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A FRAMEWORK FOR COGNITIVE HUMAN DIMENSION STUDIES IN FUTURE BATTLE COMMAND SYSTEMS

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Presentation Outline

1. INTRODUCTION
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3. EMERGING INSIGHTS
4. EMERGING INSIGHTS—COGNITION
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   1. Supporting Social Skills
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7. EMERGING INSIGHTS---LEADERSHIP
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8. SUMMARY & CONCLUSIONS

INTRODUCTION

The battle command concept was developed by General Frederick Franks Jr. to account for the human dimension of battle. According to Franks, battle command means seeing what is now, visualizing the future state or what needs to be done to accomplish the mission and then knowing how to get your organization from one state to the other at least cost against a given enemy on a given piece of terrain. The primary components of battle command that depend directly on the commander's intuition are decision making, visualizing, concept formulation and battlefield awareness--selecting the critical time and place to act, and knowing how and when to make adjustments during the fight.

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Battle Command Systems and Human Dimensions Are Two of the Many Components of Warfighter Outcomes

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Warfighter Outcomes and Requirements Traceability System (WORTS)

Army Capabilities Integration Center
US Army Training and Doctrine Command

Battle Command Network

The Future Force must possess worldwide, beyond-line-ofsight network capabilities that are effective, layered, persistent, and protected. This network must integrate Command and Control for Joint Interagency Intergovernmental Multinational operations with a single, integrated universal tactical network accessible to the global information grid. It must be optimized for mobile operations and increase access and available throughput to all echelons and the individual Soldier through: dynamic, extended range, self-organizing and multilayered communications with collaborative decision and planning support capabilities.

TRADOC Lead: Battle Command Battle Lab, Combined Arms Command, Fort Leavenworth, KS.

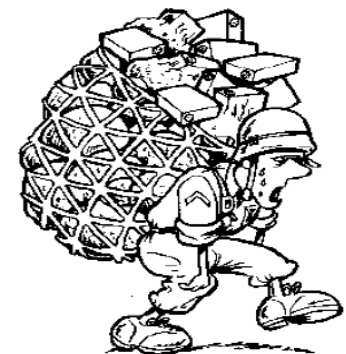*Warfighter Outcomes and Requirements Traceability System (WORTS)*

**Army Capabilities Integration Center
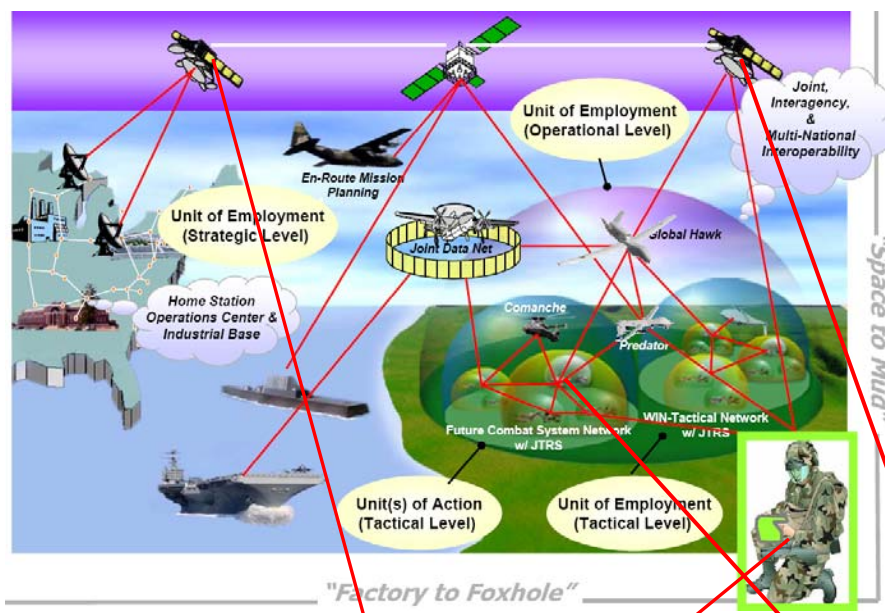US Army Training and Doctrine Command**

Human Dimension

The Army leverages enhanced means to identify, access, retain, and develop Soldiers with unsurpassed cognitive, physical, and social (moral and cultural) capabilities. Soldiers are enabled by technology, cognitive, medical and social sciences to achieve excellence in small unit competence and to dominate increasingly complex operational environments. Soldiers are able to leverage technologies and processes that optimize and restore cognitive and physical performance.

