Decisions, decisions….and even more decisions: The impact of digitisation in the land warfare domain

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ABSTRACT

Motivation - Digitised mission support systems are currently being introduced in the military arena. The projected benefits include quicker, better-informed, more efficient decision making by the teams using them; however, these claims are often made without appropriate scientific testing. **Research approach** – A live operational field trial of a new land warfare digital mission support system was observed. A range of Human Factors approaches were used to evaluate performance with the system in question. **Findings/Design** – As a corollary of various flaws associated with the digital system, decision making was found to be more difficult, more drawn out and more susceptible to error. Rather than augment the decision making process, in some cases these flaws were seen to create further decision making requirements for users. **Research limitations/Implications** – Using technology to provide access to more information alone does not guarantee improved decision making; designers must also consider aspects such as interface design, system usability and technological limitations in order to produce systems that truly support decision making in complex systems. **Originality/Value** – Typically, digital mission support systems are bereft of human factors analysis; this article provides insight and guidance for future system design efforts. **Take away message** – Inappropriately designed technology has the potential to degrade decision making; designers need to understand and carefully consider the existing decision making processes that the end system is being designed to support.

Keywords

Digital mission support systems, decision making, human factors, system design

INTRODUCTION

Making decisions and plans are core activities for military commanders and staff (Thunholm, 2006). With continued increases in technological capability and the emergence of Network Enabled Capability (NEC), there now exists great potential to support the military decision making process through the introduction of digitised mission support systems. Such systems aim to enhance the quality and speed of decision making through the provision of more information, quicker and more accurately than ever before. However, do digitised NEC-based systems actually improve the cognitive process of decision making? Proponents assert that they will lead to significant enhancements in the decision making quality (e.g. Alberts et al, 1999), whereas pessimists remind us that the provision of more information does not necessarily mean that users will make better decisions (e.g. Bolia et al, 2006). The purpose of this article is to investigate the impact of digitisation on a time served military decision making process, the Combat Estimate (CE), which is used in the land warfare domain. To do this we present a summary of a case study involving a comprehensive human factors analysis of a recently developed digital mission support system.

Decision making in land warfare

Common across most militaries is the use of structured processes to guide decision making during mission planning and execution. This article focuses on the current UK Army land warfare decision making process, the CE, or 'Seven Questions' planning process. Essentially, the process involves planners working through seven structured questions (e.g. what is the enemy doing and why?, what have I been told to do and why?, what effects

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do I want to have on the enemy?, where can I best accomplish each action/effect?, what resources do I need to accomplish each action/effect?, when and where do the actions/effects take place in relation to one another?, what control measures do I need to impose?) in order to understand the battlefield situation and mission and choose, produce and refine an appropriate course of action for the mission ahead. Although decision making occurs throughout the process, the key decision making element is the way in which it structures the Commander's tactical decisions regarding course of action selection for the mission in question. Also, for decision making during enactment of the plan (i.e. the battle), the approach encourages the use of anticipated Decision Points (DPs) to trigger key primed decisions during the battle. Following the seven questions process a course of action is selected by the Commander and wargaming is used to simulate and refine the chosen course of action. Execution of the plan involves responding in prescribed ways to orders received from higher command formations as they relate to information derived from the intelligence preparation of the battlefield. The command staff then direct the various force elements to engage the enemy. This is undertaken with voice/radio communications with the planning staff constantly updating dynamic aspects of the battlespace maps, as well as monitoring and where necessary cycling through the CE process to modify the plan.

The digitised mission support system

There is currently an increasing emphasis within the military domain on the use of advanced technology to improve decision making during operations (Bolia, 2005). Accordingly, there has been a recent spate of so-called digitised software-based mission support systems being developed, tested and even introduced in theatre. The tool that this article focuses on is a digitised mission support system that provides tools (i.e. planning tools, communications tools, electronic mapping and real time situational display) for battlefield planning and execution tasks in the land warfare domain. It is intended that the new system will replace the traditional planning and execution command and control approach, labelled here after as the 'traditional' approach. Briefly, the traditional approach involves the development of planning products using paper maps, whiteboards, flipcharts and acetate overlays. Key elements related to the plan are drawn on acetate overlays (e.g. terrain analysis, commander's effects, situation overlays etc) and products are produced on paper, whiteboards (e.g. mission analysis) or on acetates (e.g. overlays such as the commander's effects schematic). During battle execution, a Local Operational Picture (LOP) is constructed on a paper map and enemy and friendly entities are placed on the maps using 'stickies' (plastic icons that can be stuck on and moved around the map).

