Measuring the Impact of Situational Awareness on Digitised Force Effectiveness

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Susan Fellows, Paul Pearce

Defence Science and Technology Laboratory, UK

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Study Overview

Study Aim

- To measure the impact of differing Communications Information Systems (CIS) capability on force effectiveness (FE) at the tactical level
  - Develop methodology
  - Conduct pilot study

Scope

- BG level
- Land oriented
- Comparing a baseline analogue BG (Clansman) with two Epochs of digitally enabled BG (BCIP5)

Hypothesis

‘ the digitisation of a BG HQ, its superiors, subordinates and BG enablers improves the timely delivery of appropriate effects, leading to improvements in Blue force effectiveness ’

Conclusions

- Successfully developed and applied innovative analytical method for measuring benefits of CIS
- Results showed that Blue force effectiveness and C2 effectiveness improve with the introduction of digitised CIS

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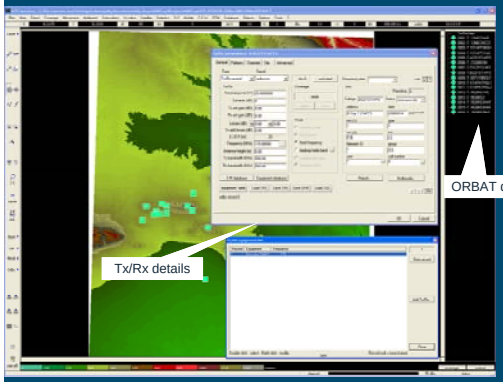
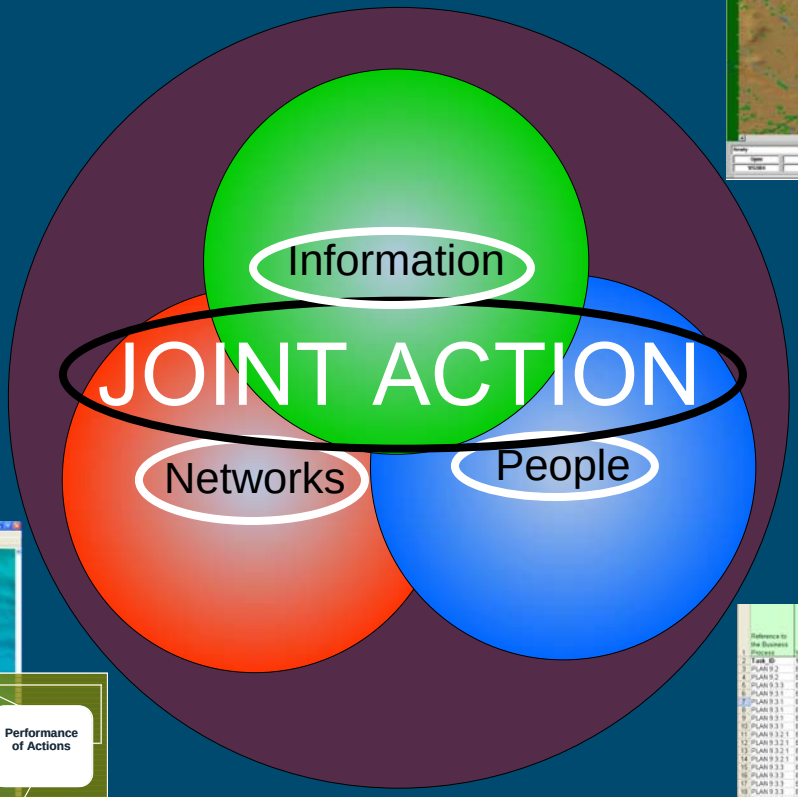
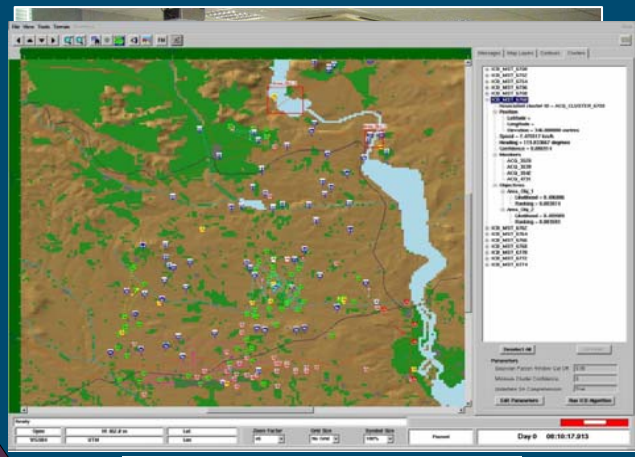
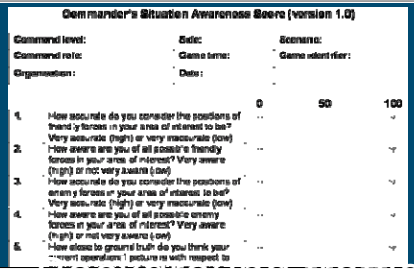
Overview of Method

