

COLLABORATION TOOLS FOR THE ARMY'S FUTURE FORCE

Cheryl A. Bolstad, Mica R. Endsley
SA Technologies

ABSTRACT

Collaboration tools are used to facilitate the communication and exchange of information among team members who are working together to complete a shared task. The Army has under development a wide variety of tools for supporting collaboration. In addition, many commercial products have also been developed for supporting collaborative activities. Each of these tools offers very different types of capabilities, however, and little guidance exists as to which tools provide the highest levels of situation awareness (SA) and are appropriate for which types of collaborative tasks or situations relevant to Army Operations. An evaluation of these tools for Army command and control operations was conducted in a simulation exercise at Ft. Leavenworth. Overall, soldiers found that face-to-face communication, a domain mapping tool and instant messaging were most effective for their tasks.

Key words: Collaboration Tools, Team Performance, Situation Awareness, Army

INTRODUCTION

In many complex systems, tasks will often need to be accomplished through teams. Team members must continuously collaborate and share information in order to perform a common task. This dynamic process may be best exemplified by command and control (C²) in the U.S. Army. During C² soldiers must continuously seek out new information, integrating it with existing information and share this information with relevant officers all for the purpose of creating, executing and modifying the Commander's plan. In current Army operations, this process is done while the majority of participants are geographically co-located. However, in the near future, the Army's envisions smaller teams working together in a distributed, asynchronous fashion. While this will give the Army more mobility as well as faster deployment times, it provides a challenge as to how these teams will continuously collaborate together from large distances.

One way to help coordinate and share information is through the use of collaboration tools (Bolstad & Endsley, 2003). The challenge is selecting the right tool for each task, as there are a variety of collaborative tools available. In the future, if soldiers are to function in a distributed fashion they will need collaborative tools and systems to exchange information and most importantly Situation Awareness (SA). By providing the soldier with the right collaborative tool at the right time he will be more likely create, maintain and share SA at a high level, which will be needed for distributed operations (Bolstad & Endsley, 2003).

Collaboration Taxonomy

To help determine which tool is best suited for specific tasks Bolstad and Endsley (2003) created a taxonomy of collaboration tools. The taxonomy describes the different types of collaboration techniques and tool characteristics that are needed to support the differing types of collaboration. The matrix consists of 13 major collaboration tool types (face-to-face, video conferencing, audio conferencing, telephone, net radio, chat/instant messaging, white board, file transfer, program sharing, email, groupware, bulletin board and domain specific tools) and four main content areas: collaboration characteristics (time, predictability, place and interaction), tool characteristics (recordable/traceable, identifiable, structured), information types supported (verbal, textual, spatial/graphical, emotional, photographic, video) and processes supported (planning, scheduling, tracking, brainstorming, document creation, data gathering, data distribution and shared SA). While the matrix is not exhaustive in its coverage of collaboration tools and collaboration characteristics, it does cover the majority of collaboration tasks that occur within the Army.

The matrix was color coded to show the level of support each tool provides for the various collaboration characteristics, tool types, information types and team processes. For example, the matrix section on collaboration processes shows that domain specific tools provide the highest level of support for shared SA, followed by face-to-face collaboration, video conferencing, audio conferencing, telephone and net radio (see Table 1).

Of interest during this experiment reported in this paper was to tool type Army officers selected when performing command and control tasks. When given a variety of collaboration tools, did the soldiers use the tools

that best supported the processes they were doing (listed in Table 1). Specifically, did they use tools that best support shared SA.

Tool Category	Processes				
	Planning	Brain-Storming	Data Gathering	Data Distribution	Shared SA
Face-to-Face	Good	Good	Moderate	Moderate	Medium-High
Video Conferencing	Moderate	Limited	Limited	Good	Medium-High
Audio Conferencing	Moderate	Limited	Limited	Good	Medium-High
Telephone	Moderate	Limited	Limited	Good	Medium-High
Net Radio	Moderate	Limited	Limited	Good	Medium-High
Chat/Instant Messaging	Poor	Poor	Limited	Moderate	Moderately-Low
White Board	Moderate	Limited	Limited	Moderate	Moderate
File Transfer	Poor	Poor	Moderate	Moderately Good	Moderate
Program Sharing	Moderate	??	Low	Low	Low
Email	Low	Poor	Low	Moderately Good	Moderately-Low
Groupware	Poor	Moderate	Moderate	Low	Low
Bulletin Board	Poor	Moderate	Moderate	Low	Low
Domain Specific Tools	High	Limited	High	High	High