LAND WARFARE CASE STUDY

Researchers from the Human Factors Integration-Defence Technology Centre (HFI-DTC) were invited to undertake a human factors analysis of the digitised mission support system during a recent operational field trial. Various analyses were undertaken (see Stanton et al (In Press)); however, this article focuses on the impact that the system had on decision making during the activities observed.

Methodology

The study involved a live observational study of an operational field trial involving the digital mission support system described above. The three-week field trial involved a fully functional Division (Div), Brigade (Bde) and BattleGroup (BG) undertaking land warfare missions using the new system. The trial was set up in order to test the new system and closely represented a real-world operational situation. The participants involved in the study were the army staff working in the Bde and BG teams involved in the operational field trial. Due to the nature of the study and data restrictions, it was not possible to collect participant demographic data. Six analysts were given access to the Bde and BG HQs and undertook direct observation of the mission planning and battle execution activities over the course of the field trial. Observational and verbal transcripts were recorded throughout. The data recorded included a description of the activity being performed by each of the agents involved, transcripts of the communications that occurred between agents during the scenarios, the technology used to mediate communications, the artefacts used to aid task performance (e.g. maps, manuals, whiteboards, computers, SOIs etc), the temporal aspects of the tasks being undertaken (e.g. time undertaken, time available and time taken to perform tasks), and any additional notes relating to the tasks being performed (e.g. why the task was being performed, what the outcomes were, errors made, impact of the system on task etc). Analysts were also given access to planning products, SOIs, logs, briefs and Subject Matter Experts (SMEs) throughout the field trials. To back up the data collected during the observations the analysts frequently held discussions with the trainees and SMEs.

The Event Analysis of Systemic Teamwork (EAST; Stanton et al, 2005) framework was used to analyse the data collected. EAST provides an integrated suite of approaches for analysing teamwork activities within complex sociotechnical domains. Underpinning the approach is the notion that teamwork can be meaningfully described via a 'network of networks' approach; to this end EAST is used to analyse teamwork activities from three different but interlinked perspectives, the *task*, *social* and *knowledge* networks that underlie teamwork activity. Task networks represent a summary of the goals and subsequent tasks being performed within a system; social networks analyse the organisation of the team and the communications taking place between agents (human and technological); and knowledge networks describe the information and knowledge that agents use and share in order to make decisions and perform activities. This so-called 'network of networks' approach to understanding collaborative endeavour is represented in Figure 1.

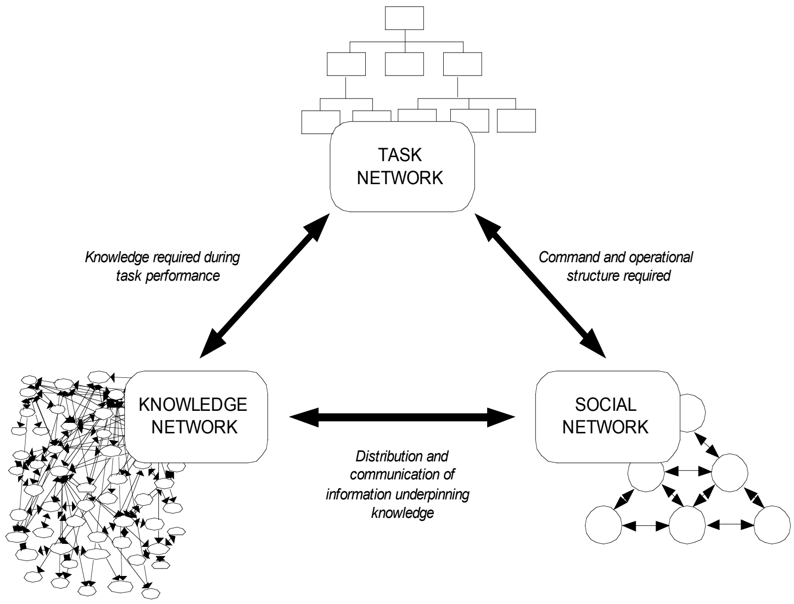

Figure 1. Network of networks approach to analysing distributed teamwork; figure shows example representations of each network, including hierarchical task analysis (task network), social network analysis (social network) and propositional network (knowledge network) representations.

