al. 2003).

There are particular challenges for those undertaking evaluations in situations where capabilities become an extension of human cognitive and social abilities and technologies become largely transparent to users. The situation becomes even more difficult where the activities being undertaken involve teams engaged in activities where the situational dynamics are such that people innovate and adapt their work practices and their supporting capabilities as a normal part of their tasks. For example, in the war-game evaluation, the teams could quickly adjust their level of awareness of other teams by adjusting the volume, size, and visibility of the telepresence displays. The use of touch screens allowed quick annotation of information displays i.e., simply using their finger as a drawing device, individuals could quickly add, adapt, and convey information to other team members and other teams. Moreover, the interfaces allowed rapid access to and display of required information, they could easily share the information displayed on their screens, and they could use multiple modes of communication including gesture, voice, annotation, and text chat.

Analysts and observers have a particular problem in these situations, especially when trying to get a holistic view of the entire activity, yet restricted to being at a particular location. The use of paper-based methods to capture information about teamwork mechanics is also problematic in that the information needs to be recorded within the context of the work setting together with an understanding of how the capability is being used. For example, if the team is deciding on a course of action, the information captured by the analyst needs to take into account what task was being performed, when it was

undertaken, what information was being displayed at that particular time in each location, how each member was interacting with the underlying system, and how the teams were interacting both through implicit and explicit communication. The capture of video footage for post-hoc analysis can help in this respect, however there are major challenges in synchronizing and analyzing and marking up video taken at separate locations. Moreover, video does not capture some of the important interactions that take place between people and the systems they use, or the autonomic support provided by systems on behalf of people.

ICT Enabled Evaluation Approach

The approach adopted in this article for addressing many of the evaluation challenges has been to use the underlying ICT itself as a way of supporting evaluation activities. For example, the LiveSpaces Operating Environment (LOE) was used to capture a rich account of the events that are taking place during an activity such as when new information was displayed, where it is displayed, who made the changes, and when it occurred. New LiveSpaces applications were also developed to allow analysts to readily capture, record and share their observations with other analysts involved in an evaluation activity (see Figure 4 and "Analyst 1" in Figure 5). This technique has been applied on several evaluations, both for collocated teams and for geographically distributed teams using LiveSpaces environments (Evdokiou et al. 2004). In this section the Braccetto war-gaming example will be referred to help describe the concepts and approaches of ICT-enabled Evaluation.

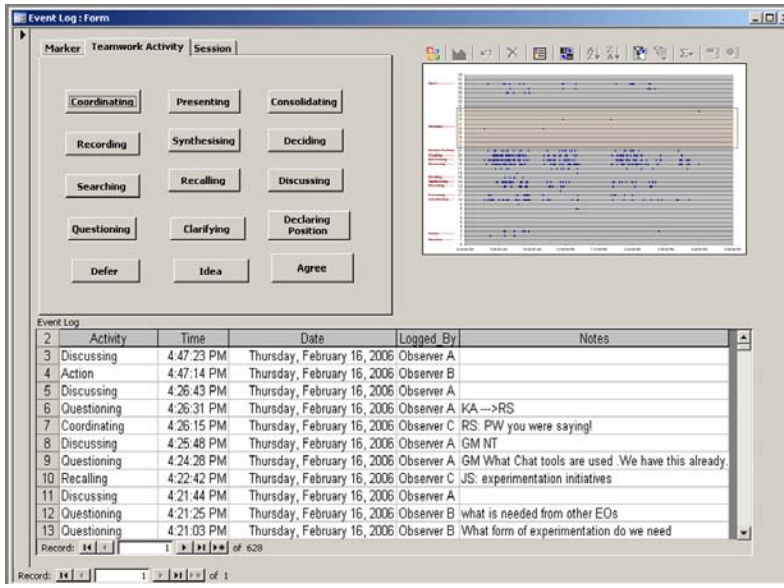

Figure 4. LiveSpace enabled Analyst Observation Tool

The setup of the ICT-enabled evaluation capability for the Braccetto war-gaming experimentation was based on the model shown in Figure 5. The approach exploited the LiveSpaces Operating Environment which uses a publish/subscribe information bus to support integration within and across each of the LiveSpaces enabled environments. This facilitated the capture and storage of information and events that were being published onto the LiveSpaces Bus. Figure 5 gives examples of the various types of information and events which are managed by the LiveSpaces infrastructure and which can be accessed to provide detailed accounts of how people are using applications, devices, information and how they are communicating with each other by way of electronic chat. This infrastructure also allows rapid development of additional applications and services. An Analyst/Observer application (as shown in Figure 4) was developed to provide the analyst with the ability to define and capture annotated time–stamped observations of interest, such as used in ethnographic and usability evaluation coding schemes.