TRADOC Lead: Accelerated and Capabilities Development

*Directorate, Army Capabilities Integration Center, Fort Monroe, VA.*

SAMPLE BATTLE COMMAND ARCHITECTURE

Joint, Interagency, & Multi-National Interoperability

Unit of Employment (Operational Level)

En-Route Mission Planning

Unit of Employment (Strategic Level)

Joint Data Net

Global Hawk

Home Station Operations Center & Industrial Base

Comanche

Predator

WIN-Tactical Network w/ JTRS

Future Combat System Network w/ JTRS

Unit(s) of Action (Tactical Level)

Unit of Employment (Tactical Level)

"Factory to Foxhole"

"Space to Mud"

Military operations are complex (Human) endeavors. They involve struggles between opposing human wills.(FM1 5-0.1, 2006, pp.1-2). DS is using a clever way to defeat the (opposing) enemy's will.

Decision Superiority: " It *is by the eyes of the mind, by reasoning over the whole, by a species of inspiration that the general sees, knows and judges" (Napoleon Bonaparte)*

Information

Human In-the Loop

?≠,=? Superiority

Decision Superiority
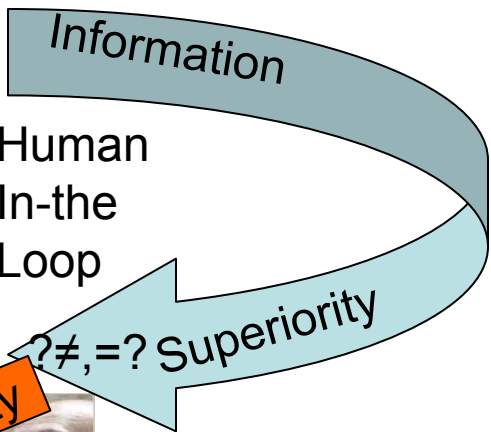
The Thinking Enemy

HUMAN DIMENSION IN BATTLE COMMAND SYSTEMS

