

Workshop on Sensemaking

Workshop conducted at the request of OASD(C3I)

Organized by AIAA TC on I&C2 Systems

6-8 March, 2001

This is a work in progress

Participants

Name	Affiliation
Alberts, David S.	OSD (C3I)
Arya, Pamela	GRCI
Cooper, Jeff	SAIC
Donahue, Arnold	Pactrade
Hayes, Richard E.	EBR, Inc.
Mahen, Ed	USAF
Oertel, Dan	Booz Allen & Hamilton
Palmquist, M. Steven	Software Eng. Inst.
Ray, Jack	EBR, Inc.
Smith, Ed	Boeing
Soules, Steve	BAH for ASD C3I PAI
Starr, Stuart	MITRE
Wertheim, Mitzi	CNA
Wheatley, Gary	EBR, Inc.

Redefining the Problem

- Original tasking
 - Explore the application of Knowledge Management (KM) concepts and techniques to the operational decision-maker
- The study team concluded that this was the *wrong* issue for the following reasons
 - KM tends to be primarily useful for relatively simple problems along established processes, not for addressing a dynamic, emergent environment with many complex decisions
 - KM tends to focus on the computer science/info tech dimension of the problem (vice the cognitive, belief dimensions)
 - KM should be a CIO function focused on infrastructure/organizational and enabling capabilities
- For these reasons, the study team elected to focus on *sensemaking* (i.e., understanding the physical, information, and cognitive domains) in operational missions under stress

Workshop Objectives

- Define a conceptual framework for sensemaking in a military context
- Specify emerging requirements
- Explore how to improve military sensemaking
 - Develop a diagnostic methodology
 - Assess how well we do sensemaking today
 - Identify sources of failures/successes and causal dynamics
 - Explore how we remove impediments and create capabilities
- Develop a roadmap
 - Process (workshops, experimentation, research)
 - Creating better sensemaking capabilities (DOTMLPF)

Sensemaking is:

- A process
 - At the individual, group, organizational and cultural level
- That builds on a “deep understanding” of a situation
 - Prior knowledge
 - Belief systems
 - Situational Awareness
 - Missions & Constraints--Capabilites & Intentions of Red, Blue & Other
 - Environment--Uncertainties--Opportunities & Risks
 - Context
 - Values
 - Anticipated dynamic futures
 - Alternatives perceived
- In order to deal with that situation more effectively, through better judgments, decisions and actions

What is Sensemaking about?

- Sensemaking is about such things as
 - Placement of items into frameworks
 - Comprehending
 - Constructing meaning
 - Interacting in pursuit of mutual understanding
 - Patterning
 - Redressing surprise

Adapted from: Karl Weick, “Sensemaking in Organizations”

