

AN APPROACH TO COLLABORATIVE SENSEMAKING PROCESS

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Presentation Outline

1. INTRODUCTION: Define Sensemaking/
Occasions for SM
2. THE INDIVIDUAL SENSEMAKING
STRUCTURE
3. COLLABORATIVE SENSEMAKING (CS)
4. PRINCIPLES SUPPORTING CS
5. CS FRAMEWORK
6. CHALLENGES
7. SUMMARY/ CONCLUSIONS/ EXAMPLE
CS SYSTEM

WHAT IS SENSEMAKING ?

Sensemaking: A process, design, or techniques of fusing information in context to derive understanding.

Making Sense: The art or science of making meaning and/ or interpreting information in context for decision making.

Some Sensemaking Definitions

1. HOW MEANING IS CONSTRUCTED AT BOTH THE INDIVIDUAL & THE GROUP LEVELS – (Weick, 1995).
2. A SYSTEM OF ACTIONS, SYMBOLS AND PROCESSES THAT ENABLES AN ORGANIZATION TO TRANSFORM INFORMATION INTO VALUED KNOWLEDGE WHICH INTURN INCREASES ITS LONG-RUN ADAPTIVE CAPACITY – (Schandt, 1997; pp. 8)

Some Sensemaking Definitions

3. A THEORY AND A PROCESS OF HOW PEOPLE REDUCE UNCERTAINTY OR AMBIGUITY; SOCIALLY NEGOTIATE MEANING DURING DECISION MAKING
----(Weick, 1985)
4. ARTICULATING AND POSSIBLY CONTESTING THE MEANING AND SIGNIFICANCE OF AN ARTIFACT OR IDEA –(S.B. Shum & A. M. Selvin, In Distributive Collective Practices 2000: www.limsi.fr/WkG/PCD2000)

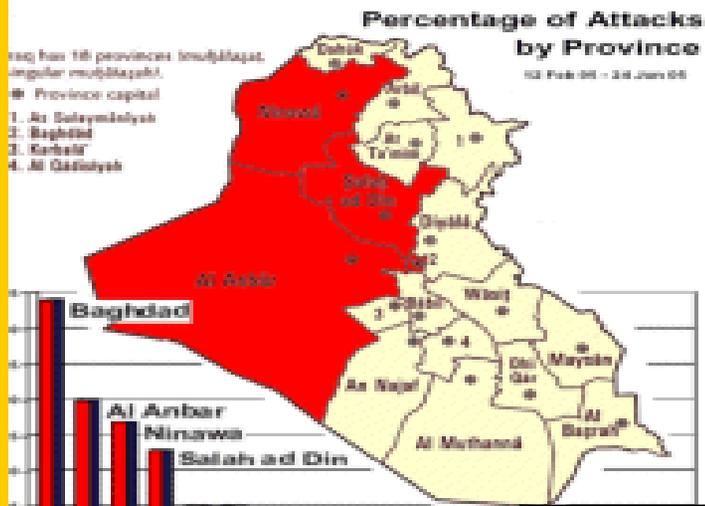
Some Sensemaking Definitions

5. COLLECTING “DOTS” and BRIDGING MEANING TO HUGE VOLUME OF DATA---
INQ-Tel (Arlington-based company).
6. DERIVING MEANING FROM FRAGMENTARY CUES–
(DARPA’S Information Awareness Project).

Why Sensemaking ? Situation Understanding

Iraqi Problems

- Insurgency
- Terrorism
- Civil Unrest
- Ethnic Rivalry
- Weapon of Mass Destruction
- Despotic Leadership