Table 1. Collaboration Tool and Team Processes

Experiment

A large simulation exercise was conducted at the Battle Command Battle Lab at Fort Leavenworth, KS. The study was conducted to determine which organizational structure best supports command and control in the future. During the exercise, soldiers were presented with a variety of collaborative tools for both military planning and execution. Soldiers were given several collaboration tools including: the Defense Collaborative Tool Suite (DCTS), group systems, MC2 (mapping tool) and Microsoft Word, Excel and Power Point. DCTS is a DOD (Department of Defense) collaboration tool. It is composed of multiple collaboration techniques including: online chat (instant messaging), shared white board, application sharing and file sharing.

METHOD

Participants

Forty-five participants, consisting of both active duty officers and retired officers familiar with Brigade level operations participated in this study.

Collaboration Tool Usage Measurement

Three sets of questionnaires on collaboration tool usage were created for this study: pre-test, during-test and post-test. The pre and post-test questionnaire were given to see if the participant's opinions on what tools work best for planning and execution changed during the exercise. The during-test questionnaire was designed to elicit what tools the soldiers were currently using to perform their jobs and which tools were most effective for these purposes.

PROCEDURE

Prior to participating in the exercise, participants were asked to fill out a pre-test questionnaire designed to determine their familiarity with the collaboration tools they would be using in the study. Participants then received one week of training on the new organizational structure and the positions they would be playing as well as the tasks they would be performing. Participants completed three days of simulated battle runs in which they planned then executed their course of action using these tools. The simulation consisted of the MC2 mapping system to displays the common operational picture (COP) and a separate display for collaboration tool usage (see Figure 1).

At random times throughout both planning and execution, activity was halted and the soldiers were asked to complete a 5-minute on-line questionnaire. In addition to collecting communication activity data and workload scores several questions were asked about collaboration tools used during the previous hour of the simulation. At completion of the exercise participants participated in an AAR (After Action Review) in which they completed the post-test questionnaire.



Figure 1. Exercise Set-Up

RESULTS

Pre-Test

The pre-test questionnaire asked participants how often they used currently available collaborative tools. Prior to the exercise, most participants were familiar (used at least once) with the tools to be used in this study.

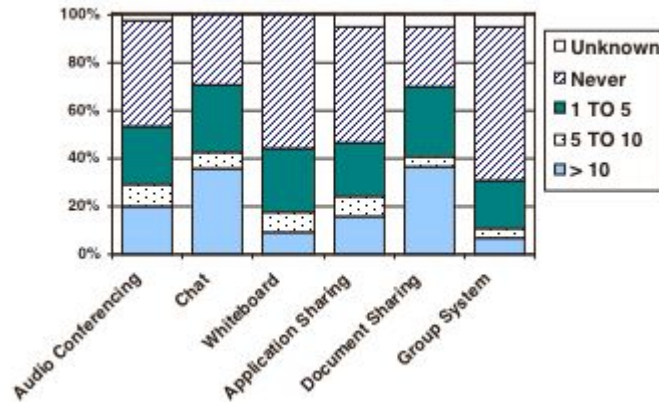


Figure 2. Pre-Test Number of Times Used These Collaboration Tools.

Participants were also asked to rank the tools they would use (when given a choice) for planning and execution. For planning purposes the top three tools were the COP, Microsoft Office Tools and Audio Conferencing. For execution the top three tools were network radio, COP and audio conferencing. These choices reflect currently available tools for command and control.

During-Test

At 16 times in the simulation the participants were given an on-line questionnaire and asked which tools they were currently using and how effective they were for their current activities.