The Human dimension encompasses the moral, physical, and cognitive components of Soldier, leader, and organizational development and performance essential to raise, prepare, and employ the Army (or any service--added) in full spectrum operations. TRADOC Pamphlet 525-3-7-01: The U.S. Army Study of Human Dimension in the Future 2015-2024; Chapter 1. 1 April 2008.
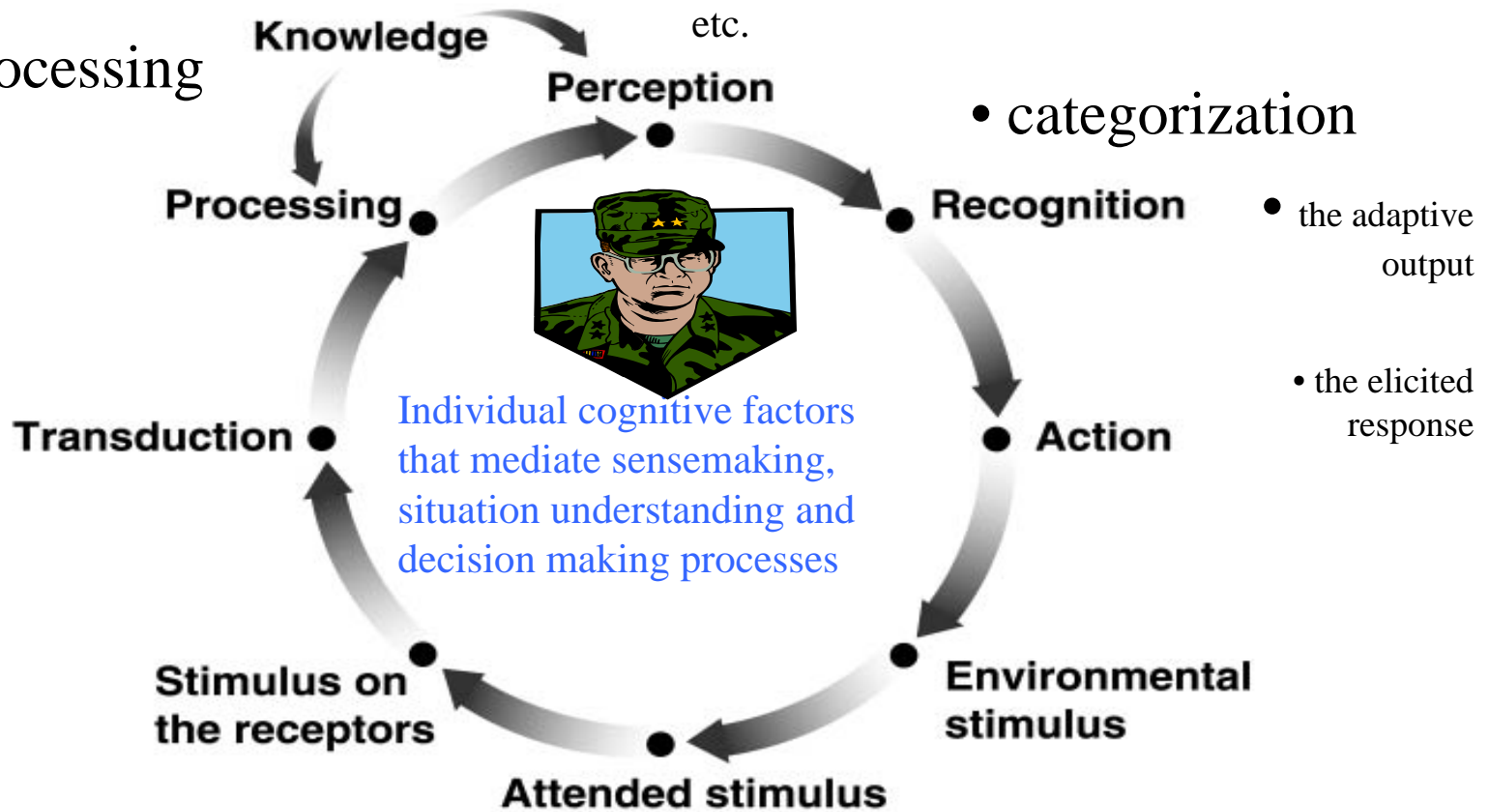
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HUMAN PERSPECTIVE OF COGNITION & VISUALIZATION

• experience the seeing, the hearing, etc.

• neural processing

• categorization

Cognitive Psychology: Mind, Research, and Everyday experience (Bruce Goldstein) Wadsworth Publishing, 2005

Knowledge

Perception

Processing

Recognition

• the adaptive output

Transduction

Individual cognitive factors that mediate sensemaking, situation understanding and decision making processes

• the elicited response

Action

Stimulus on the receptors

Environmental stimulus

Attended stimulus

• what you are paying attention to

Reality of the Battle Field
Mission/Enemy/Terrain +weather/Troops/Time available/Civil (METT-TC)