Solution Approach

- Political
- Economic
- Military
- Social
- Information
- Infrastructure

Adversary Characteristics

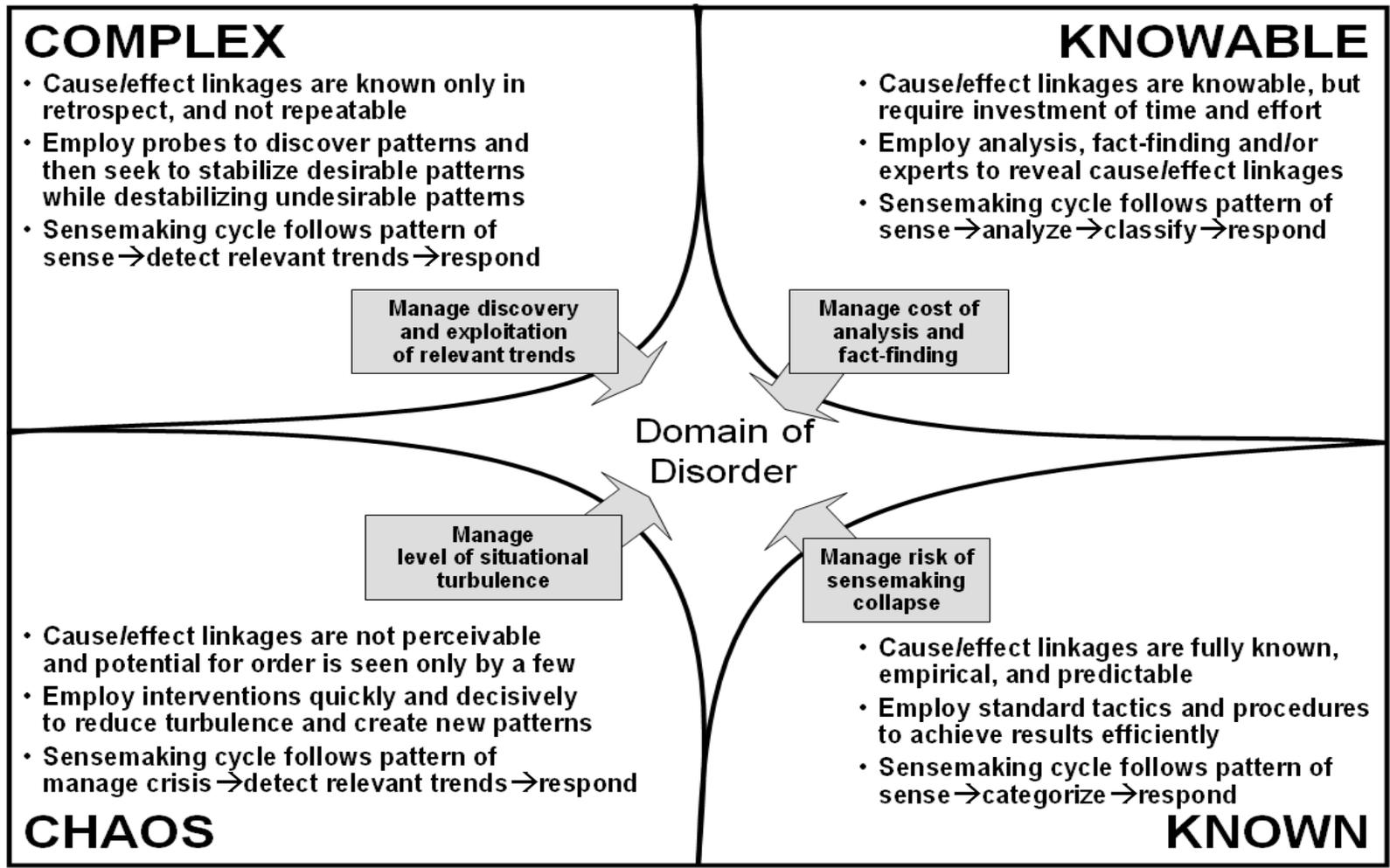
Dynamic, Uncertain, Chaos,
Complex, Novel, Ambiguous,
Asymmetric



Enemy
Or
Friend?

Why Sensemaking ? Interpreting Commander's Intent





Spatial dimensions of the Sensemaking Environment: *the Cynfin framework (a la Leedom, 2004)*

Sensemaking: An End-to-End Approach

Understanding

Cognitive Domain

Command Intent

Sensemaking

Awareness

Battlespace Management

Information Domain

Battlespace Monitoring

Synchronization

Physical Domain

Operating Environment

Adapted from "Understanding Information Age Warfare" (CCRP, 2001)



Sensemaking Challenge

To create a *systematic, widespread and persistent* **Cognitive Edge** for the warfighter



Effect

Target



INDIVIDUAL SENSEMAKING STRUCTURE

Hindsight:

The commander relies in hindsight—elements of experiential knowledge; lessons-learned data; “I have seen this before syndrome”

Insight:

The commander relies on tacit knowledge—“knowing more than he can tell;” the “aha” experience

Outsight:

The commander looks for outside information to confirm his beliefs—HUMINT, SIGMINT, etc. “What is happening out there syndrome”

Foresight:

The commander attempts to project his knowledge into the future through envisioning, anticipated (expected goals). A product of mental simulation



Short-sight:

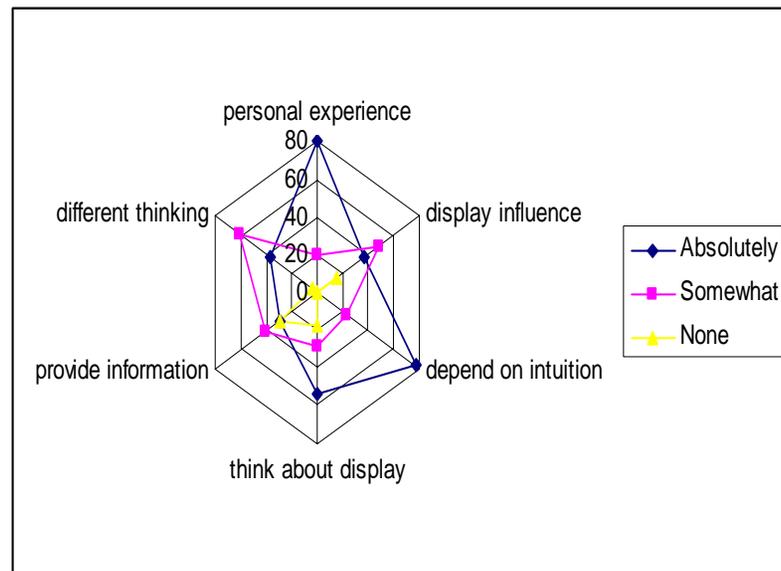
The commander relies on short-term goals; Lacks discernment or long-range planning perspective.

Oversight:

The commander overestimates/ Underestimates situation—unintentional omission or mistake.

The Adversary

INDIVIDUAL SENSEMAKING STRUCTURE



TACIT KNOWLEDGE
INDIVIDUAL MENTAL MODEL
SELF AWARENESS
PERSONAL EXPERIENCE
CRITICAL THINKING ABILITY
INTUITION / COGNITIVE DEVELOPMENT
TRAINING
LEVEL OF EXPERTISE

INTERACTION WITH OTHERS
LEARNING STYLES
LEADERSHIP STYLES
PERSONALITY STYLES
OTHER TRAITS

THEORETICAL RATIONALE AND EMPIRICAL SUPPORT—THE INDIVIDUAL PERSPECTIVE

KLEIN (1988):

- Power of Intuition
- Mental Simulation
- Metaphor
- Story Telling

Theory of Expertise (Chi, Simon; 1981; Adelson, 1984; many others:

- Product of experience
- Training
- Skill, ability, knowledge
- Competency, Proficiency

Situated Acts (Suchman, 1987)

- Situational factors
- Task complexity
- Uncertainties
- Cognitive codes in the mind

- Schema Theories (Hintzman, 1976)
- Cognitive codes in the mind
 - Storehouse of experience
 - Daily coping (Functional)
 - Atypical beliefs (Cognitive)
 - Meta-cognitive codes (Contextual)

Pirolli & Card Model:

INFORMATION → SCHEMA → INSIGHT

COLLABORATIVE SENSEMAKING



A12 NEWS & RECORD, Friday, February 17, 2006

NEWS & RECORD

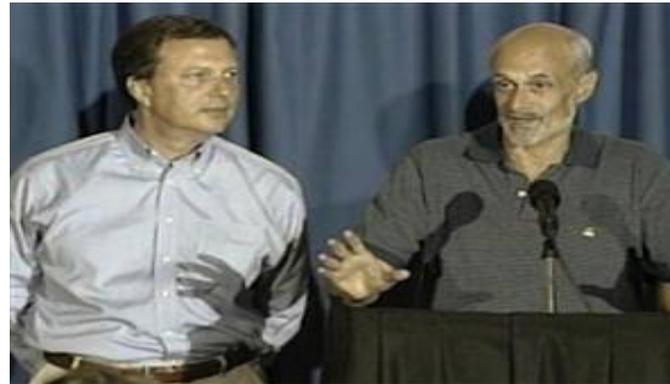
Greensboro, North Carolina



COLLABORATIVE SENSEMAKING



Panic
Confusion
Inconsistency
Lack of Cohesion
Snafus
Lack of Consensus
Break down in sensemaking