The component methods underpinning the EAST approach used for this study included Hierarchical Task Analysis (HTA; Annett et al, 1971), the propositional network approach (Salmon et al, 2009), and the Critical Decision Method (CDM; Klein et al, 1989). This allows decision making during distributed teamwork to be analysed from multiple perspectives, including what the different decisions required for different tasks are, what information, knowledge and communications underpin each decision, the role of technology in the decision making process, and the role of distributed agents in the decision making process. The EAST approach therefore aids Naturalistic Decision Making (NDM) researchers since it allows decision making to be viewed from multiple perspectives. For example, the HTA deals with 'what' tasks, the CDM deals with 'what' decisions, and the propositional networks deal with 'what' knowledge or situation awareness underpins the tasks being performed and decisions being made. Each being a different but complementary perspective on the same descriptive construct, and a different but complementary perspective on the same data derived from observation and interview, which is an example of analysis triangulation. The methods that form the EAST framework are also generic and so the approach can be applied, and results compared, across different systems and domains.

RESULTS

HTAs, social network analyses, and propositional networks were constructed for each planning phase (i.e. each question of the seven questions process) and for each battle phase (i.e. battle phase lines) for two missions. Extracts of the results of the EAST analysis are presented in Figures 2 and 3. The HTAs were constructed based on live observation, interviews with Subject Matter Experts (SMEs) and review of relevant documentation. Figure 2 shows an extract of the HTA developed for question one of the mission planning process. The propositional networks were constructed based on content analysis of live observation, verbal transcript and CDM interview data. Figure 3 shows a propositional network for question one of the mission planning process. The nodes in Figure 3 represent all of the information elements, and the relationships between them, used by the planning system during completion of question one.