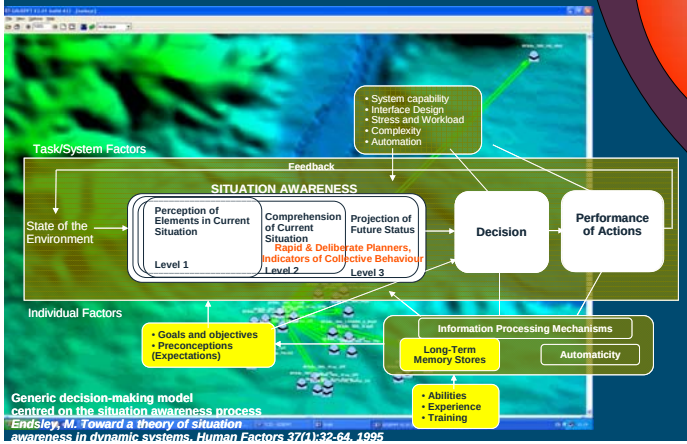
Network Modelling

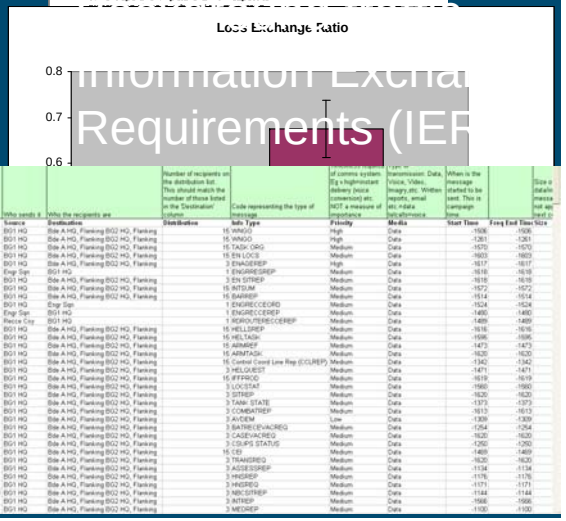












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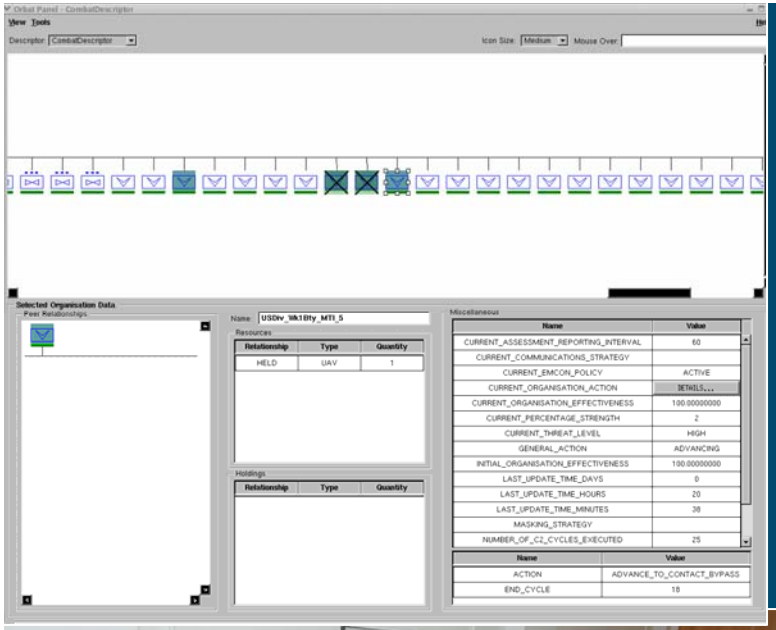
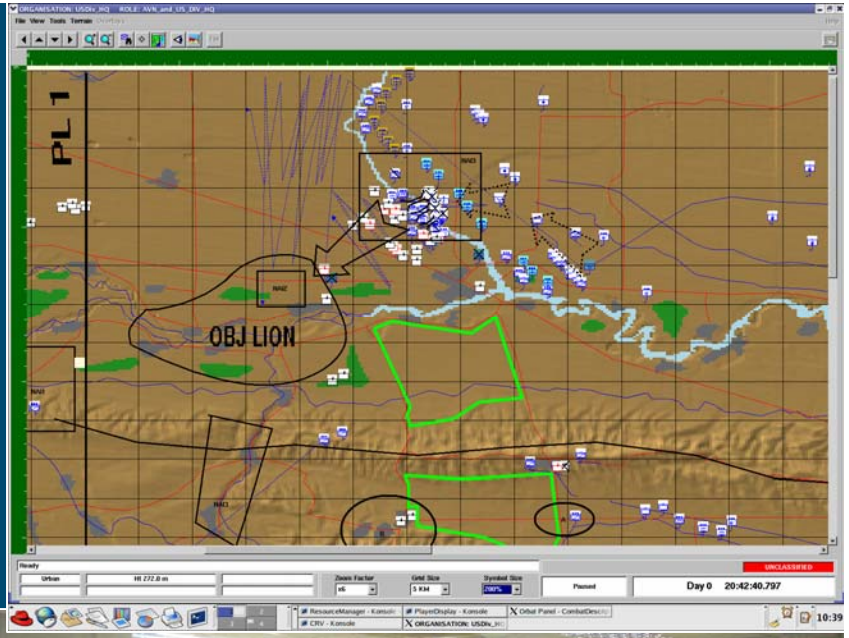
WISE