Human Cognitive Elements

Situation assessment

Sensemaking

Situation
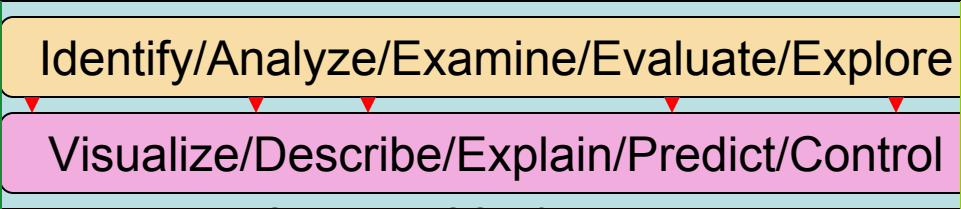
Decision

Understanding

Awareness
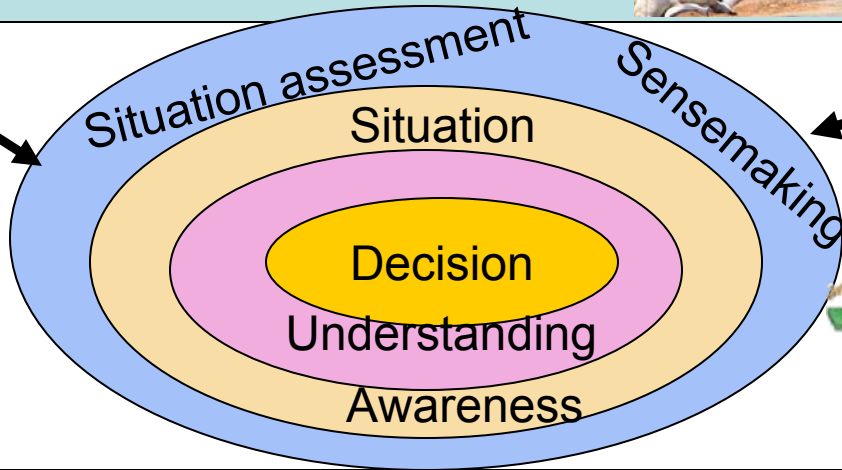
Theoretical expected human & technology endeavors

Doctrines

Mission Command
• CDR intents, Order
• Guidance, PIR
• CCIR, EEFI
• Staff initiatives

Identify/Analyze/Examine/Evaluate/Explore

Visualize/Describe/Explain/Predict/Control

Analytical Support:, e.g OODA & DSS for Planning

Decision Support Systems

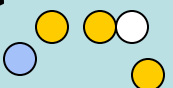Optimized COA & Running estimates

Anticipate | Influence | Affect

CDR Decision Making Points

DIME

PMESII

Executions

Measurements

After-fact Report/Review

Decision Superiority Assessment Meter (DESAM)

Human:
Adaptive, insightful
Collaborative, leadership
Decision quality

Information:
Relevancy, timeliness
Availability, reliability
Trust, quality, etc

Technology:
Resiliency, robust, Reliable, adaptable
Adaptive,

THE WORSHOP SETTING

8th Annual Symposium on Human Interaction with Complex Systems and 2nd Sensemaking of Complex Information
April 3-4, 2008
Sheraton Norfolk Waterside Hotel, Norfolk, VA, USA

Special Panel on The Art of Battle Command

BG Berk
NATO

COL Bullimore
ACIC

COL Dunn
BCBL

COL Surdu,
DARPA

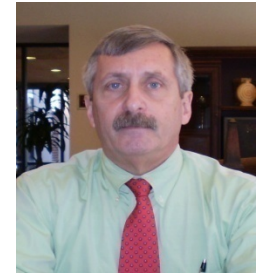COL (Rtd.)
. Murphy

Mr. Cassella

COL. (Rtd). J.
Connelly

LTG (Retired)
Keller

COL (Rtd).
Johnson,
BCBL

WORSHOP EMERGING INSIGHTS

Human Dimensions (HD) emerged as a priority topic for discussion at four complementary areas with training embedded in each topical area.

➢Cognitive
➢Social
➢Ecological
➢Leadership

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WORSHOP EMERGING INSIGHTS--Cognitive

➢Information/cognitive load:

   ➢Too many information from many different sensors—human or artificial

   ➢Dynamic, fast-tempo, limited time processing

➢Fixed human memory

   ➢Human memory is relatively fixed

➢Variations in attention processing

   ➢Responding to different information cues and types of attention requirements

   ➢Coping with information changes in space, time, and context

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WORSHOP EMERGING INSIGHTS--Cognitive

➢ Variations in interpreting information:
  ➢ Sensemaking and information equivocality
  ➢ Same object may mean different things to different people, especially under stress and dynamic changes
➢ Cognitive dissonance
  ➢ Sensory conflict—when information is presented in multimodal channels
  ➢ Reconciling human and technology bandwidth, speed of processing, and contact distance.