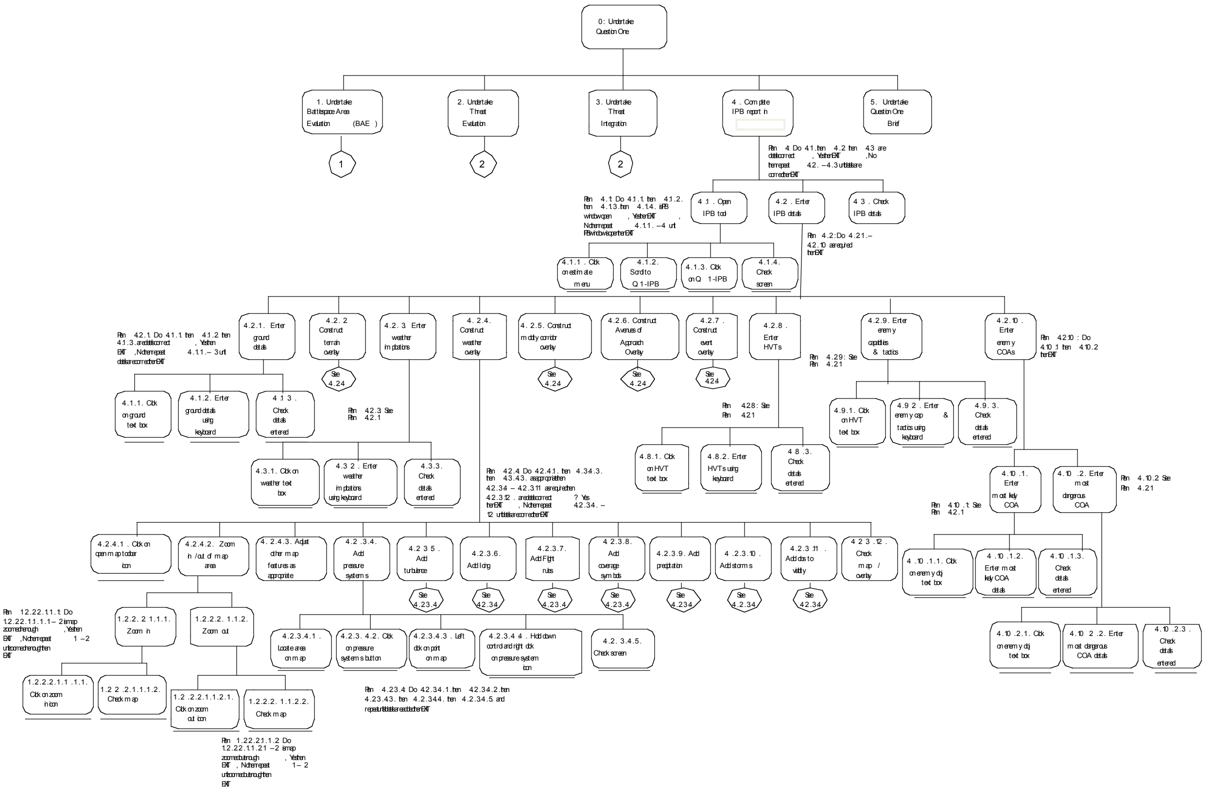

Figure 2. Question one HTA extract.

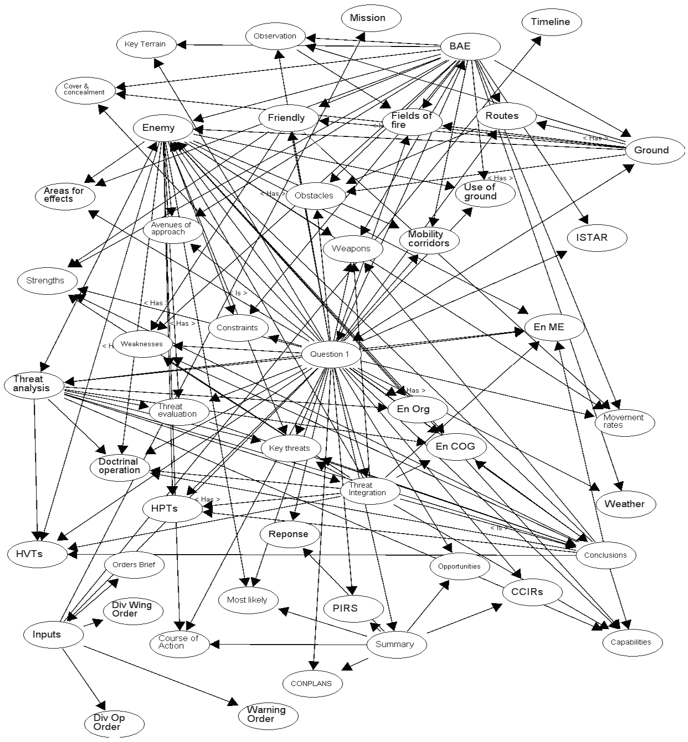

Figure 3. Question one propositional network.

DISCUSSION

The nature of decision making in the land warfare domain

Previous research indicates that decision making models and processes are rarely followed during real world military operations and that experienced military planners often use very different strategies to plan missions

(Thunholm, 2006). This was not the case here; the decision making process observed closely mapped onto the process prescribed by the CE. Essentially, the process involved being tasked with a mission (i.e. receiving orders from higher up the command chain), undertaking situation assessment (i.e. battlefield area evaluation), decomposition of the mission in order to identify role and tasks (i.e. mission analysis), deciding on a range of courses of action (i.e. commanders direction), choosing the most appropriate course of action (i.e. course of action selection), and then developing, testing (i.e. wargaming) and refining it. From our analysis it was concluded that decision making in the land warfare domain primarily comprises three forms of decision making: diagnostic decision making (i.e. what is going on and what is likely to happen?), course of action selection (i.e. choices between alternatives, what is needed to achieve a particular goal?), and anticipatory decision making (Alberts & Hayes, 2007), which was used to forecast and evaluate the decisions that were likely to be faced during enactment of the plan. In particular, the importance of diagnostic decision making was demonstrated throughout the case study. During planning for example, staff were heavily engaged in situation assessment activities regarding the battlefield, the current situation, the enemy and the friendly forces mission (i.e. what is going on? What is likely to go on? What are the enemy doing, what are they likely to do and what are their main strengths and weaknesses?). For example, question 1 involved diagnostic decision making in terms of analysing the battlefield area, the enemy and the resultant level of threat, whereas question 2 involved diagnostic decision making in terms of identifying the BG role in the overall mission and the subsequent tasks required. Examples of the diagnostic decisions faced during questions 1 and 2 of the planning process are presented in Table 1.