In the Braccetto war-gaming example the coding scheme used was based on the awareness theory by (Gutwin and Greenberg 2002) and allowed analysts to capture observations such as explicit and implicit communication and when team members were undertaking particular activities such as deciding or recording results.

This approach allowed analysts to observe the situation unfolding and at specific points in time would select predefined buttons representing specific observations/codes of interest and hence generating time stamped events onto the LiveSpaces Bus for storage, recall, processing, visualization, and analysis. Analysts were able to view the observations made by other analysts in real time and within the context of other events captured automatically by the system, such as chat events speech to text processing events and the like. The information was also available for post-hoc analysis. Analysts could also define new un-anticipated codes of interest. Since the analyst applications were enabled by the LiveSpaces Operating Environment, they were able to be used across multiple federated LiveSpaces Environments thereby enabling it as a true distributed data capture capability.

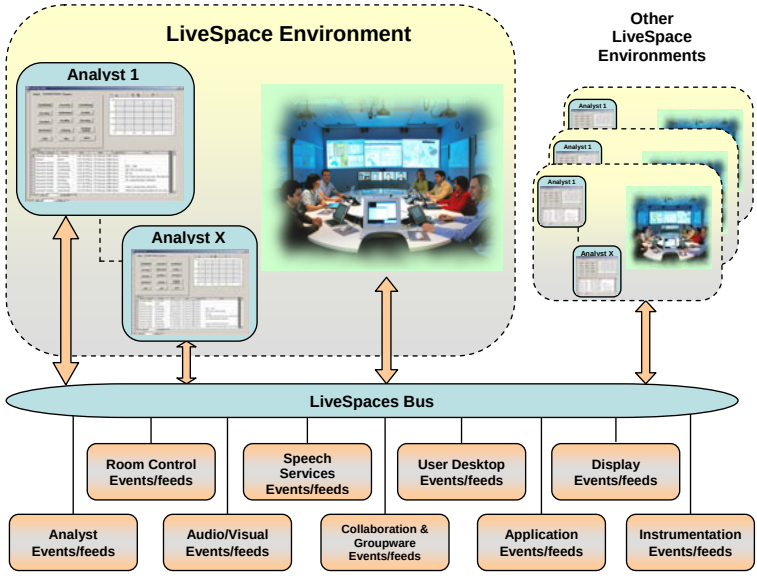

Figure 5. Setup of Initial ICT-enabled Evaluation Capability

One of the major problems with the initial approach was the lack of an effective capability for post-hoc evaluation, whereby various analyst inputs, system information, and video could be fused and used for analysis. This led to the definition and development of a new system called TeamScope.

TeamScope

The experiences and learned lessons in the initial use of ICT-enabled Evaluation highlighted the need for a comprehensive system for the synchronized capture/recall, analysis, and visualization of multiple sources of evaluation information, including audio/video feeds, systems data, analyst markup and notes.

There are several systems that provide support for data capture and evaluation activities. For example, Observer XT (Noldus 1991) is a professional event logging capability for the collection, analysis, and presentation of observational data. It provides many features over and above those used in the Analyst Observation Tool shown in Figure 4 such as the integration of individual web cam facilities. Anvil (Kipp 2001, 2008, 2010) is an open source video annotation tool which was originally developed for gesture research and is commonly used in various research fields including human-computer interaction, linguistics, ethnology, anthropology, psychotherapy, embodied agents, etc. Among other features, Anvil also caters for phonetic data such as speech transcription and can display waveform and pitch contours. Morae is a commercial product that is primarily intended for web-based usability testing and market research (Asselin and Moayeri 2010). There are many other tools that can aid analysts involved in particular evaluation activities. For example, (Rose 2007) provides an extensive survey of multimodal annotation tools and summarizes key differences among them.

TeamScope was specifically developed as a comprehensive system for the capture and analysis of collaborative teamwork, where the work setting could comprise a complex arrangement of both collocated and distributed teams. TeamScope is based on an integrated ICT-enabled evaluation approach which takes advantage of the deployed ICT infrastructure. For example, TeamScope was developed by using the underlying LiveSpaces Operating Environment infrastructure together with a client/server architecture, thereby enabling it to be used in various modes of operation such as in geographically distributed environments and standalone configurations.

TeamScope caters for synchronized distributed capture/recall, multimedia integration, analysis, and visualization of multiple sources of evaluation information including audio/video feeds, systems data, analysts' markup and notes. An important feature of TeamScope and the LiveSpaces Operating Environment is their integrated ability to utilize the captured and analyzed data in real-time and reflect

or feedback interventions back into the environment to assist the users in achieving their end goals effectively and efficiently. This feature is what is commonly referred to as context aware support.