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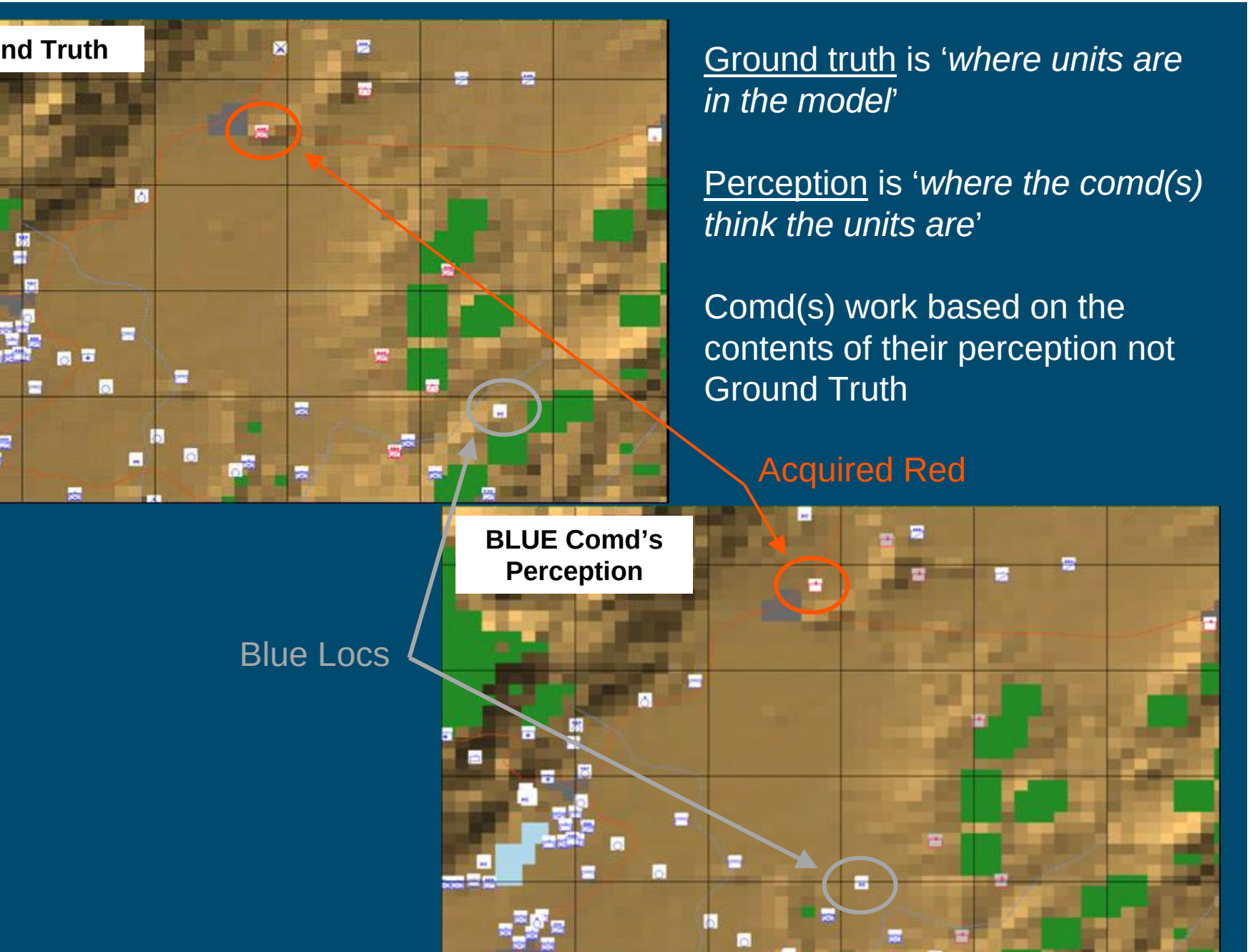