Diagnostic decision making during mission planning involved a process of assessing the situation and making relationships between different elements of the situation in order to arrive at a diagnosis (i.e. with this terrain, this doctrine and these strengths and weakness the enemy is likely to act in this manner). Klein (1992) discusses the importance of diagnostic decision making in the command and control process. Similarly, this case study also highlights the importance of diagnostic decision making in the land warfare mission planning and execution process. Effective diagnostic decision making in terms of accurately and exhaustively diagnosing the current and likely future situation (e.g. what the enemy are likely to do) make the course of action selection decisions far simpler. As Klein (1992) points out, with effective diagnostic decision making the course of action becomes obvious. Incorrect or erroneous situational diagnosis may lead to inappropriate courses of action being chosen. This suggests that any technological support should be focused on aiding the accuracy of situational diagnosis during the early phases of the planning process. In particular, the relationship between different elements of the situation appears to be an important aspect that could be supported through interface design (i.e. grouping of different classes of information).

Table 1. Diagnostic decision making examples.

Diagnostic Decision Making Examples	
Question 1	**Question 2**
Where/what is the key terrain?	What is the BG's unique contribution to the Bde mission?
Where/what are the obstacles?	What is the BG's main effort?
Where are the likely mobility corridors/avenues of approach?	What are the specified & implied tasks?
What is the enemy's intent?	What are the freedoms and constraints?
What is the enemy's most likely course of action?	
What is the enemy's most dangerous course of action?	
What are the enemy's main strengths and weaknesses?	
What does enemy doctrine say about the enemy's likely modus operandi?	

Diagnostic decision making was also heavily used during the battle execution phase. Within the Bde for example, a paper map and digital LOP were kept throughout the battle. Both LOPs were used to diagnose the battle situation in terms of what was happening, what was likely to happen and what could be done. Interestingly diagnostic decision making during battle execution was more collaborative in nature than that seen during the planning process. During planning, individual staff members or cells would work in isolation and diagnose different elements of the situation, and then communicate back their situation assessment to the entire Bde or BG during collaborative briefs. During the battle, however, diagnostic decisions around the paper LOP were more often than made collaboratively by up to six agents.

It was also found that Klein's recognition primed decision making model (Klein, Calderwood & Clinton-Cirocco, 1986) applied in this case both to the individual 'in-the-head' decisions being made and also the overall systemic decision making process. From a systems perspective, during planning activities the Bde and BG were involved in a collaborative process of assessing the current situation (i.e. battlefield area evaluation, mission analysis), selecting a course of action (i.e. commanders effects, course of action selection) and evaluating and refining the course of action selected (i.e. wargaming). Treating the decision making process as a systemic endeavour is in line with contemporary movements within the wider human factors arena, with concepts such as distributed cognition (Hutchins, 1995) and distributed situation awareness (Salmon et al, 2008) currently popular. The concept of 'systemic' decision making also has significant implications for NEC-based system design since it advocates the importance of the use of so-called cognitive artefacts (Hutchins, 1995) in the decision making process. Cognitive artefacts used in this case included whiteboards displaying the mission analysis, selected course of action, synchronisation matrix and Commanders Critical Information Requirements (CCIRs), flipcharts displaying task organisation and kill charts and the paper map and electronic LOPs. The extent to which these cognitive artefacts are represented on the 'Network' and in technological systems is therefore a key consideration in NEC system design.

Digitised systems affect on decision making

The study findings provided insights into the impact of the digitised mission support system on the decision making process during the activities observed. Disappointingly, it seems that the decision making process may have been made more difficult, more time consuming and more susceptible to error due to the introduction of the system in question. Firstly, the situation assessment component of the decision making process was undoubtedly made more difficult and time consuming due to flaws present in the digitised system. For example, the process of analysing the battlefield area was made particularly difficult due to problems with the mapping, screen size and screen resolution on the digital system. Diagnostic decisions regarding the key terrain were therefore more difficult as result, since users could not see specific areas (such as towns, rivers and roads etc) in the level of detail required for classification. Further, usability problems with the digitised system meant that situation assessment products took far longer than normal to produce and disseminate, which ultimately led to the planning process being delayed. Because of these problems, the Bde and BG staff typically reverted to the traditional paper map system for situation assessment tasks. In terms of selecting the most appropriate course of action, in this case the digital system had no real impact on this process. On the majority of occasions, collaborative briefs were held around paper maps using acetate overlays. Course of action selections were typically made based on traditional 'paper map' planning products, such as paper flip charts and acetate overlays. Various usability problems identified with the digital system (See Stanton et al, In Press), such as unintuitive tools, convoluted processes and high error potential, meant that users reverted to the old paper map processes to support decision making activities.