WORSHOP EMERGING INSIGHTS--Cognitive

➢Mental model variations:
  ➢Theory of expertise—novice vs. experts
➢Knowledge, skill, and ability
    ➢Knowing in context and performance
    ➢Tacit knowing
    ➢Exhibiting competency
    ➢Learning from outcomes (feedbacks and effects)
➢Reasoning
    ➢Top-down vs. bottom-up (deduction vs induction)
    ➢Abduction (looking for best fit in context)
    ➢Meta-reasoning: knowing effortlessly with results

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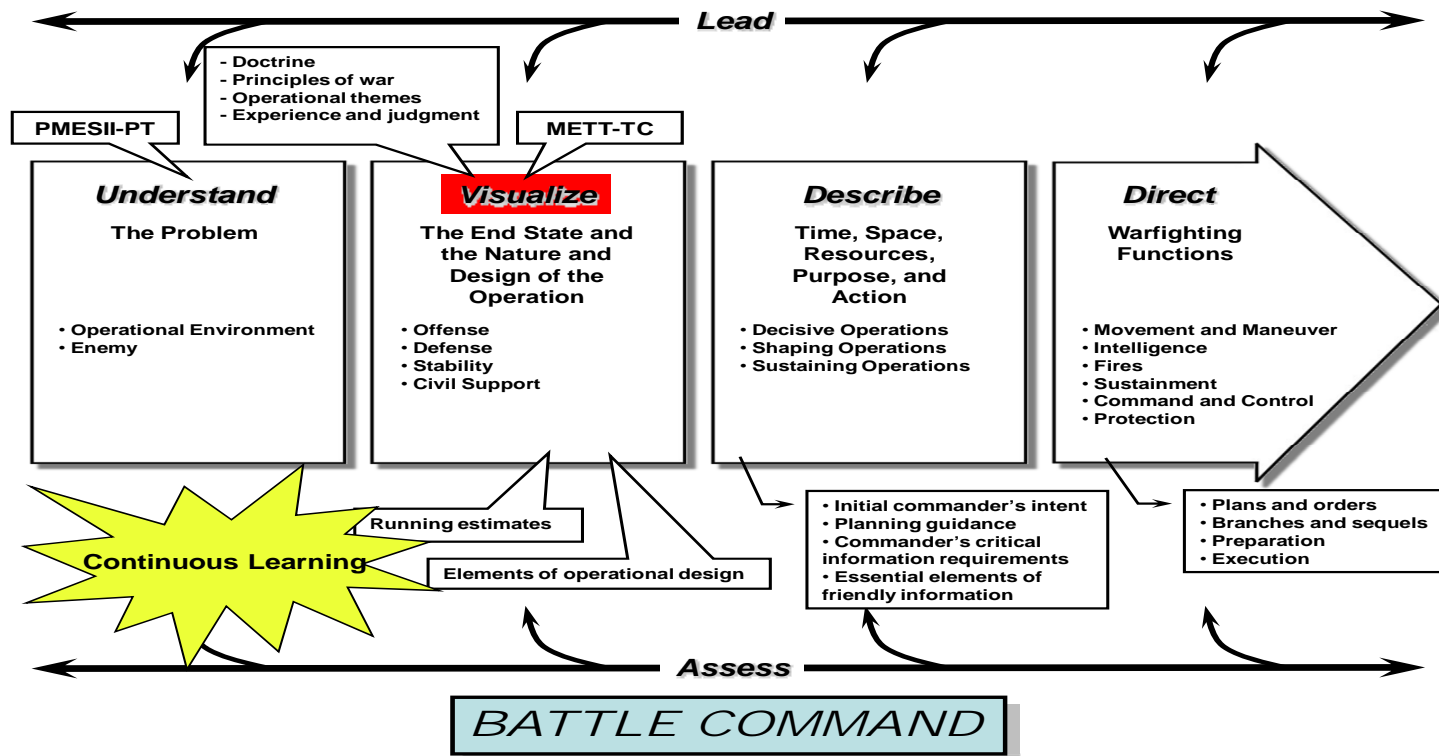# WORSHOP EMERGING INSIGHTS--Cognitive

➤ Bias:

  ➤ Habit/functional fixity
  ➤ Stereotype & Cultural
  ➤ Dealing with "short-cuts"
  ➤ Doctrinal invariants

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WORSHOP EMERGING INSIGHTS—Cognitive: From Doctrinal Elements of Visualization

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WORSHOP EMERGING INSIGHTS—Cognitive: From Doctrinal Elements of Visualization

Doctrinal Background

LTG. William S. Wallace (Military Review, May-June, 2005): *In the Battle Command concept, commanders use a personal decision-making process that incorporates* *visualizing the operation*, *describing the operation in terms of intent and guidance, and then directing actions within that intent.*

Army Transformation Road Map, 2003: Battle command includes visualizing the current and desired future states of friendly and enemy forces and then deciding how to get from one to the other at least cost.

