

Dynamic Battlefield Visualization: Knowledge Management in a Complex, Emergent PMESII-PT Battlefield Paper 162

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Visualization Defined

Visualization can be generally defined as the art and science of developing situational understanding, determining a desired end state, and envisioning how to move the force from its current state to the desired end state.

Counterinsurgency Operations Defeat the Insurgency						
	End State					
Establish Civil Security Restore and Maintain Order Conclust Coperations to fast Violemoce	Safe, secure and stable environment established					
Establish Civil Control Provide Provi	Rule of Law established					
Support Host Nation Security Forces Identify Security Forces Security Force Security Security Security Security Security Secur	Self Sufficient National Security Forces Established					
Support to Governance Provide Public Mercify and Pacifiete Provide Support and Support Administration Resort Local College Support Bections Retorms	Functioning legitimate government that does not require external support					
Restore Essential Services	Essential services restored					
Support to Economic and Infrastructure Development Provide Public Provide Provide Civilian Provide Coordinate Works Corrinerce Support Civilian Health Apriculture Civic Assistance Support Support	Economic foundation with sufficient infrastructure established					
Conduct Information Engagement Tell the Bory to the US public Thurs of the transfer to the tra	Increased support to the HN Government					

Visualization Challenge





The operational variables describe the overall operational environment. Upon receipt of a warning order or mission, Army tactical leaders narrow their focus to six mission variables. Mission variables are those aspects of the operational environment that directly affect a mission.

Phase 1: Task Requirements Analysis



Visualization Characteristics

Battlespace Visualization

- · Purposefully frames actions and links them with understanding and intent
- Is synchronized vertically across the commander and staff
- Balances intuition with deliberate reasoning according to past experience
- Structurally framed by doctrine to provide common ground of understanding
- Matched to the dimensions and levels of operational complexity
- Collaboratively constructed to achieve unity of purpose
- Continuously adjusted to revealed aspects and unpredictable adversary
- Supports and guides a larger planning and execution process

Levels of Visualization Thinking



Commander's Visualization Space



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Issues Highlighted in Interviews

- 25 interviews with officers possessing relevant BCT/BTF command and staff experience
- Read-ahead survey form based on initial task model
- 2 hour interviews recorded for post-analysis
- Visualizing effects of non-lethal actions on civilian population (center of gravity) / lack of doctrinal concepts and MOEs
- Reconciling multiple operational perspectives of military forces, interagency organizations, and intergovernmental elements in a common PMESII-PT battlespace
- Reconciliation of short-term operational objectives against short-term tactical actions
- Loss of operational focus during unit rotation / discontinuity of operations during unit handovers
- Managing multiple forms of verbal, written, graphic, and tacit knowledge

Visualization Task Areas

• Build the Visualization Framework

1. Identify tactical problems employing METT-TC and Operational Design frameworks

• Synchronize the Visualization Framework

- 2. Synchronize the visualization internally across Commander and staff to develop shared understanding
- 3. Synchronize the visualization across relevant external players to accommodate multiple stakeholder perspectives

Assess the Visualization Framework

- 4. Focus collection of information and identify patterns / trends to discover operational variances and maintain a running estimate
- Develop meaningful measures of effectiveness (MOE) based on endstate objectives and 2nd-order consequences

• Exploit the Visualization Framework

- 6. Target shaping and ISR operations to reduce risk/uncertainty and discover adversary weaknesses
- 7. Exploit newly revealed problem elements to seize and maintain operational initiative

Training Development and Testing



- Deliberate practice of expert cognitive behaviors
- ✓ Multiple, realistic COE scenarios
- ✓ Built-in cues or triggers: ambiguous, critical, useful, irrelevant, and misleading
- ✓ Built-in performance measurement supports feedback
- Coaching/feedback via video or avatars of authentic mentors, instructors, and Soldier role models

PC-Based Tutorial Lessons



Introductory Materials

Visualization Introduction



Road-to-War Briefing



Battlefield Update Briefing



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Training Vignette Features

Video from Iraq



UAS Video



Realistic Animations



C2 Information Displays



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Pre- and Post-Training Assessment

Students review situation



Students perform task skills

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Students receive feedback



Training Effectiveness Evaluation

CONFIDENCE RATINGS

Viewelization Skill	Mean Rating			
Domain	Pre-Training	Post-Training		
Build	3.89	3.92		
Synchronize	3.96	4.05		
Assess	3.37	3.76		
Exploit	3.04	3.71		

PERFORMANCE ASSESSMENT

- Pre-test (*M* = 79.6, *SD* = 4.6)
- (Wilcoxon's Z = 2.533, p < .05)
- Post-test (*M* = 87.8, *SD* = 4.9)

Phase 2: Refine the Visualization Model



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Sensemaking Strategies

COMPLEX

Cause and effect are only coherent in retrospect and do not repeat

Pattern management

Perspective filters

Complex adaptive systems

Probe-Sense-Respond

KNOWABLE

Cause and effect separated over time and space

Analytical/Reductionist Scenario planning

Systems thinking Sense-Analyze-Respond

CHAOS

No cause and effect relationships perceivable

Stability-focused intervention

Enactment tools

Crisis management Act-Sense-Respond

KNOWN

Cause and effect relations repeatable, perceivable and predictable

Legitimate best practice

Standard operating procedures

Process reengineering Sense-Categorize-Respond

KURTZ & SNOWDEN, 2003

Forms of Sensemaking Knowledge

LOGICO-SCIENTIFIC KNOWLEDGE

- Objective: Establish a body of universal truths
- Nature: Empirically validated truths, objective definition
- Method: Formal reasoning using predicate logic and proofs
- Application: Theory-driven, context-free, objective, ahistorical

NARRATIVE KNOWLEDGE

- Objective: Endow experience with meaning and intentionality
- Nature: Plausible explanations, bracketed by experience
- Method: Abductive just-in-time reasoning using story-telling
- Application: Meaning-driven, context sensitive, intentional, paradoxical

BRUNER, 1986

Mapping onto Operational Design



Issues Highlighted in 2nd Interviews

- 18 interviews with officers possessing relevant BCT/BTF command and staff experience
- 2 hour interviews recorded for post-analysis
- Misuse of intuitive (RPD) reasoning and abbreviated MDMP when it is not supported by relevant operational experience
 - Traditional MDMP viewed as a time-consuming, pro forma exercise
 - Continuous series of FRAGOs cannot substitute for deliberate reevaluation of operational requirements and strategy
- Failure to adequately transfer situation awareness and understanding between rotating units
 - New unit experiences steep learning curve
 - Adversaries learn to exploit operational seams
- Operational objectives poorly articulated
 - Reactive operations consist of disconnected series of tactical engagements and effects (*e.g.*, "Ground Hog Day" syndrome)
 - Consequence management consumes considerable resources

Continuous Visualization Cycle



Flow of Knowledge in Battle Rhythm



Transfer of Visualization between Units



Questions ?