Problems with the mission support system, such as a poorly designed interface and planning tools, and also a lack of familiarity with the system, also meant that users were faced with additional diagnostic decisions regarding the system itself. These decisions primarily concerned what the system could actually do, how the system worked, what the system was doing and why the system was doing it. Users often did not know if the system had a particular capability and so had to decide whether to attempt to find the required tool and undertake an aspect of planning on the system or to revert to the paper map system. Users also often did not know how to work the planning tools (e.g. synchronisation matrix) and so had to make a decision as to whether they should proceed to attempt to use the digitised system or to revert back to the old paper map system. Poor feedback from the system also meant that users often did not know what the system was doing or why the system was doing it.

The digitised system also had a negative influence on decision making during battle execution. The primary use of the system during battle execution was for the secure voice communications function and also the real time digital LOP that it provided. Unfortunately problems with the digital LOP meant that the battle execution decision making process was also negatively impacted. First, there were many instances in which the information presented on the LOP was in fact inaccurate and was not compatible with the real state of the world at the time when it was presented. Often the information presented on the LOP was either out of date or spurious. This meant that the Bde and BG's understanding of enemy and friendly force locations, movements, number and capabilities was often inaccurate. Diagnostic decision making was therefore made more difficult and more time consuming, since staff had to first recognise that data was likely to be wrong, and then take additional measures (i.e. voice communications) to query the data and arrive at a correct situation assessment. Secondly, the information presented by the LOP was not always done so in a timely manner; due to data bandwidth limitations voice transmission was given precedence over global positioning data regarding the locations and movements of entities on the battlefield. As a result of this, contact reports and positional information presented on the LOP was often up to twenty minutes late. Again, diagnostic decision making was adversely impacted, since the situational picture being presented by the system was in fact inaccurate. Because of the problems discussed above, users held a low level of trust in the information presented to them by the electronic system. Users often questioned the information presented by the electronic system and took measures to clarify the accuracy of the information (e.g. requests for clarification of location and status reports).

As a corollary of the problems discussed, the system actually introduced a requirement for more diagnostic decisions during battle execution. Users had to first decide whether the data presented by the system was likely to be correct, following which they had to determine why it was not correct and then who they needed to contact in order to query the data. These additional decisions had the effect of reducing operational tempo during the activities observed. An example can be seen in Figure 4, which presents a knowledge network for battle execution. Within Figure 4, those information elements circled represent the information involved in the additional diagnostic decision faced regarding the current location and status of a Javelin group during battle execution. During enactment of the battle, the exact location of the Javelin group, as presented by the digital LOP, caused some uncertainty between the Chief of Staff (COS) and the Operations Officer (OpsO). The COS suggested that the Javelin group were in the wrong location (the LOP suggested that they were ahead of the recce group when they should have been behind them) and that they should be ordered to turn back and proceed to their correct position. After some debate between the COS and the OpsO as to whether the information regarding the Javelin group's location was correct, incorrect or out of date, the COS used the radio to request confirmation of the Javelin group's position. After interaction with the Javelin group and the OpsO, the COS decided that the data was spurious and that the Javelin group were in fact in the appropriate location on the battlefield as specified by the mission plan. Following this, the OpsO found another Javelin icon on the map and then had to decide which of the two icons was the appropriate one for the Javelin group. This incident was not an isolated one and there were many instances in which users around the digital LOP had to decide whether the information being presented to them was correct, and if not, what the correct location and status of entities on the battlefield actually was.