Soldiers preferred to use slightly different tool sets for planning versus execution. Overall, soldiers reported using the mapping system (COP), chat, audio conferencing and instant messaging more frequently than the other collaboration tools (see Figure 3). However, they found face-to-face communication to be the COP, instant messaging and audio conferencing to be the most effective tools (see Figure 4).

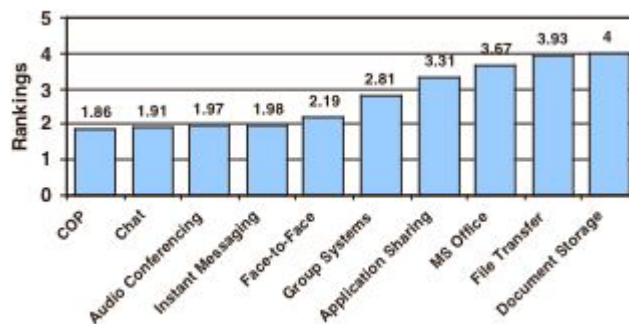


Figure 3. Overall Tool Frequency Rankings During Test

Post-Test

At the conclusion of the exercise the participants were asked to rate how likely they would be to use the specific collaborative tools in future command and control exercises. Using a scale from 1 (most likely) to 4 (not likely) the participants agreed almost unanimously that they would use face to face collaboration ($\bar{M} = 1.09$) followed, by the COP ($\bar{M} = 1.26$) and MS Office Products ($\bar{M} = 1.32$) (see Figure 5).

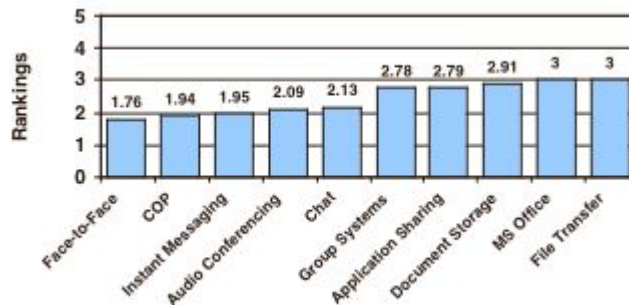


Figure 4. Overall Tool Effectiveness Rankings

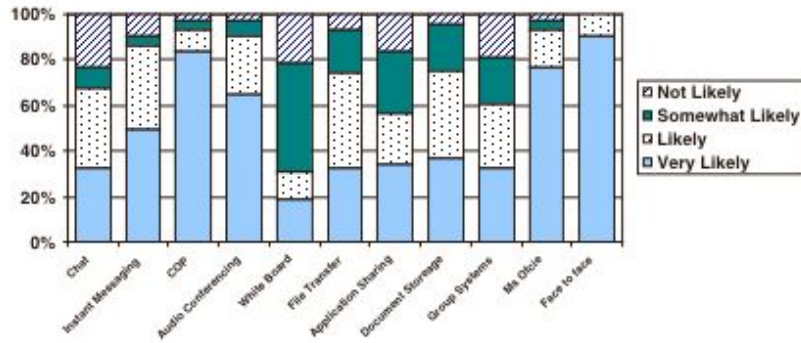


Figure 5. Likelihood Would Use Tools in Future Operations

CONCLUSIONS

Participants were given a variety of collaboration tools to use in this exercise. They preferred to use those tools that had the potential to provide the highest levels of SA (domain specific, face-to-face and audio conferencing). They also found these tools to be the most effective.

One surprising finding was the frequent usage of chat and instant messaging. This may be due to the constraints of the exercise or this tool may have been the substitute for electronic mail (email). In the post exercise discussions, email was one of the tools participants would have liked included in the tool suite.

ACKNOWLEDGEMENTS

Work on this paper was prepared through participation in the Advanced Decision Architectures Collaborative Technology Alliance sponsored by the U.S. Army Research Laboratory (ARL) under Cooperative Agreement DAAD19-01-2-0009. The views and conclusions contained herein, however, are those of the authors and should not be interpreted as representing the official policies, either expressed or implied of the ARL or the U. S. Government

REFERENCES

Bolstad, C. A., & Endsley, M. R. (2003). Tools for supporting team collaboration. Paper presented at the Human Factors and Ergonomics 47th Annual Meeting, Denver, Colorado.