nd Truth
Ground truth is '*where units are in the model*'
Perception is '*where the comd(s) think the units are*'
Comd(s) work based on the contents of their perception not Ground Truth
Acquired Red
BLUE Comd's Perception
Blue Locs

ituation Awareness (SA) Analysis

Level 1 SA
Perception of Elements

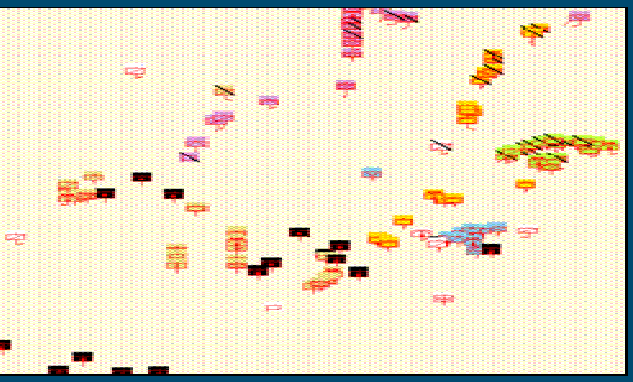
Level 2 SA
Comprehension

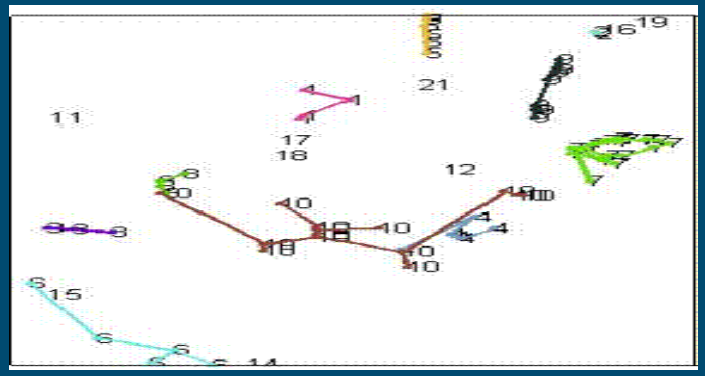
Level 3 SA
Projection

ulates the contribution made to SA by the isitions achieved by the organisation (i.e. ny / neutral picture) and information about side units, using positional accuracy and e composition compared to ground truth.

Uses the acquisitions achieved to infer likely enemy groupings leading to a measurement of the comprehension of the situation.

Based on inference of intent of likely enemy groupings with respect to a set of enemy objectives.





WISE 'Perception'

Indicators of Collective Behaviour (ICB)

Underpinning Subjective Self-Rated Analysis (SART and COSAQ)

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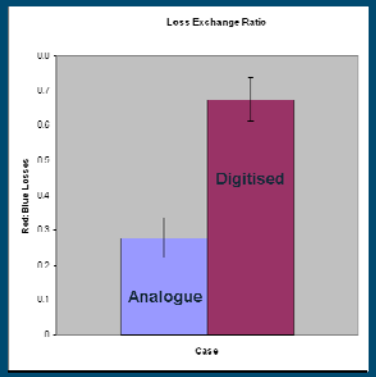
hase 1 Results

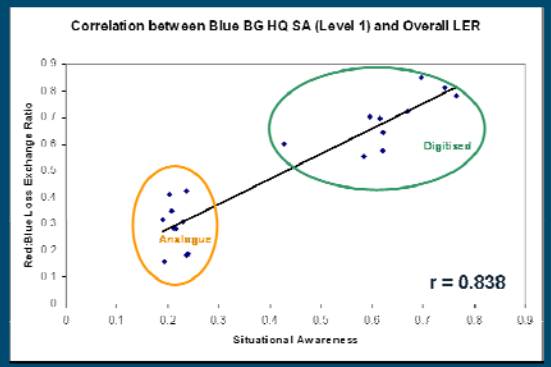
Phase 1 of study:

- Developed an initial set of measures for L1, L2 and L3
- Compared Analogue versus Digitised (Epoch 4)
- Calculated L1 for correlation with FE and trialled L2 and L3
- Measured subjective assessments objectively using SART



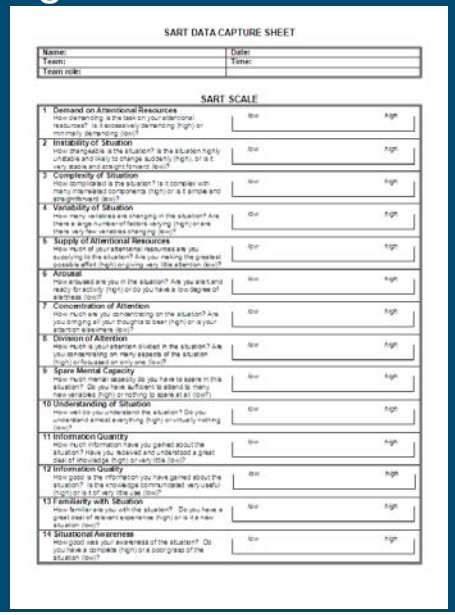
Loss Exchange Ratio
(RED losses: BLUE losses)

Non parametric stats test – Mann Whitney U Test
U=0.0, p=0.000 (two-tailed)



Loss Exchange Ratio
vs.
Level 1Situational Awareness

Non parametric stats test – Spearman Rank Test
r=0.838, n=10, p=0.01 (two-tailed)


SART DATA CAPTURE SHEET

SART SCALE

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hase 2 Experimental Design

hree cases examined but only one gamed in phase 2

Case	Own Side Reporting Frequency (seconds)			Own Side Reporting Delays (seconds)			Enemy/Neutral Reporting Frequency (seconds)			Enemy/Neutral Reporting Delays (seconds)			Peers
	PI → Coy	Coy → BG	BG → Bde	PI → Coy	Coy → BG	BG → Bde	PI → Coy	Coy → BG	BG → Bde	PI → Coy	Coy → BG	BG → Bde	
Analogue[1]	30	360	360	0	90	90	30	360	360	0	90	90	None
Digitised (Epoch 3)[2]	30	360	360	0	0	0	30	360	360	0	0	0	Limited
Digitised (Epoch 4)[3]	30	360	360	0	0	0	30	360	360	0	0	0	Extensive

epresentative of CLANSMAN: Delays on reporting due to manual encryption for insecure voice. The reporting frequency for Bde to report a solidated ISTAR product to BG was set at 1 hour.

epresentative of BCIP Epoch 3: No peer links other than for AH (to BG). No delays have been included for message passing as systems encrypted. The reporting frequency for Bde to report a consolidated ISTAR product to BG was set at 6 minutes.

epresentative of BCIP Epoch 4: Significant number of peer relationships so that an all-informed net is generated. No delays have been uded for message passing as systems are encrypted. The reporting frequency for Bde to report a consolidated ISTAR product to BG was at 6 minutes.

0 replications of each game and the two previous games with IERs

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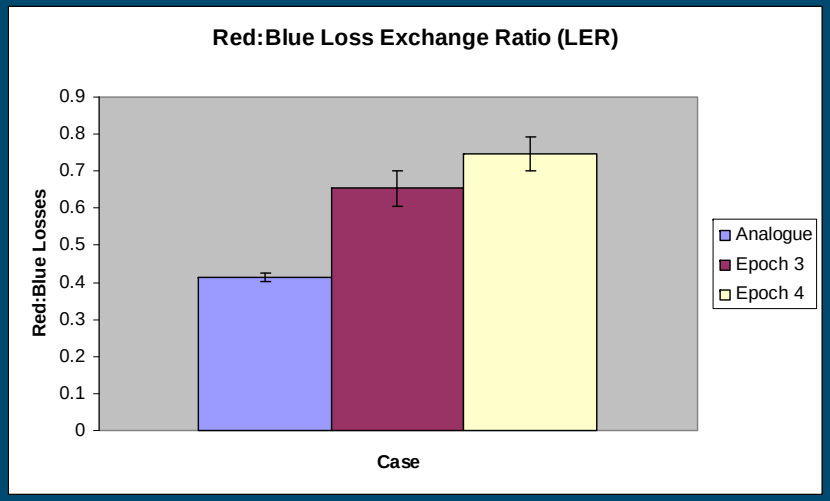
xperimental Case Study (1)