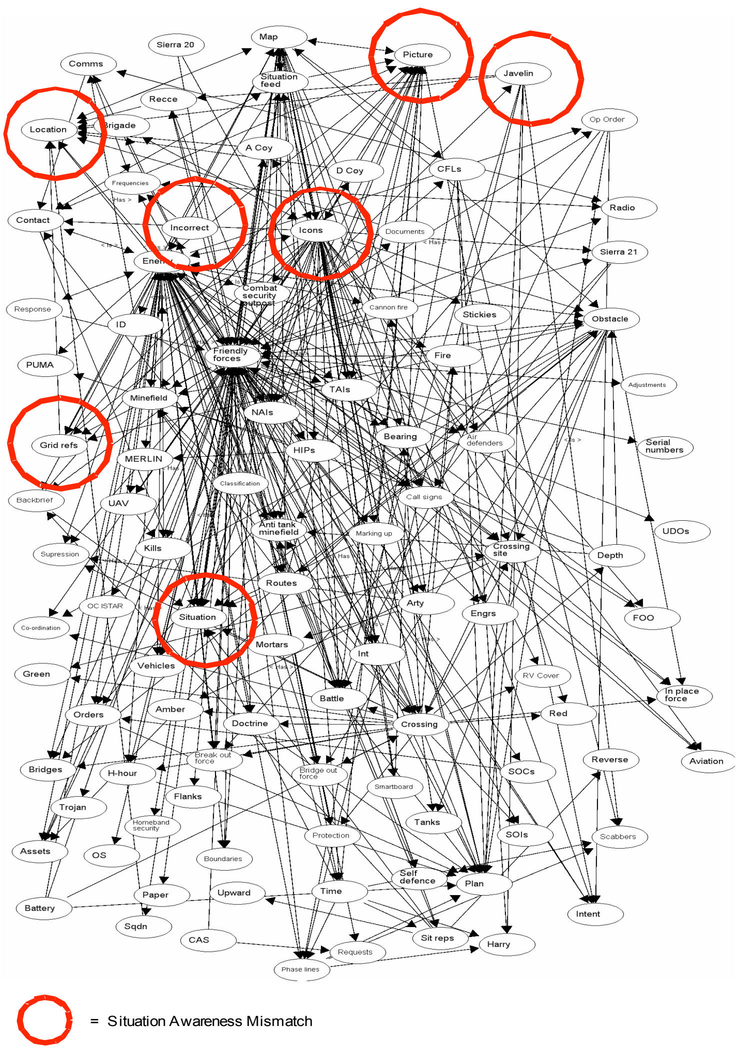

Figure 4. Additional diagnostic decision requirement example; circled information elements show those involved in the diagnostic decision regarding the location of the Javelin group on the battlefield.

Clearly the system analysed in this case did not effectively support the decision making process, on the contrary, it is argued that it hindered the decision making process significantly. It was found that the digitised mission support system actually led to a requirement for more decisions during mission planning and execution. In particular, poor interface design, incongruence with user mental models and a general lack of familiarity with the system meant that users often faced decisions regarding the system itself (i.e. can the system do this? How do I get the system to do this? Should I use the system or use paper maps? What is the system doing? Why is the system doing that?) and the information being presented by the system (i.e. is this information accurate? Why is this information not accurate? Which of these two contact reports is the most accurate?). It was concluded from our wider analysis that this was a consequence of three primary factors: firstly, on behalf of the system designers there seemed to be a lack of understanding of the decision making process that the digital support system was being designed to support; secondly, poorly designed graphical user interface and tools impacted the systems usability; and thirdly, technological limitations impacted the performance of the system.

Digitisation and decision making: the way forward?

In moving this research forward, it is clear that the first step involves identifying those aspects of the land warfare planning and battle execution decision process that would benefit from the provision of technological support. Are there decisions that are likely to be made better (i.e. quicker and more accurately) via the introduction of technological support? Alternatively, does the human element of the system already make decisions in an optimal fashion? From our experiences of both the land warfare decision making process and the digitised mission support system analysed here, it seems that the answer to these questions lies somewhere between the two; there are undoubtedly some decisions that are best left to the humans involved, but also there remain some decisions that could benefit from appropriate technological support. Question 1, the situation assessment phase, for example, entails the cognitive process of analysing the battlefield area and the likely modus operandi of the enemy. It is a diagnostic decision making process which is heavily based upon experience, an accurate representation of the battlefield and supporting documentation (i.e. enemy doctrine, intelligence etc). The extent to which this component can be enhanced by decision support system is questionable. Other components, such as course of action selection and evaluation, however, could be enhanced through decision support systems that undertake wargaming and analysis of different courses of action and present likelihood of success-related data to the Commander and staff. Different decision point outcomes (i.e. outcomes associated with different decisions made) could also be demonstrated by technological systems using a decision point demonstration function.

