“Exploring Joint Usability and Decision Effectiveness using a Networked-Enabled Virtual Collaborative Working and Visualisation Environment for Military Planning”

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Agenda

- Introduction
- Objectives of Study
- Research Methodology
- Results & Analysis
- Conclusion
- Recommendations
Study Aim

To develop shared Situational Awareness using a common operational picture to support collaborative military planning in joint command and control situations using a Collaborative Working and Visualisation Environment (CWVE), i.e. using virtual collaborative desks
Aim

Can VCDs be used for military planning when the Commander & Staff are not co-located?
Study Objectives

- Investigate the usability & effectiveness of VCDs for Military Planning in VCWE
- Inform development of VCD design as an enabling tool for collaborative military planning
- Develop a theoretical framework to inform the product development of a VCD
Virtual Environment:

“a distributed organisation that can meet mission requirements without a static spatial frame of reference across time and organisational boundaries using technology enhancements and innovative techniques that allow an organisation to: function, provide transparent and responsive support in order to enhance situational awareness and accomplish its mission”

(Duklis, 2006)
Virtual Collaboration Desk (VCD)
The driving force behind Virtual Team Collaboration

- Create equal levels of communication speed and effectiveness
- Technology *serving* the Virtual Team not about *serving* the technology
- Develop strong intra-team relationships for effective virtual F2F communications
- Ensure effective & strong leadership
- Facilitate flow of synergy & creativity

But: Patience, persistence, perseverance, tolerance, flexibility & understanding required!
Military Significance

- Joint decision support to achieve military effect
- Synchronised decision making
- Superior information fusion & decision edge
- Commander enhanced shared situational awareness
- Reduced security risk of commander and staff
- HQ team mobility (larger staffs and larger HQs)
- Improved Shared Situational Awareness (SSA) through information sharing and collaboration.
- SSA improves synchronisation and thereby mission effectiveness
- Resilient agile distributed HQ groups
The Challenges....

- Provision of multiple nodes of communication: *Pre-verbal & non-verbal cues*
- Smooth interoperability between team members
- Willingness to contribute with own opinions
- Technical difficulties
- Language & Culture
- Cognitive complexity (Transactive memory)
- Human Computer Interaction (HCI): Functionality & usability
Research Methodology

- Multi-Method Qualitative Explanatory Approach

- Military Judgement Panel (MJP)

- QARS (Qualitative Anchored Rating Scale) to assess:
  - Systems usability
  - Interface quality & design of VCD

- Simulation Experiment in the Estimate Process
Research Methodology Cont’d

- Structured Approach - 7 Questions (7Qs)
  Estimate Process (British Army Doctrine)

- Real Scenario used – Salisbury Plain Training Area

- 7Qs guide Commander & staff through a logical sequence of steps to determine what effects need to be achieved & the best way to do this.
Aim

Can VCDs be used for military planning when the Commander & Staff are not co-located?
NEC Benefits Chain
Planning – 7Qs

- 1. IPB
- 2. Mission analysis
- 3. Intent and direction consideration
- 4-7. CoA development
- Commander’s decision
- Prepare and issue orders
Issues to Address:
Does a shared Virtual Workspace.....

- Lessen or increase ambiguity in the planning process

- Provide the necessary features, functions and interaction mechanisms
  - to support effective co-ordination?
  - to allow for the necessary dialogues between commanders and his staff to occur?
Theoretical framework for assessing technology usability For Planning in a Virtual Collaborative Environment

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Physical Interaction

Findings
- All VCD communication channels used (shared workspace, voice & video)
- Video – very useful for facilitating non-verbal comms & body language

Constraints
- Further development required to facilitate users’ intention to use the tool in planning
- Conflicts experienced – moving & navigating documents
- Shared workspace size too small - limited & hampered visibility of documentation
- Pen device useful
Collaborative Ease of Use of VCD

Findings
- Confidence & more training will increase ease of use
- Intuitive to use
- High learnability factor

Constraints
- Advanced functions & features difficult to use
- VCD easy to learn, high complexity when using in planning process
Cognitive Interaction

- Situation Awareness (SA) synergistically raised via **Transactive Memory process** - Appropriate Course of Action (COA)
- **Shared Data Products**
  - High Information quality
  - Quantity of Information – sufficient

Shared Data Products
- DSO
- DSM

Transactive Memory

Shared Situation Awareness Synergistically Raised

Decision Making

COA
Boyd’s OODA Loop

- Observe
- Orientate
- Decide
- Act
Joint Usability & Assessment

- High level of productivity achieved during planning
- VCD usability in the planning process:
  - SME 3: “It is a good bit of development work.”
  - SME 1, 2 & 3: “Never as good as co-located planning.”
  - SME 1, 2 & 3: “A good second best.”
  - SME 1: “With more structured training the effectiveness of collaboration would be better.”
  - SME 1: “VCD has a substantial potential.”
  - SME 1: “I started to enjoy the environment.”
  - SME 3: “This is quite good fun!”
Military Planning Effectiveness

Products developed were good & an effective plan was created for:

- Intent Schematic
- RFIs
- DSO
- Synchronisation Matrix
Theoretical Framework: Technology Usability and Acceptance Model for Military Planning in a Collaborative Virtual Environment
Salient Findings

- System usability – satisfactory
- Good 2nd best to conventional planning
- Estimate products produced - ‘Fit for Purpose’
- Enables maintenance of commanders leadership in a distributed planning environment & synchronous multi-channel information sharing with staff
- Allows for synchronous information sharing to put plans together at a faster pace than traditional method
- Centralised HQ not required – security reduced
- Video Application gave feeling of team presence
Salient Findings cont’d

- Not robust enough for operational use in theatre
- More suited to static HQ operations
- VCD – lower end of TRL scale
- Link between Users’ intention to use VCD & TRL
- Further development to facilitate
  - Users’ intention to use the tool for planning purposes in a distributed environment
  - System validation in a military environment
Conclusions & Recommendations

- Ability to work synchronously as a cohesive team & maintain good SA
- More rapid planning due to synchronous information sharing
- Cognitive complexity of commanders reduced due to ‘pooling’ of unshared information – transactive memory system
- Greater level of expertise to be achieved in NDM environment
- Enables team mobility – reduced risk
- Time efficient
- Security & Bandwidth - Challenges
VCD Success

- Clearly defined goals, objectives & communication through established frameworks (7Qs)
- Team cohesiveness
- Defined roles
- Strong leadership
- Trust
CVE

- Will not change the thinking process or the planning process
- Supports outputs of planning process
- Enables more efficient & effective communication
- Does enhance team working
- Enables good team co-ordination
- Delivers Plans to an acceptable standard
- Gives commander flexibility
- Confirms important linkage between physical & cognitive interaction
Technology Readiness Levels

TRL9: Actual technology qualified through successful mission operations
TRL8: Actual technology system completed and qualified through test and demonstration
TRL7: Technology system prototype demonstration in an operational environment
TRL6: Technology system/subsystem model or prototype demonstration in a relevant environment
TRL5: Technology component and/or basic technology subsystem validation in relevant environment
TRL4: Technology component and/or basic technology subsystem validation in laboratory environment
TRL3: Analytical and experimental critical function and/or characteristic proof-of-concept
TRL2: Technology concept and/or application formulated
TRL1: Basic principles observed and reported

Definition of Technology Readiness Levels and mapping to CADMID Process
Lurey and Raisinghani, (2001)

“clearly defined goals and objectives and communication through established frameworks are considered to be one of the most important factors for the successful virtual team working”

= 7Qs
Thank You