



Working Group 4 Outbrief

Analysis of Human Decision Making in a Networked Environment

26 January 2012



Overview

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Working Group Members

Co-Chair: Dr. Sylvia Acchione-Noel, US Army TRADOC Analysis Center – White Sands Missile Range

Co-Chair: Dr. Jennifer Ockerman, Johns Hopkins University Applied Physics Laboratory

Members

Dr. Naomi Abigadol, CEMA/Rafael

Dr. Elizabeth Bowman, Army Research Laboratory

Dr. Norbou Buchler, Army Research Laboratory – HRED

Brett Burland, Mission Command Battle Lab, Fort Leavenworth

LTC Thomas Dillingham, XVIII Airborne Corps

Dr. Norman Geddes, Applied Systems Intelligence Inc.

Dr. Victor Finomore, Air Force Research Laboratory

LCOL Roger Lupien, Canadian Forces

Stephen Masi, Booz Allen Hamilton

Dr. Harry Nimon, Boeing Phantom Works

Dan O'Neill, CERDEC

Dr. Gerald Powell, Army Research Laboratory – HRED

Rick Sanders, TRAC-FLVN

Mark Tillman, Institute for Defense Analysis



Working Group Objectives

- Objective 1: Identify major factors and/or risks that prevent adequate analysis of decision making in the networked environment.
- Objective 2: Identify potential solutions to overcome negative factors and/or mitigate risks to adequate analysis of decision making in the networked environment.
- Objective 3: Report findings and actionable recommendations for promoting adequate analysis of decision making in the networked environment.



BLUF Recommendations

- Create a scientific experimental infrastructure focusing on theory development, experimentation, hypothesis testing, data collection relevant to operations
- Conduct more rigorous research on impact of networking on mission command and human cognition
- Transition of research results initially into DoD training community
- Lead organization should report to the Office of the Secretary of Defense to foster a joint services approach



Approach

Mix of participant presentations of current or recent work and brain storming discussions.

Brainstorming was focused on root causes of difficulties with analyzing human decision making in a networked environment using a root cause or fish bone diagram for first day of workshop, then shifted to brainstorming solutions to the root causes and metrics for the second day of workshop.



Presentations

Analysis of Human Decision Making in a Networked Environment: WG4 Kick-Off

Sylvia Acchione-Noel, TRAC-White Sands

Provides a history of how the term decision making has been defined over the years in the military and initial statements about how to analyze the quality of decision making.



Presentations

Demonstration of a Network-Centric Communication Management Suite: Multi-Modal Communication

Victor Finomore, Air Force Research Laboratory

Provided a demonstration of the Multi-Modal Communication (MMC) which is a network-centric communication management suite developed to improve communication performance for Command and Control operators and experimental data collection. MMC captures, records, and displays radio and chat communications to the operator so that they have instant access and full control over all current and past information.



Presentations

Measuring Human Performance in a Mobile Ad Hoc Network (MANET)

Elizabeth Bowman, Army Research Laboratory

Demonstrated one way to tie together network performance, system performance, and cognitive performance. Showed the use of a tool that provided ground truth for the location of participants in a study, which allowed an evaluation of the participants workload, situation awareness, and information sharing.



Presentations

Warfighter Associate: Decision Aiding and Cognitive Metrics for Mission Command

Norm Geddes, Applied Systems Intelligence

Norbou Bucher, Army Research Laboratory

Demonstrated a human cognition model that can be used both for decision aiding and for assessing human cognition, in particular, cognitive workload, currently active plans and goals, timing to complete tasks, and necessary collaborations (shared plans and goals).