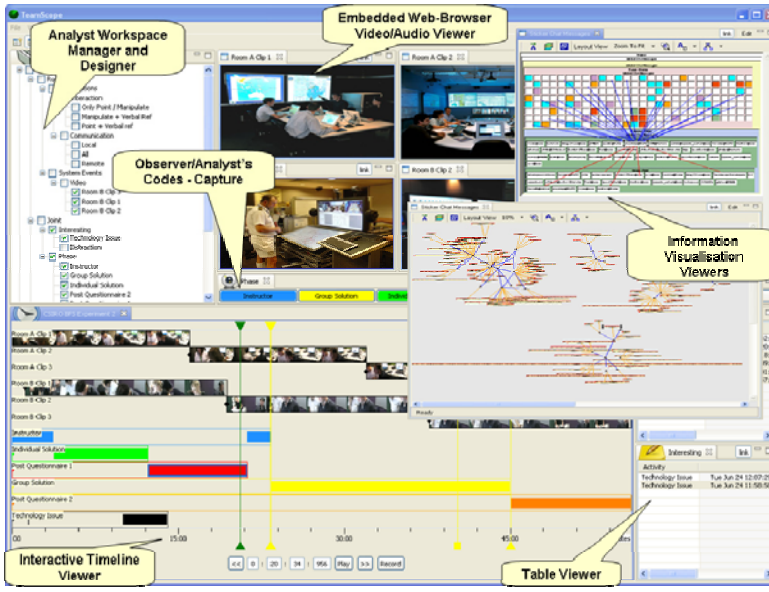

Figure 6. TeamScope in a typical analyst mode of operation

Figure 6, shows the TeamScope user interface as presented to the user in a typical analyst observation mode of operation. The "Analyst Workspace Manager and Designer" section allows users to define new and/or to load existing analyst projects. This module also allows the user to break down the analyst project into sessions and groupings of evaluation each with their own specific data capture configurations. The "Embedded Web-Browser - Audio Video Viewer" allows for the viewing of audio-visual feeds captured by the system within a web browser window. The "Observer/analyst's Codes Capture" is a user definable area where the analyst or observer interacts to capture pre-defined observations of interest. The color of each button corresponds with the colored events on the timeline viewer. The "Table Viewer" provides a listing of the captured events

as they unfold. The "Information Visualization Viewer" provides the user with rich data visualizations (graphs, charts etc,) of the captured data and any user defined relationships between the data. The "Interactive Timeline Viewer" visualizes the data/events on a time line allowing the users to see at a glance what is going on. Users are able to engage interactively with the timeline viewer to perform functions such as zoom multiple levels, edit duration of events, and move events forward and backward in time, among other features.

TeamScope is somewhat unique in that it facilitates the real-time distributed capture, logging, and review of: raw and processed audio-visual events/feeds, system events/feeds from devices and software such as any LiveSpaces type event, user/human defined events such as performed in ethnography and usability style evaluations. It provides a simple analysis module which enables real-time and post-hoc analysis of captured data. It provides data visualization modules for visualizing the captured data in various ways such as charts and graphs. TeamScope provides interactive and rich timeline viewers to observe all time based events with multiple zoom levels and graphical event editing functions. It also provides the ability to import and export time based events as well as audio video content for post-hoc evaluation. TeamScope provides a flexible framework for integrating other analysis and reasoning capabilities such as in identifying patterns of behavior and providing real-time context aware support. It supports and facilitates the design, specification, configuration, instrumentation, observation, evaluation, presentation and reporting of experiments for team collaborative environments.

The experiences with utilizing TeamScope to date have largely been focused on understanding the ICT Enabled Evaluation Approach as it applies to teams engaged in intense distributed collaboration activities. TeamScope has been utilized in innovation focused command-post exercises, HxI-Braccetto related experiments and pilot studies, and DSTO in-house monitoring of LiveSpaces facilities. These experiences have led to an informed evolutionary development of the TeamScope capability and a deeper understanding of the ICT

Enabled Evaluation Approach. The TeamScope capability has evolved into a flexible framework and software architecture enabling it to be extended and modified to cater for future requirements.

Among some of the data tracked with the proposed integrated techniques one can start building evidences of the potential collaboration synergies in specific circumstances. For example we were capable of tracking usage data for integrated telepresence capabilities at a certain frequency which is of value in extending specific set of trials and which may now be used to better describe plausible hypotheses of value to concerned decision makers. Such traceability and quasi repeatability of critical data enhanced with user and analyst metadata were not possible before. The proposed integrated approach is consequently a critical milestone in scientifically evaluating complex systems made of machines and humans collaboratively conducting operations of all types ranging from simple to ill-defined and changing objectives.