ORGANIZATIONAL (DRIVING) FACTORS IN THE SENSEMAKING PROCESS

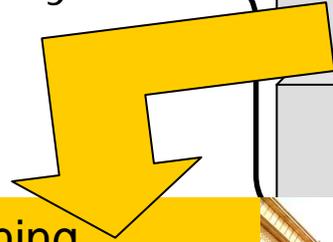
Levels of Organizational Sensemaking Analysis

Ecological Level (Environmental Interactions)

Organizational Level (Collaborative Work Communities)

Individual Level (Cognitive Core)

- Individual & Group Training
- Complexity & Interdependence of multiple cultures
- Availability of Aiding Tools
- Framing Shared Understanding
- Team Situation Awareness
- Team Mental Model
- Shared Purpose
- Common Language for communication
- Synchronizing Efforts: Time & place



Bleach training in Iraq



Who is there?

COLLABORATIVE SENSEMAKING

Principle 1: Collaboration requires a shared vision and goal

Principle 2: Collaboration takes place in the same information space

(a) Common operating picture

(b) Common situation awareness

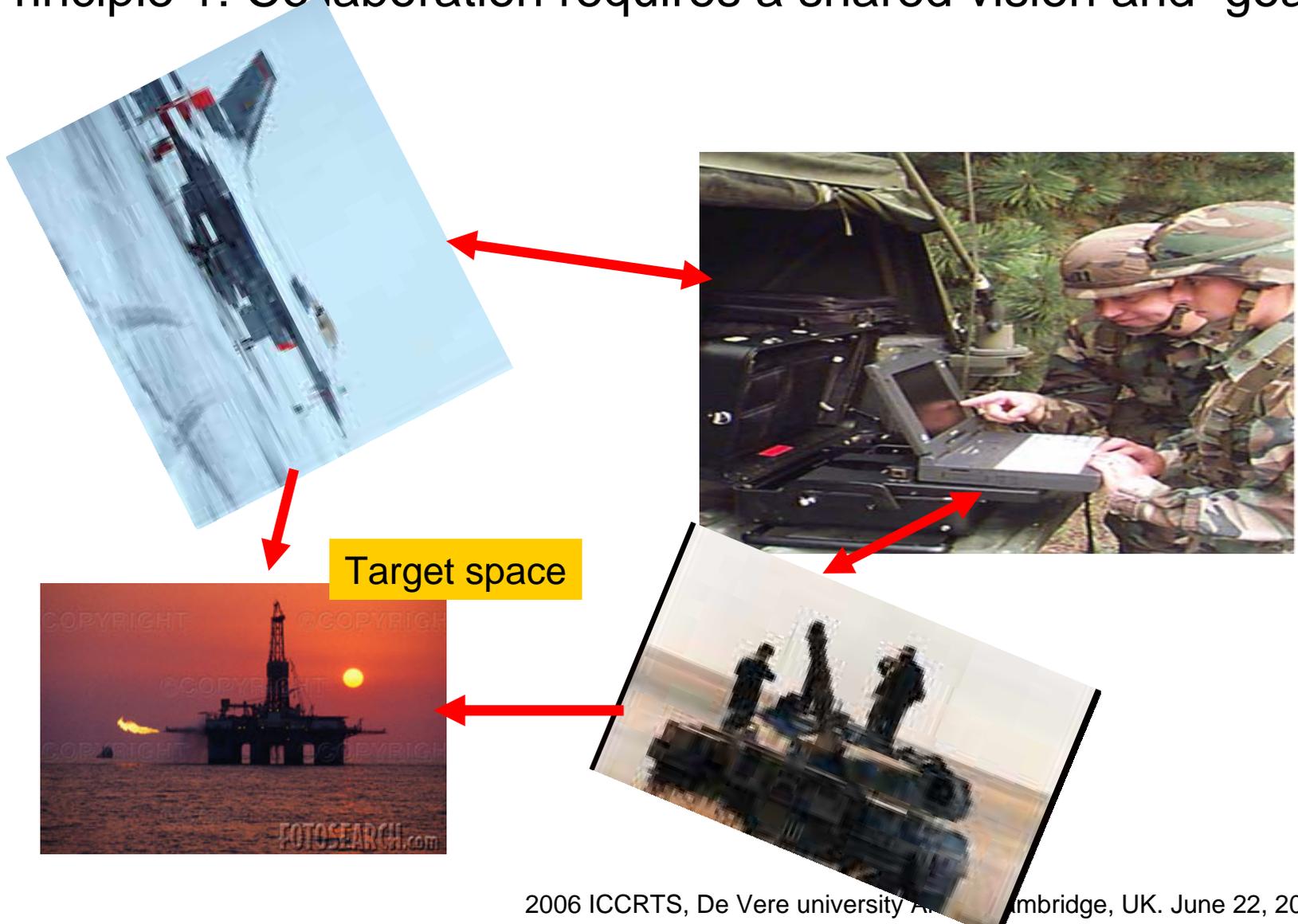
Principle 3: Collaboration results from shared communication