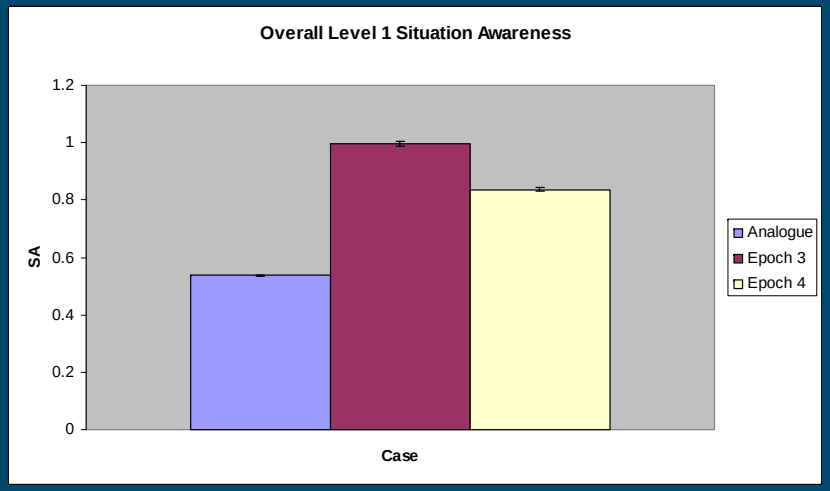
orce Effectiveness

- The loss exchange ratio improves with the introduction of digitisation (i.e. there are a greater proportion of red losses than blue losses)

2 Effectiveness

- Level 1 SA is significantly better in the two digitised cases than in the analogue case
- The Epoch 3 case shows higher SA due to more targeted use of ISTAR assets during the game





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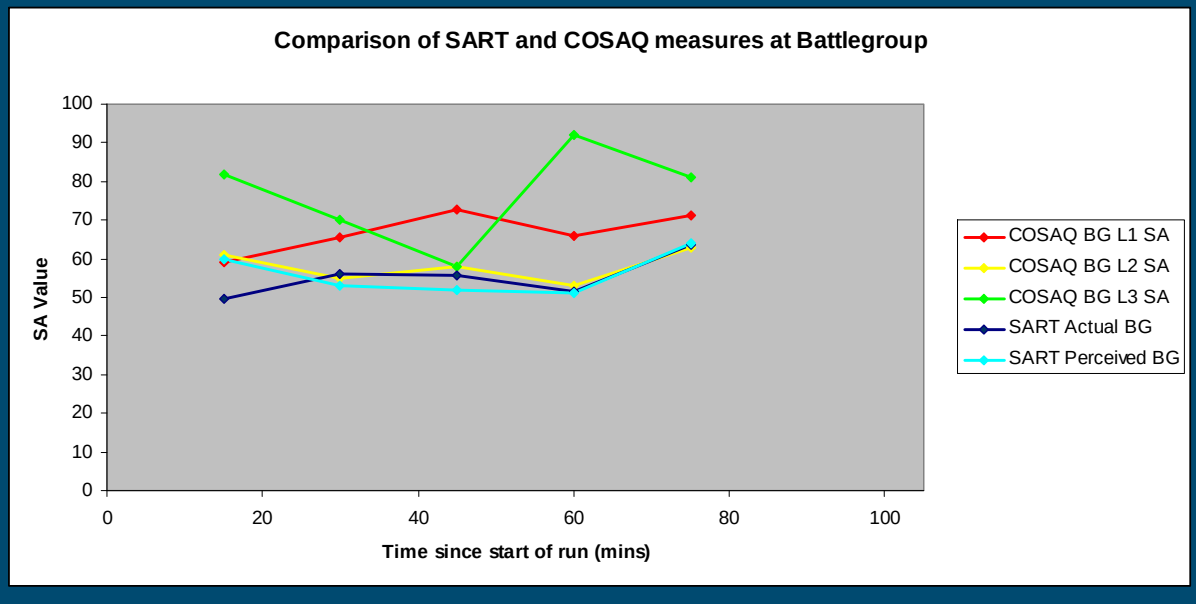
Comparison of Subjective Measures

Compared Situation Awareness Rating Technique (SART) & Commander's SA Questionnaire (COSAQ)