FM 100-5: Battle command is the art of battle decision making, leading, motivating soldiers and units into action. It includes visualizing your current and future state.

Doctrinal Background

Army FM 6-0, Mission Command: Command and Control of Army Forces:

Visualization is a cognitive ability that creates mental images based on
(i) experience, training and education and knowledge of doctrines;
(ii) goals, the timetable for achieving them, and the desired end state to include mission and intent; and
(iii) resources and activities to achieve the goals

WORSHOP EMERGING INSIGHTS—Supporting Cognitive Skills

- Decision support tools should be developed with a diverse use of human
- The tools should be able to reason in contextual and situational problems with different scales, risks, and uncertainties.
- Create tools that can help the commanders to know what they did not know before, and avoid creating tools which are only duplications of the commander's mental models.
  - Create ad hoc cognitive tools that are reconfigurable, adaptable, and ready for plug and play into situation foxholes.
  - Create cognitive tools that can explore frontiers of artificial ignorance; i.e., explore decision making space and regime to identify contextual information that the commander does not currently know and their impacts on command decision making.

- The tools should have <u>decision-centric interfaces</u> to capture individual decision making styles; recognize Personal Construct Theory (PCT)
  - o Adaptive, content-sharable, and consistent human-machine interface (HMI).
  - o Ubiquitous support for knowledge management.
  - o Human essential information network capability: information exchange capability through video, voice, graphics, texts, signs and gestures, and so on.
  - o HMI functionalities tailored to optimally use different human modalities of information and communication processing.
  - o Provides pervasive document processing capability, including, text mining and video.

WORSHOP EMERGING INSIGHTS--Social

- ➢Cultural cognition
  - ➢Knowing the people you work with—coalition force, joint task force, enemy culture, etc.
- ➢Socio-cognitive networks
  - ➢Who is talking to who, when, how, why
  - ➢Who is the leader, why
  - ➢Why information is shared with cliques, groups, foes & friends
- ➢Adversary network
  - ➢What are the characteristics?
  - ➢How do the enemy operate (strategically, tactically?)
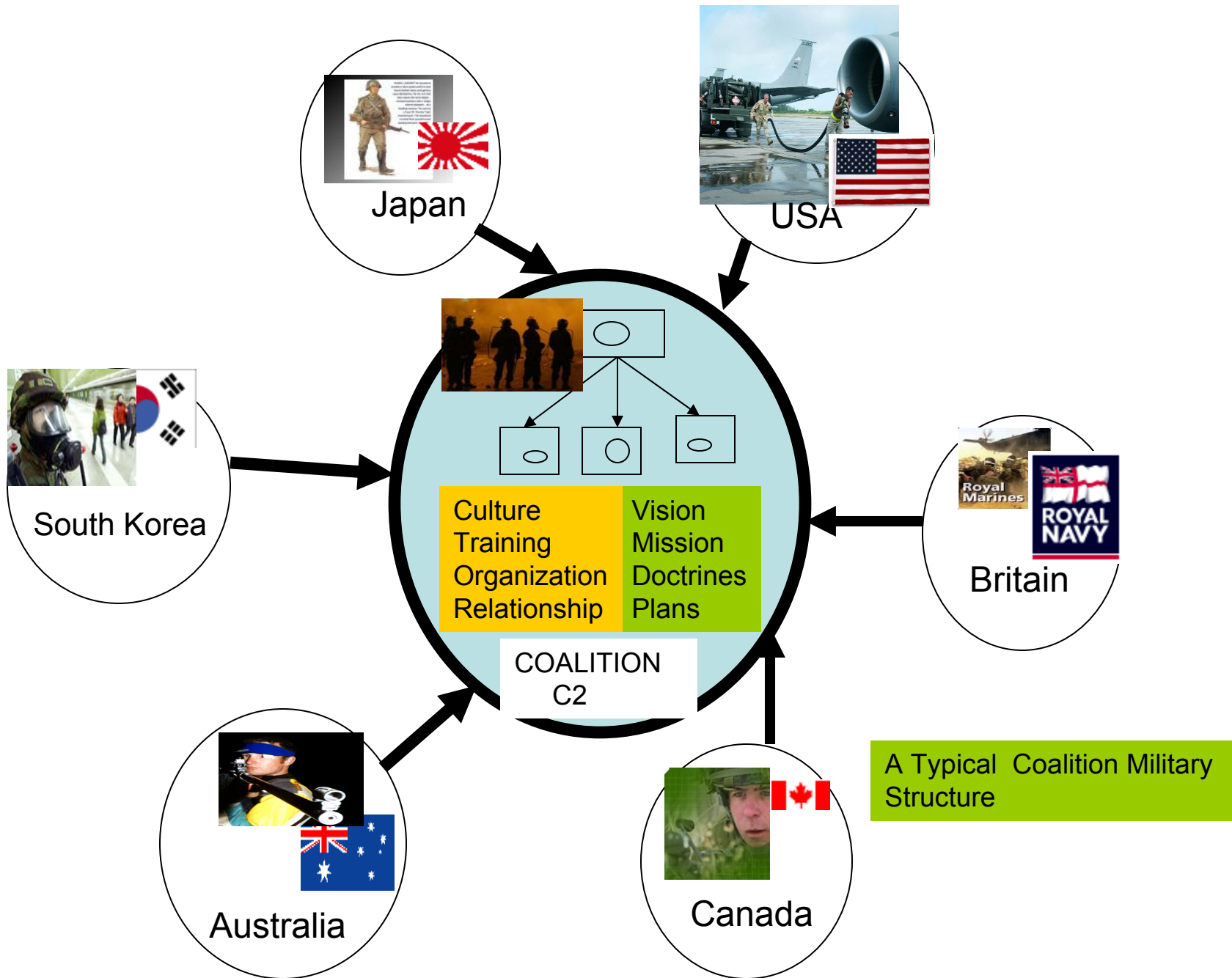 - ➢What do they know from the blue forces, when, how, which?