Presentations

NEC2 Effectiveness and Agility: Analysis Methodology, Metrics, and Experimental Results

Mark Tillman, Institute for Defense Analysis

- Explains why measuring C2 Effectiveness is insufficient
- Introduces Agility and C2 Agility
- Presents results of ELICIT C2 Agility Experiments
- Demonstrates ability to measure effectiveness / agility of distributed decision making in a networked environment



Presentations

Determining the Cause of Personnel Rejection of Computer Mediated Communications (CMC) Systems During Combat Operations

Harry Nimon, Boeing Phantom Works

Described a study that looked at the effects of personality (introversion versus extroversion) on perceived confidence in decision making when using different modes of communication – face-to-face, radio, CMC without graphics and CMC with graphics. The trend showed that the different personality types did have different levels of confidence with different communication modes.



Presentations

Potential Discriminating Metrics of Cognitive Task Performance in Mission Command

Sylvia Acchione-Noel, TRAC-White Sands

Described the development of metrics of workload and macrocognition that might provide insight into decision making ability.



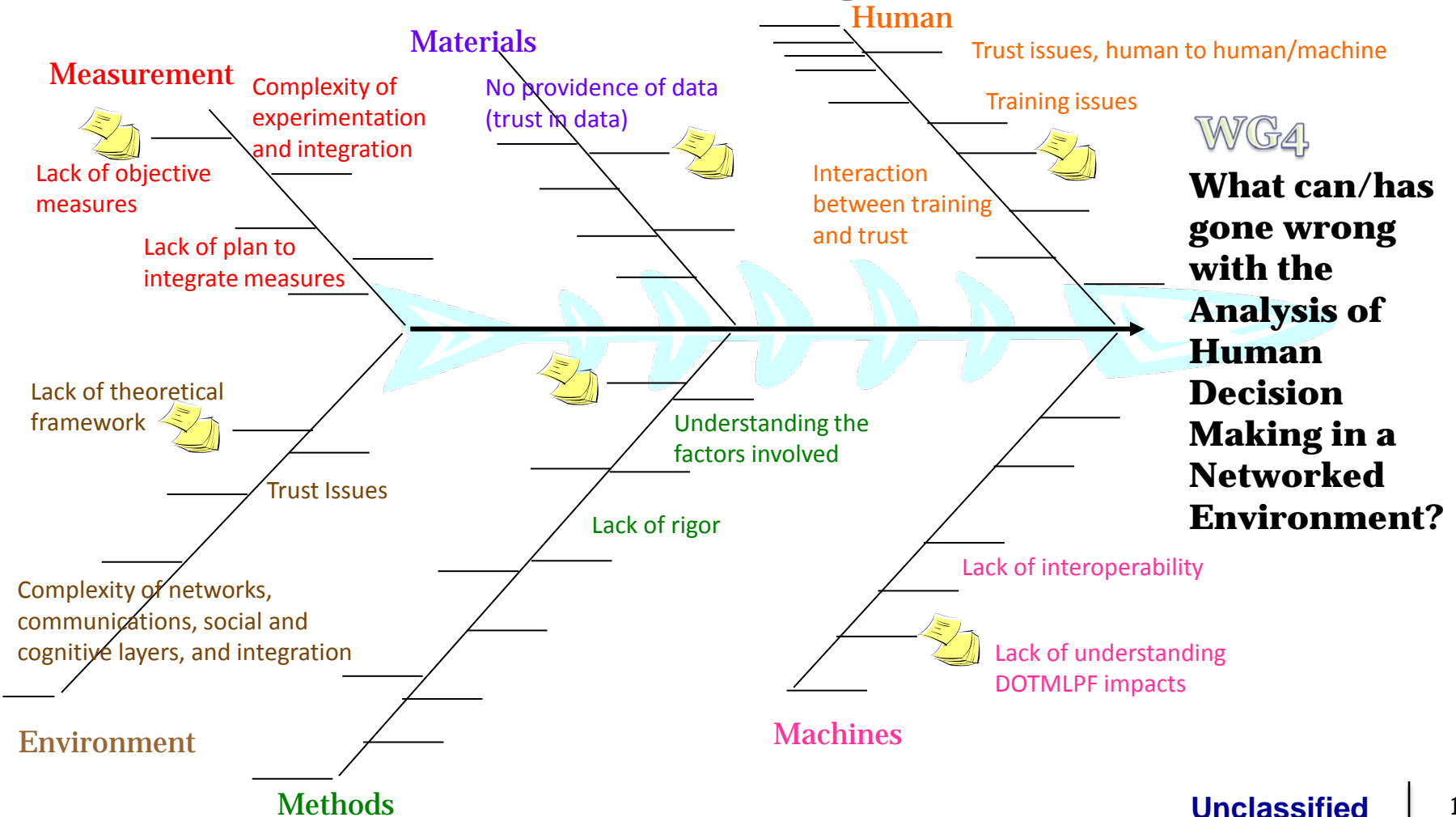
Observations

Some observed trends in the networked military:

- Becoming a more complex socio-technical system, organizationally and environmentally
- Technology enables
 - Pushing decisions down to lower echelons
 - Micro-management
- Requires changes in leadership approaches
- Assumes more information is better – however can exceed the limits of human cognition
- Definitions of decision making are continually evolving
- Need for conceptual and computational models to leverage the network domains for dynamically changing mission command needs
- Lack of effort to enhance understanding of impacts of network on the human dimension of mission command



Challenges



C2 Metrics Framework

Metrics
Derived



Operations

Mission

Tasks

Human

C2 Functions

Social
Cognitive

Information

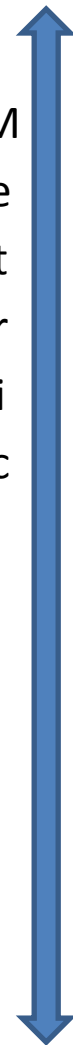
System of
Systems

C2 System of Systems

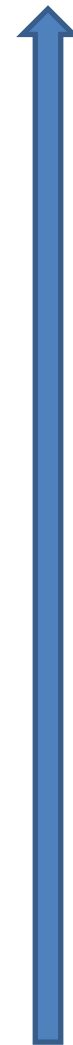
Acquisition

S	S	S	S	S	S	S
Y	Y	Y	Y	Y	Y	Y
S	S	S	S	S	S	S

M
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Metrics
Implemented



Relationships



Context
Environment



Commander's Tasks

Understand
Visualize
Describe
Direct
Monitor (Lead/Assess)



Measurement Concepts

Social

Force synchronization
Shared SA
Planning
Staff processes
Cultural factors

Cognitive

Decision making
Performance
Mental states
Cognitive workload
Macro cognition
Usability of system
Experience knowledge