- SART actual and perceived scores are a reasonably good match to the COSAQ L2 score
- SART actual follows a similar trend to COSAQ L1 but it is consistently lower
- SART is unable to reflect COSAQ L3



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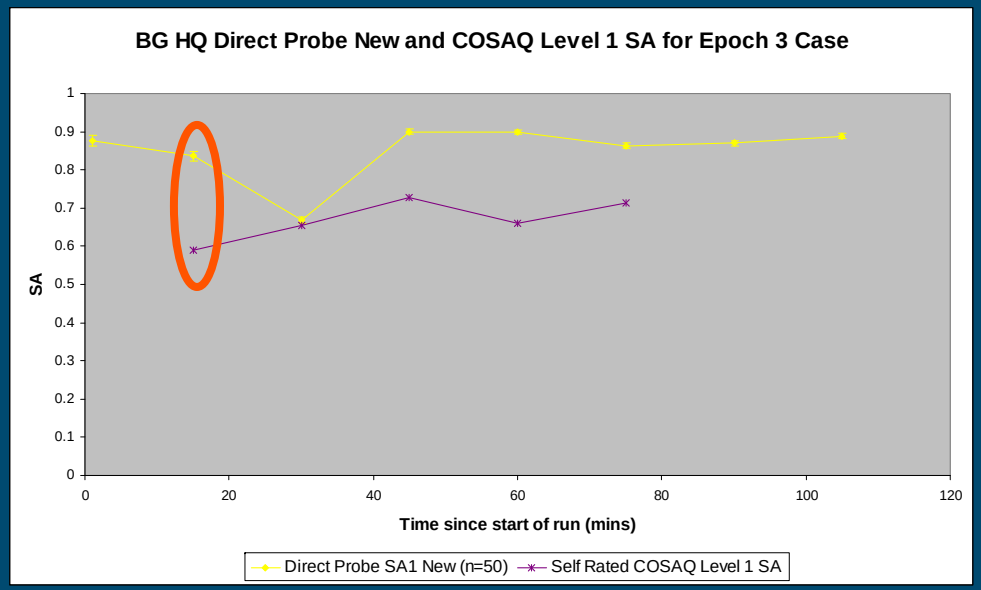
omparing Subjective & Direct Probe

he graph presents the COSAQ and direct probe L1 SA measures for the Epoch 3 ase



- Direct probe values systematically higher than COSAQ
- Higher COSAQ at start reflects pre-scenario player briefings
- Increase in COSAQ between 30-45 minutes is seen in direct probe measure
- Marginal drop in direct probe measure after 45 minutes consistent with COSAQ
- Trends in direct probe measure similar to those in COSAQ

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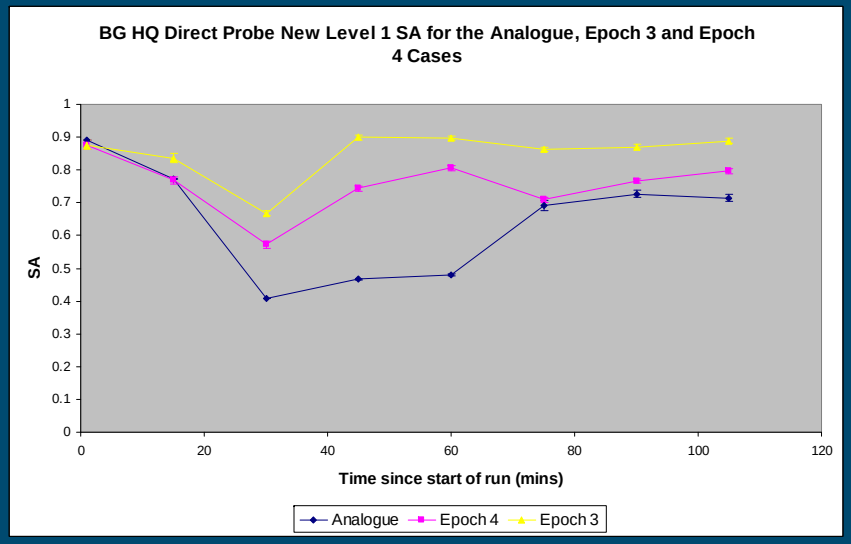
Comparing Direct Probe – All Cases

Improved SA for Epoch 3 compared with Epoch 4 not expected but was due to difficulties managing game variables

- Level 1 SA is better in both the digitised cases than the analogue
- Shape of curves consistent with key events in cases