WORSHOP EMERGING INSIGHTS--Social

➤ Shaping Operation in Context

    ➤ Use cultural information to shape the psychological processes that determine how people THINK and FEEL, and social processes that determine HOW PEOPLE INTERACT

➤ Doctrinal and Operational Values

    ➤ Mapping DIME (Diplomatic, Information, Military, Economic) strategies to PMSEII (Political, Military, Social, Economic, Information, and Infrastructure) tactical elements

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Japan

USA

South Korea

Culture
Training
Organization
Relationship

Vision
Mission
Doctrines
Plans

COALITION
C2

Britain

Australia

Canada

A Typical Coalition Military Structure

Riot in Tibet. Who is a rogue agent?

MOSOP in Niger Delta of Nigeria. What does this Woman know? When?

Political riot in Kenya. Why is America concerned?

Any common Information meme?

In Iraq. Welcome America. Who is a friend or foe?

Christians also support Al Qaeda: True or false?

- Joint Battle Command:
  - Dynamics of social interaction
  - Emerging behaviors/objects within the joint/social network
  - Collaboration
  - Conflict resolution
  - Evolving doctrines orchestrated by changing missions
  - Reconciling different SOPs

Joint Battle Command

▸ Joint Battle Command depends on the alignment and synchronization of:

– Operational concepts and doctrine

– Horizontally and vertically integrated systems

– The underlying joint technical architectural standards and global information grid infrastructure in which the layered networks are nested.

- 2004 Army Transformation Roadmap

Booz | Allen | Hamilton

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WORSHOP EMERGING INSIGHTS—Supporting Social Skills

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- Achieving human network interoperability requires the understanding of socio-cultural cognition, the important being the cultural human terrain of the enemy.
- The operational impacts of socio-cultural and human terrain networks, node-to-node commander's intent with mixed and joint command structures will continue to be a limiting factor in successful operations.
- More typically, battle staffs and commanders working jointly and collaboratively—each holding a unique perspective on the problem space—must collaborate to form a shared understanding of the operational work domain. Issues on cultural sensemaking, team/group situation awareness, language understanding, and many socio-cultural issues must be addressed with new and existing ethnographic techniques for data mining.