Decision Goal

Time and Risk Management



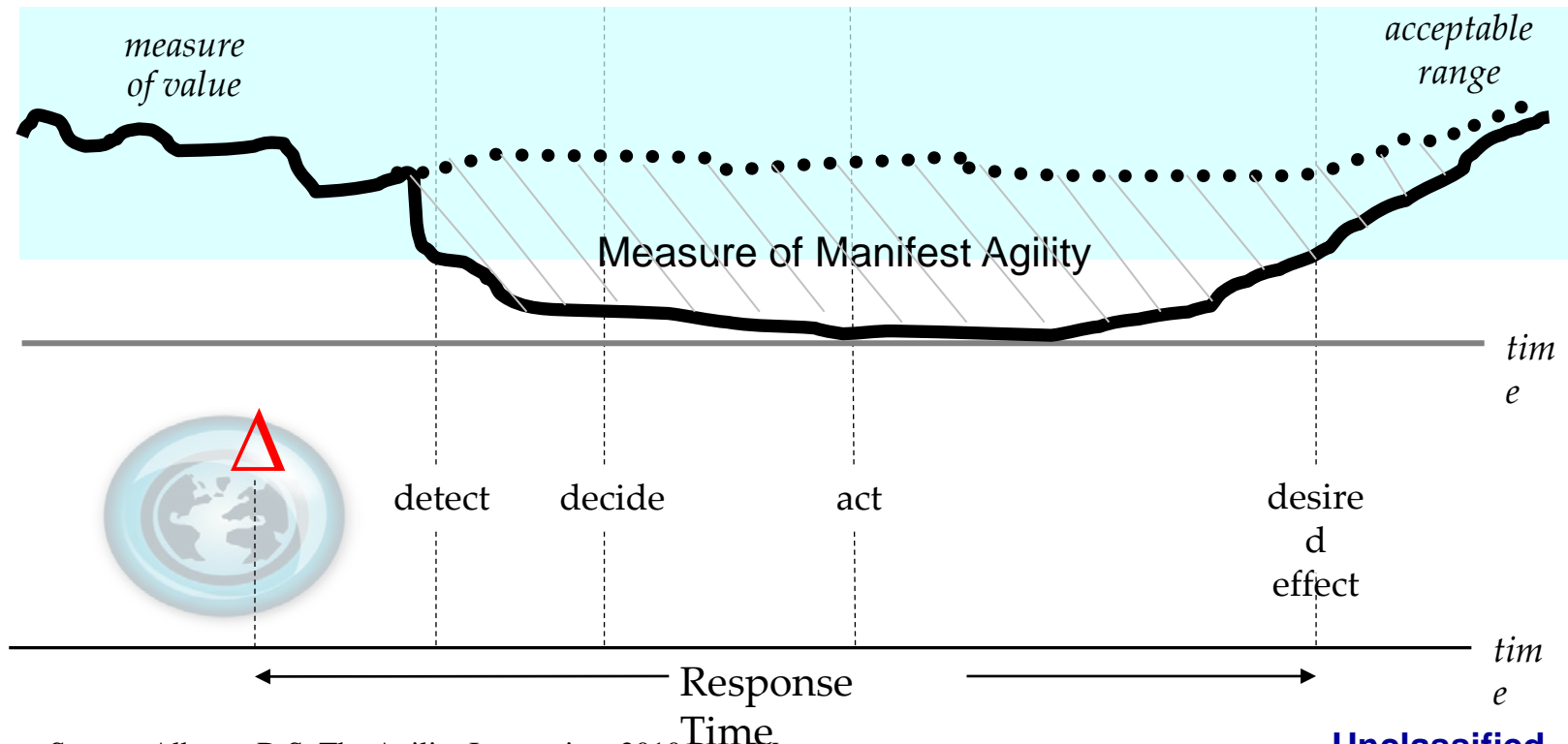
Findings

- Test the empirical relationship between decision making quality and mission effectiveness.
 - Establish definition of decision making quality
- Need more automated measures (flight recorder “blackbox”) for mission command decision making
 - Currently, collecting, organizing and analyzing the amount of complex data needed to understand and evaluate decision making is extremely time and labor intensive.
 - Synchronizing events with collected human data can be very valuable



Findings

- The quality of the commander's decision making is not measured at a point in time but over a period of time.





Findings

- Trust has a significant impact on decision making
 - Acceptance of new technology needs extensive attention and evaluation across the DOTMLPF spectrum
 - Personality differences may influence trust and should be investigated further (standard personality tests)



Findings

- To properly explore the issues with commanders' decision making in the military environment a scientific experimentation infrastructure is needed
 - Functional building blocks
 - Theory development
 - Hypothesis testing
 - Results guiding theory modification
 - Evolving system complexity
- Additional benefits are training environments and knowledge evaluation in C2 tasks



Recommendations

- Conduct more rigorous research on impact of networking on mission command and human cognition
 - Need more work on triad of theory, model, and data

- Office of Primary Responsibility
 - ARL
 - ARI



Recommendations

- Create a scientific experimental infrastructure
 - Automated data collection
 - Deployable OR tools

- Office of Primary Responsibility
 - OSD – CAPE
 - OSD – ATL



Recommendations

- Transition of research and research tools to use in the field
 - Needs a champion
 - Need operational connection
- Office of Primary Responsibility
 - Joint Staff J7
 - CIO with IDA
 - TRADOC