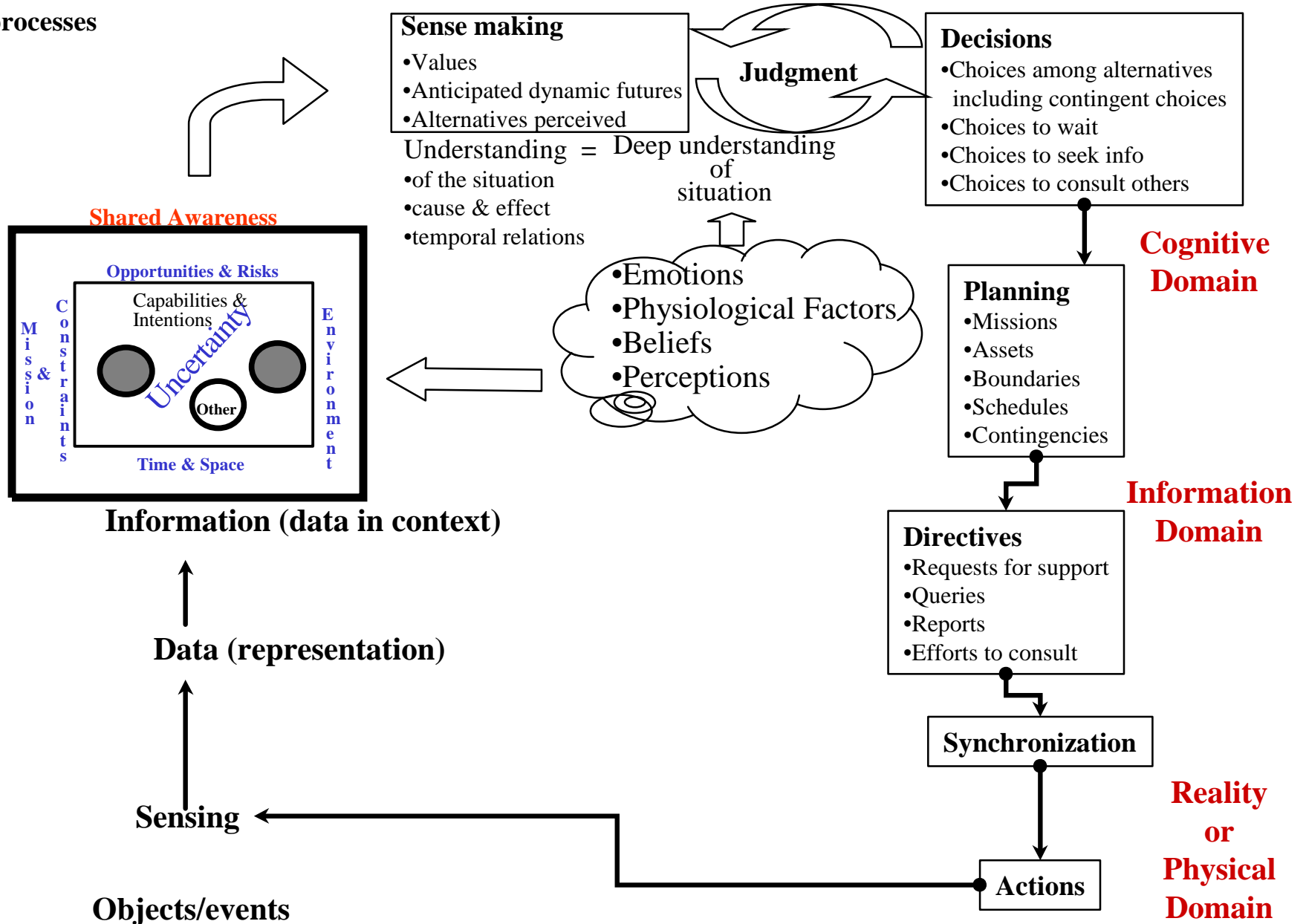
Scope

- Military context
- Full mission spectrum
- Now through 2020 and beyond
- Decision-making under stress
- Primary focus on complex decisions
- Consideration of physiological and cognitive factors, values, beliefs, expertise and experience

Conceptual Framework for Sensemaking

Decision processes

Pre-real
time
knowledge



Diagnostic Sensemaking Chain

- Did they collect enough of the “right” data?
- Did they put it together:
 - Correlation?
 - Context?
- Did they put it in a form that facilitates awareness?
- Did they actually develop situational awareness?
- Did the individuals develop appropriate SA?
- Was the SA shared with all who were involved?
- Was the situation correctly understood?
- Did they make sense of the situation?

Sensemaking on selected Incidents

A Matrix of Relevant Factors

Sense-Making in Selected Incidents—A Matrix of Relevant Factors

Incident/Factors	Stress	Time	Training	GUI Equipment	Pre-Conceived Notion	Intel-Comm	ROE Policy	Culture	Dominant level/Remarks
Starke		X	X	X	X	X			Complacency (K)
Vincennes	X	X		X	X				Aggressive CO (D)
O'Grady		X		X		X	X	X	Intel community culture (D/I)
Blackhawk Shoot-Down			X	X	X	X	X		Communications Failure (D/I)
Saratoga Turkish FF	X	X	X	X	X	X			(D/I)
Greek-Turkey Terrorty Dispute					X	X		X	Governments distracted. Press became player to fan flames. (K)
Grozny	X	X	X	X	X	X	X	X	Mistakes at every possible level (K)
Into the Storm	X	X			X	X			(K)
Desert Storm FSCL		X			X	X	X	X	(K)

K=Knowledge of the situation

I=Information (Data in context)

D=Data

S=Sensing

This is a work in progress

Barriers to Sense-making

Systems, Processes, Human (issues)