Analogue case approaches digitised cases

- Initially: due to ISTAR sweep and 'flush' of information to lower levels
- Around 75 minutes: in the close battle

Detailed Results

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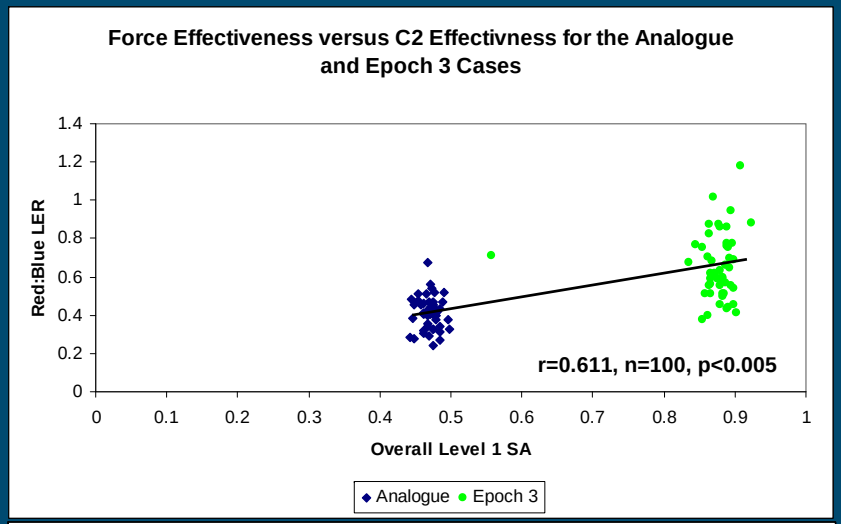
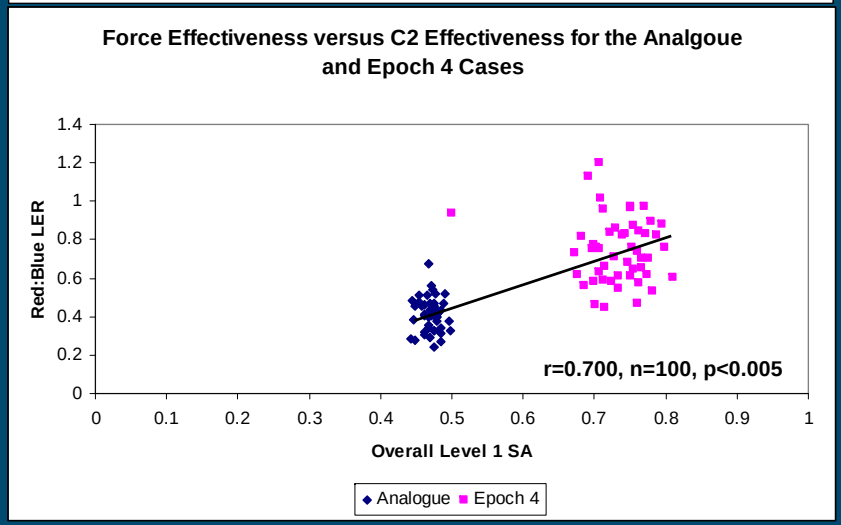
orrelations – All Cases

ork to date indicates that there a relationship between FE and E and that digitisation leads to ignificant improvement in both and C2E

e results show that, although is improved through the roduction of a digitised CIS and t force effectiveness improves, ere is a greater variation in force ectiveness in the digitised ses when compared to the alogue

ere is also a larger variation in erall Level 1 SA in the Epoch 4 ses when compared to the och 3 and analogue cases





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hase 3 Way Forward

Background traffic IERs represented explicitly in WISE

Explicit model of communications now represented within WISE:

- Representation of communications systems and fixed and mobile networks;
- Representation of physical propagation constraints using the Global Information System Electronic Planning Tool (GISEPPT);
- Throughput delays for messages

mprovements to calculation of situation awareness measures for Level 2 and 3

Constructive simulation only experimentation currently underway to repeat phase 2 assessment

Dstl is part of the

ummary

- A direct probe method for measuring situation awareness has been developed
- The new analytical method is able to differentiate between changes in CIS options
- The application of the method was successful however experimental control was challenging
- Improvements have been made to the method, are currently being tested with the aim to report them at the next ICCRTS

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Points of contact

For more info, contact:

- **Sue Fellows (tech lead)**
  scfellows@dstl.gov.uk
  Tel: +44 1959 897226
- **Paul Pearce (advisor)**
  pvpearce@dstl.gov.uk
  Tel: +44 1959 892087

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