Conclusion

This article has described and discussed a range of challenges that analysts face in the evaluation of C2 capabilities for teams engaged in intense collaborative activities. An ICT-enabled evaluation approach has been described. This approach takes advantage of the deployed ICT infrastructure as a means of dealing with a range of difficulties and challenges inherent in the evaluation of socio-technical systems within complex work settings. The concepts and approaches outlined in this article have been presented in relation to actual field experimentation activities which have helped define, refine, and test the approach. The approach extends the traditional evaluation of post-hoc analysis approaches by facilitating the traceability and quasi repeatability of critical data enhanced with user and analyst metadata. The results of this work has led to the development of a new evaluation system called TeamScope which sup-

ports the capture, annotation, integration, analysis, and visualization of multi-media evaluation data during and post-hoc ICT-enabled Evaluation sessions.

The work to date has shown the utility of the ICT-enabled Evaluation approach. Much of the work to date has focused on the evaluation of capabilities in areas such as workspace awareness. Additional work needs to be done on defining, developing, and validating a more substantial theoretical basis for a set of evaluation parameters applicable to the types of work contexts and capabilities discussed in this article. Also, more work needs to be done in relation to the evaluation of the evaluation capabilities themselves. For example, the evaluation of TeamScope in relation to its ability to support analysts engaged in ICT-enabled Evaluations warrants further work.

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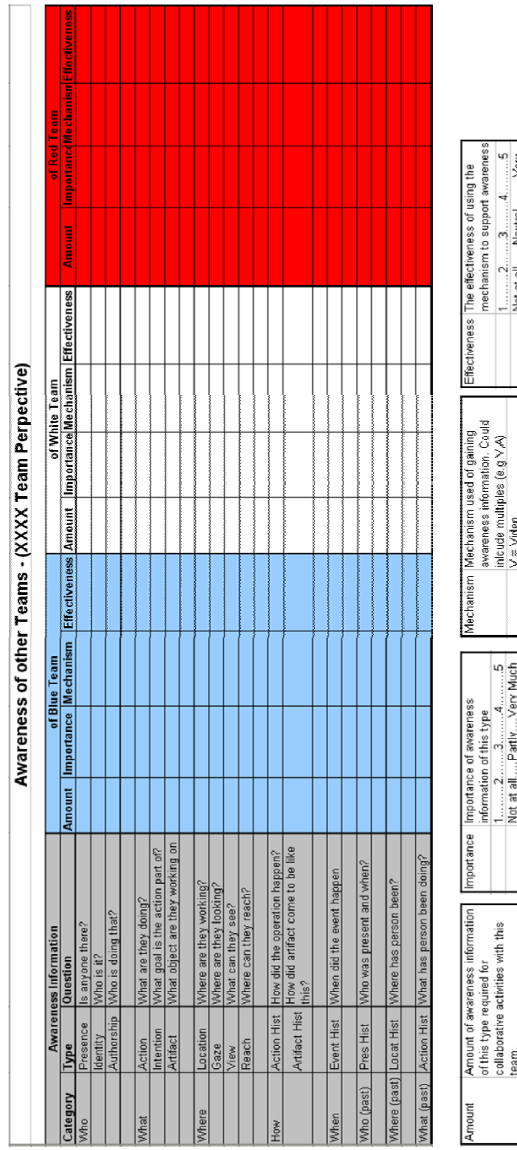
Appendix A



Awareness of other Teams - (XXXX Team Perpective)

Awareness Information			of Blue Team				of White Team				of Red Team			
Category	Type	Question	Amount	Importance	Mechanism	Effectiveness	Amount	Importance	Mechanism	Effectiveness	Amount	Importance	Mechanism	Effectiveness
Who	Presence	Is anyone there?												
	Identity	Who is it?												
	Authorship	Who is doing that?												
What	Action	What are they doing?												
	Intention	What goal is the action part of?												
	Artifact	What object are they working on												
Where	Location	Where are they working?												
	Gaze	Where are they looking?												
	View	What can they see?												
	Reach	Where can they reach?												
How	Action Hist	How did the operation happen?												
	Artifact Hist	How did artifact come to be like this?												
When	Event Hist	When did the event happen												
Who (past)	Pres Hist	Who was present and when?												
Where (past)	Locat Hist	Where has person been?												
What (past)	Action Hist	What has person been doing?												

Amount	Amount of awareness information of this type required for collaborative activities with this team.
	1.....2.....3.....4.....5
	Never....Occasionally....Always

Importance	Importance of awareness information of this type
	1.....2.....3.....4.....5
	Not at all....Partly....Very Much

Mechanism	Mechanism used of gaining awareness information. Could include multiples (e.g V,A)
	V = Video
	A = Audio
	O = object or artifact
	X = something else

Effectiveness	The effectiveness of using the mechanism to support awareness
	1.....2.....3.....4.....5
	Not at all.....Neutral.....Very