- Leadership
- Interoperability
- Doctrinal (TTPs)
- Classification
- Processes stove-piped
- Time constraints
- Organizational constraints
- DOTMLPF
- Training
- Physiological factors
- Policy
- Systems capabilities/displays
- Cognitive biases and filters (I,II Threshold)
- Cultural biases and filters
- ROEs

Information, Cognitive Domains Vs. Spectrum of Conflict

	Combat			Peace Making	Peace Enforcemnet	Peace Keeping	Coercive Ops	Non-combatant Evacuation Ops	HADR	Counter-Terrorism	Counter-Drugs	Coalition	Info War
	Strategic	Operational	Tactical										
Information Domain	Right Data	✓	✓	✓						*		*	
	Picture	✓	✓	*✓									
	Dissemination	✓	✓	✓						*		*	
	Form												
	SA												
Cognitive Domain	Shared SA		Joint	*				Inter-agency/NGO	*	*		*	
	Understanding		*			*	*	*					
	Sense												

* Limiting factor for specified mission
 ✓ Areas where resource investments are currently focused

Why we need enhanced sensemaking

- Ability to deal with
 - Rapidly emerging threats
 - Asymmetric situations
 - Unfamiliar situations
 - Dynamic situations
- Desire to employ new, more appropriate operational concepts and command approaches
 - Network Centric Operations
 - Effects Based Operations
- Ensure an open decision making process
 - Avoid “anchoring” based on early evidence (premature closure)
 - Appreciate non-linear possible futures
 - Reduce vulnerability to IO and deception
 - Evaluate new information appropriately

Key characteristics of the situation (to be made sense of)

- Asymmetrical (values, objectives, weapons and tactics)
- Cultural and linguistic differences
- Effects-based/behavioral measures of mission/policy effectiveness
- Significant capabilities against information/information processes
- Crisis-like atmosphere
 - Little perceived decision time,
 - High value at risk
 - Unfamiliar situation

Future Command and Organizational Concepts

- Flatter, more responsive organizations
- Collaboration across organizations, echelons and functions
- Widespread information sharing (selectively for coalition and civilian interaction)
- Support dissemination, shared understanding and execution of Commander's intent
 - From detailed orders to mission level directives
 - Greater responsibility and authority at lower echelons
- Promote self-synchronization
- Dynamic coalition sensemaking
 - Need to overcome cultural barriers
 - Integrate political and military decision making
 - From geographic, functional and liaison based C2 structures to integrated C2 structures
- Civilian interactions require a consensus approach (inter-agency, NGOs, IOs, host government and multi-nationals)

Key Insights

- Value of doing case studies of Sense Making
 - failures
 - successesto better understand the nature of the problem
- Value of enhancing planning & problem rehearsal capability to improve operational Sense Making
- Investment strategy focused on the the info domain at the expense of the cognitive domain's sensemaking capability
- Refocus investment strategy and increase investments in sensemaking DOTMLPF

Conclusions

- For most cases examined, failure more often caused by
 - Misperceptions
 - Misinterpretations
 - Misunderstandings
 - Miscalculations
 - Miscommunications
 - Misorientation
 - Miscorrelation
 - Maldistribution
 - ...

rather than lack of data or information

And these are in the situations and mission areas we know best

Conclusions Cont'd

- For emerging situations and mission areas:
 - We lack fundamental data and mental models
 - We lack the institutional insights necessary to understand and make sense in these arenas
 - We lack relevant education and training
 - Suited to these situations and mission areas
 - Focused on important elements of the operating environment (cultures, languages, countries, regional dynamics...)

And these are situations and mission areas
where we are most likely to be engaged

Conclusions Cont'd

- Sensemaking is the essential link to information and decision superiority, but remains a weak link in the C2 value chain
- Our current investment strategy is focused on our strengths, not our weaknesses
- Without changing the way we invest, train, and do business, we will continue to be vulnerable to mission failure

Recommendations: Major Areas

- Sensemaking Vision
- First Steps: Exploiting Existing Knowledge
- Research, Analysis and Experimentation
- Education and Training

Sensemaking Vision

- Increase people's awareness to the critical role of sensemaking
- Shift the focus from data, information and systems to sensemaking in support of more effective C2