With further technological advances the potential for enhancing decision making is likely to continue to increase somewhat. Intelligent mission support systems that identify key terrain, predict what the enemy is likely to do next and produce detailed courses of action may not be far off, however, until they are here, human factors has a key role to play in the design, development and testing of military decision support systems. System designers need to fully understand the decision making process in terms of how it unfolds and what decisions are required, what information is used to make decisions, which aspects of the decision making process are better left to humans and also how systems can be designed to enhance, rather than hinder the decision making process. Although already obvious to some and clearly stated by others, the application of structured human factors approaches during decision support system design and evaluation is again recommended.

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REFERENCES

Alberts, D. S., & Hayes, R. E. (2007). Planning: complex endeavours. Department of Defence Command and Control Research Program. Command and Control Research Program (CCRP) Publication Series.

Alberts, D. S., Garstka, J. J. & Stein F. P. (1999). Network centric warfare. Command and Control Research Program (CCRP), Washington DC. Command and Control Research Program (CCRP) Publication Series.

Annett, J., Duncan, K. D., Stammers, R. B., Gray, M. J. (1971). Task analysis. Department of Employment Training Information Paper 6. HMSO, London.

Bolia, R. S. (2005). Intelligent decision support systems in network-centric military operations. In Intelligent decisions? Intelligent support? Pre-proceedings for the International Workshop on Intelligent Decision Support Systems: Retrospect and prospects, pp. 3 – 7.

Bolia, R. S., Vidulich, M. A., Nelson, W. T., & Cook, M. J. (2006). The use of technology to support military decision-making and command & control: A historical perspective. In Cook, M. J., Noyes, J. M., & Masakowski, Y. (Eds.), Decision Making in Complex Systems. Aldershot, UK: Ashgate Publishing Ltd.

Hutchins, E., (1995). Cognition in the wild. MIT Press, Cambridge Massachusetts.

Klein, G. (1992). Decision making in complex military environments. Fairborn, OH: Klein Associates Inc. Prepared under contract, N66001-90-C-6023 for the Naval Command, Control and Ocean Surveillance Center, San Diego, CA.

Klein, G. A., Calderwood, R. & Clinton-Cirocco, A. (1986) Rapid Decision Making on the fireground. Proceedings of the 30th Annual Human Factors Society conference, (pp. 576-580). Dayton, OH: Human Factors Society.

Klein, G., Calderwood, R, & McGregor, D. (1989). Critical decision method for eliciting knowledge. *IEEE Transactions on Systems, Man & Cybernetics*, 19:3, pp. 462-472.

Ministry of Defence (2007). The combat estimate, combined armed staff trainer (CAST) Guide, Land Warfare Centre, Warminster.

Salmon, P. M., Stanton, N. A., Walker, G. H., & Jenkins, D. P. (2009). Distributed situation awareness: advances in theory, measurement and application to teamwork. Ashgate, Aldershot, UK.

Salmon, P. M, Stanton, N. A., Walker, G. H., Baber, C., Jenkins, D. P. & McMaster, R. (2008). What really is going on? Review of situation awareness models for individuals and teams. *Theoretical Issues in Ergonomics Science*, Vol 9 (4), pp. 297 - 323.

Stanton, N. A., Salmon, P. M., Baber, C., Walker, G. (2005). Human factors methods: A practical guide for engineering and design. Ashgate, Aldershot, UK.

Stanton, N. A., Jenkins, D. P., Salmon, P. M., Walker, G. H., Rafferty, L., & Revell, K. (In Press). Digitising command and control: a human factors and ergonomics analysis of mission planning and battlespace management. Ashgate, Aldershot, UK.

Thunholm, P. (2006) A new model for tactical mission planning for the Swedish Armed Forces. In Proceedings of the 2006 Command and Control Research and Technology Symposium, June 20-22, San Diego, CA. Command and Control Research Program (CCRP), Washington, D.C.