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- Social and cultural barriers must be recognized and reconciled through real-time interactive training. Social barriers include the lack of interpersonal familiarity and trust. Cultural barriers include differing views of authority and responsibility. Organizational barriers include parochial attitudes and the unwillingness to share information across organizational boundaries.
- Actors in Joint- and /or Coalition- Task Forces must be considered as members of a collaborative work community. Issues that deal with collaboration, cooperation, trust, negotiation skills will have to be trained to the force communities' members.
- The enemy's socio-cultural footprints will need to be tracked and modeled analytically from genotype and phenotype perspectives so as to predict the enemy's influence, power, intent, and prospective strategies in the battlespace.

WORSHOP EMERGING INSIGHTS--Ecological

➤The military environment is more than a battlefield
  ➤A network of inter-related artifacts, information, infrastructure, human terrain and habitats
  ➤Geospatial analysis: more than terrain and weather—now includes urban corridors and personal dwellings and factories
➤A group of individuals co-locate in "a field or social space)—Kurt Lewin
  ➤The environment is organized and differentiated in context.
  ➤The world is perceived by a person in terms of whatever meaning that person applies to a situation (Personal Construct Theory—Kelly, 1955)

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WORSHOP EMERGING INSIGHTS—Supporting Ecological Skills

➢Spatial Knowledge, skill, and ability:
Knowledge of know-how and know-where – to find relevant and up-to-date information
Ability to identify feature changes in location, time, and space

➢ The ability to identify, analyze, synthesize, and evaluate connections and patterns of information in dynamic environment.

➢ The ability to contextualize and integrate information across different forms of command nodes with different human terrain information.

➢ The ability to reconfigure, re-present and communicate information.

➢ The ability to manage information (identify, analyze, organize, classify, assess, evaluate, etc.).

➢ The ability to distinguish between meaningful and irrelevant information for the specific task at hand or problem to be solved.

➢ The ability to distinguish between valid alternate views and fundamentally flawed information.

WORSHOP EMERGING INSIGHTS—Leadership Skills

➢**Battle systems are hostile, complex, austere, and asymmetric**

  ➢Ambidextrous leader—change, adapt, lead, learn (CALL)
  ➢Spatio-temporal situation understanding
  ➢Recognizes what works in context and improvise otherwise

➢**Have predictive knowledge: Ability to think ahead**

  ➢Prospective reasoning ability
  ➢Recognizing evolving opportunity in "spring" configuration instead of "pipe" linear dimension.
  ➢Acquire anticipatory cognition to recognize future unfolding battle states, constraints, and opportunities.

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WORSHOP EMERGING
INSIGHTS—Leadership Skills

➢ **Critical thinking and Dynamic Knowledge Creation**

➢ Reproduce, create, and use knowledge as situations unfold—See, Move, Strike.

➢ **Acquire Interpretative and Explanative Intelligence**

➢ Adductive reasoning with contextual explanation
➢ Making sense of situation information and quickly transform to actionable intelligence

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WORSHOP EMERGING
INSIGHTS—Supporting Leadership
Skills

- The leader's role in creating conditions for team effectiveness and managing multi-national coalition teams.
- Developing methods, strategies and tools to facilitate the creation of leadership expertise earlier in the career pipeline.
- Commanders must be able to plan and execute on-the-go to cope with evolving novel enemy strategies.
- Needs to be educated on leading adaptive organizations that are relatively "unstructured" and authorities are distributed.

SUMMARY & CONCLUSIONS

➢ The workshop recommendations do not advocate any standard or must follow "issues."

➢ It was noted that the human dimensions will have to transcend the constructivist and physique concepts to mentalist and cognitivist

➢ As the soldiers must cope with adaptive asymmetric battlefields, the human dimensions span across many aspects of human knowledge, skill, and ability that must be trained to deal with organizations that learn through technology

Studies

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SUMMARY & CONCLUSIONS

➢ The purposes of the workshop were:
  ➢ Inform the relevance of human dimensions in future modular forces with network-enabled Battle Command System.
  ➢ Identify requirements for human-technology collaborative work systems.
  ➢ Inform the requirements for human dimension training developments