First Steps: Exploiting Existing Knowledge

- Create a senior level “experts group” to identify exploitable knowledge and methodologies
 - Cognitive psychology
 - Cognitive neuroscience
 - Area studies
 - Social anthropology
 - Human Computer Interface
 - Human factors
 - Decision science
 - Political science
- Create a senior level “practitioners group” to identify exploitable applications and technologies
 - New economy
 - Defense Industry
 - Military practitioners
 - Media
- Create interdisciplinary teams to:
 - Review mission areas to identify weak links
 - Review existing methodologies, approaches and tools

Research, Analysis and Experimentation

- Establish a new, major research thrust focused on the cognitive aspect of sensemaking
- Areas of research emphasis
 - Perception and learning
 - Creating awareness
 - Sharing awareness
 - Developing “deep understanding”
 - Distributive and collaborative processes in C2
 - Sensemaking at the individual, group and organizational level
- Analytic initiatives
 - Create/retrofit new models that represent sensemaking capabilities, processes and impacts on mission effectiveness
 - Measures of merit for sensemaking
- Design campaign of experimentation (multi-year/multi-objective) :
 - Heavy emphasis on discovery experiments
 - Some hypothesis refinement efforts (Limited Objective Experiments)

Education and Training

- Broaden educational experience (within DoD and between DoD and outside institutions)
 - Social sciences
 - Industrial internships
 - Area studies and cultures
 - Languages
 - Involvement in research and experimentation
- Create a family of discovery/experiential/learning centers focused on:
 - New World Disorder missions
 - Traditional missions in the Information Age
- Conduct “Listen and Network” symposia and workshops
 - Bringing the outside in--industry and academia
 - Interdisciplinary/cross-educational/inter-agency

Sensemaking: Symposium/Workshop Series

- 1) Workshop One: The Foundation (March, 2001)
Output: Conceptual framework and way ahead
Action: Brief within OASD (C3I)
- 2) Mini- Symposium/Workshop: Reach out to Industry and Academia (Fall, 2001)
Output: Creation of a community of interest
Action: Brief to selected audiences as applicable
- 3) Workshop Three: A DoD Research Road Map (Where should we head?)
Output: Research road map
Action: Brief to selected audiences as applicable
- 4) Workshop Four: Putting It All Together (Recommendations for DOTMLPF)
Creation of a community of practice
- 5) Book: *Sensemaking in the Military: The Essential Path to Information and Decision Superiority*
- 6) Symposium: Sensemaking in Military Operations

BACK-UP SLIDES

The Way Ahead

•Education & Training

- Conduct Educational exchanges [across educational institutions, involved communities; e.g., Cross-pollinate across belief systems]

- Encourage broader participation in seminar

- Broaden education experience at institutions, like NPS, to enhance sensemaking (broader exposure to social sciences; case studies of prior operations)

•Analyses, Experiments

- Create a family of discovery/experiential learning centers focused on New World Disorder missions (e.g., critical infrastructure protection; urban warfare; anti-access/area-denial warfare)

- Develop & apply methodologies, tools to evaluate the impact of good sensemaking on the quality of decisions made (and ultimately to mission effectiveness) e.g., Correct MoMs; “good sensemaking?”; meaning?

- Conduct series of experiments to evaluate the impact of alternative presentation of information/knowledge on sensemaking (ACTDs)

- Explore the two-sided aspects of sensemaking (e.g., is there a competitive advantage if Blue’s sensemaking dominates Red’s)

The Way Ahead

- DOTML-PF
 - Address the issue:
 - For a given mission area, how should DOTML-PF co-evolve to enhance sensemaking?
- Cross-cultural dimension
 - Conduct cross-organizational workshops (e.g., precursor ~ new mechanisms ala FAO, DOD, other-agency, allies, NGOs, IOs) to highlight:
 - importance of sensemaking
 - the need for change (I.e., cultural, process, policy, systems) to enhance sensemaking)
- R&D
 - Reallocate resources to focus on the “soft dimensions” of sensemaking (DARPA, ONR, CIA, DIA)

The Anticipated Mission Environment

- Full spectrum
- Coalition \Leftrightarrow international
- Civilian \Leftrightarrow military
- “Fish bowl”
- Misinformation and spin
- Low tolerance for casualties and collateral damage in low stakes engagements