Principle 4: Time and space is invariant during collaboration

Principle 5: Collaboration involves organizational (group) knowledge process

COLLABORATIVE SENSEMAKING

Principle 1: Collaboration requires a shared vision and goal



COLLABORATIVE SENSEMAKING

Principle 2: Collaboration takes place in the same information space

- (a) Common operating picture
- (b) Common situation awareness



Do you see what I see?

Can you tell where it is?

Can you tell what time it disappeared?

COLLABORATIVE SENSEMAKING

Principle 3: Collaboration results from shared communication



What did you tell him?

What did I say?

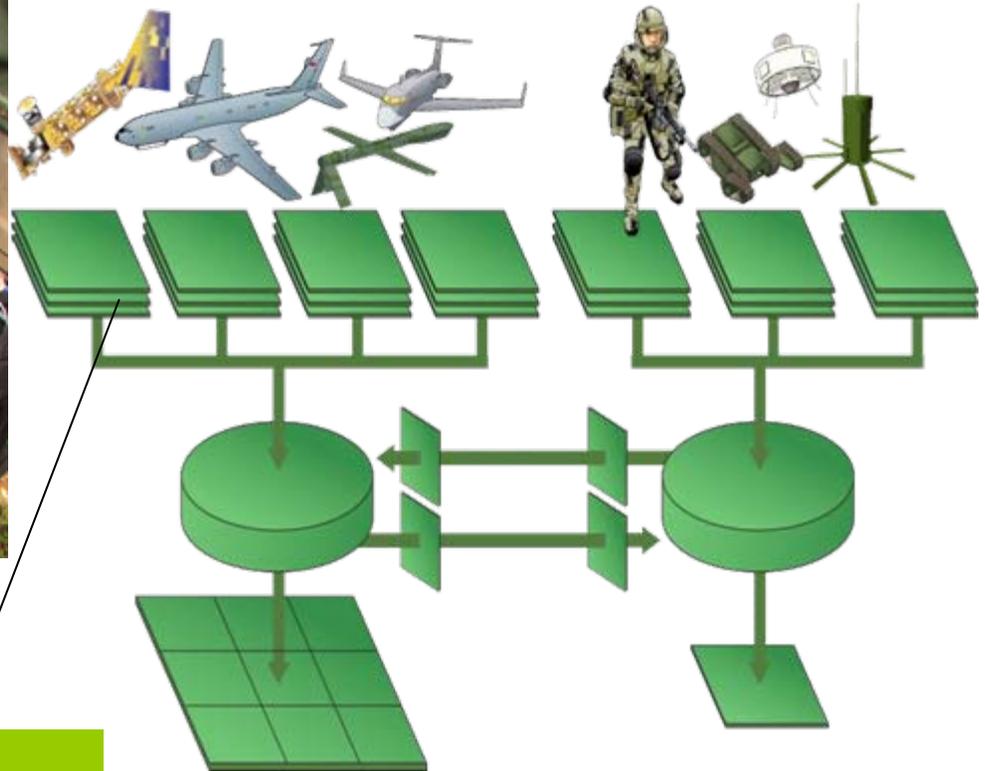
COLLABORATIVE SENSEMAKING

Principle 4: Time and space are invariant during collaboration



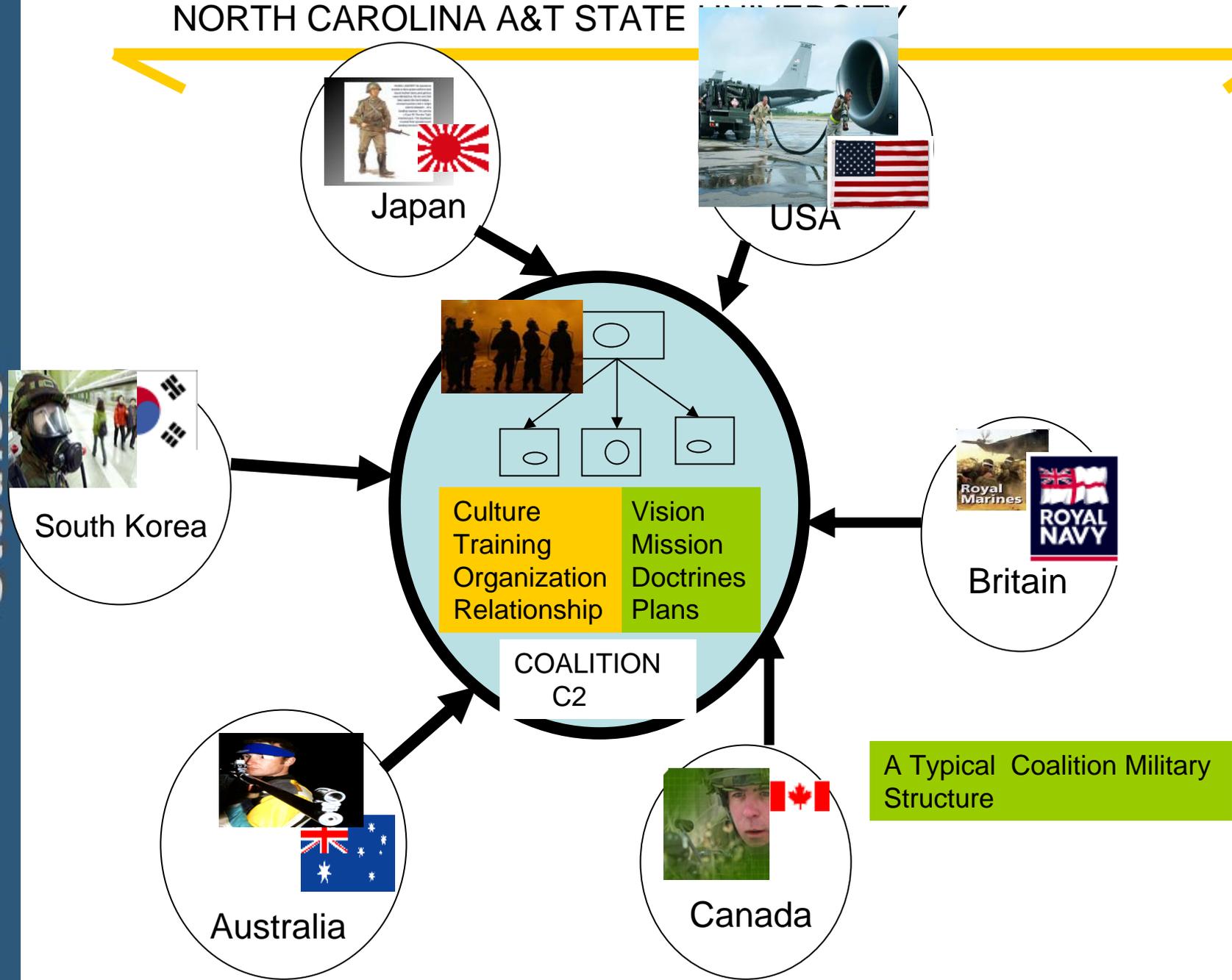
COLLABORATIVE SENSEMAKING

Principle 5: Collaboration involves organizational (group) knowledge process

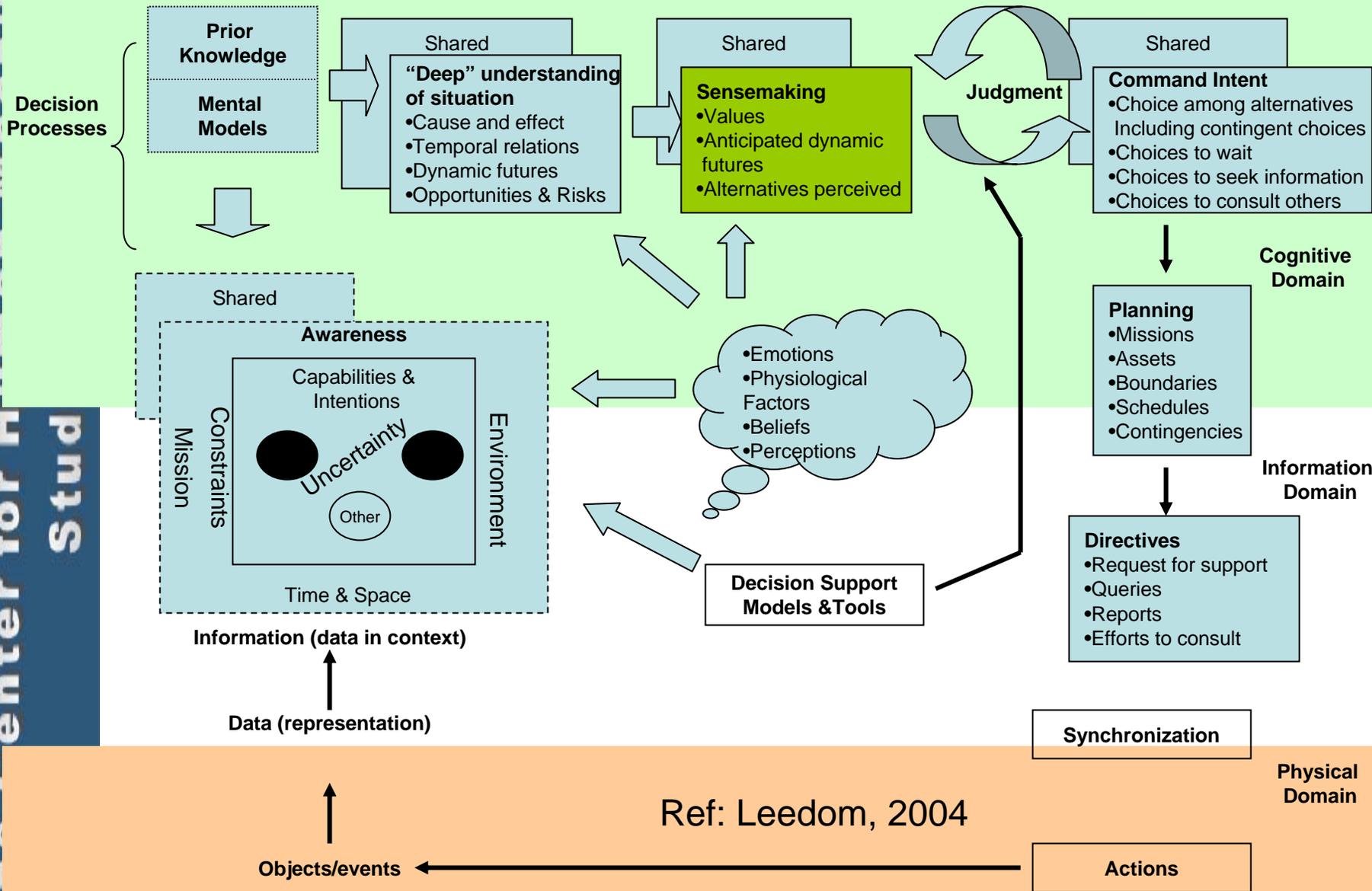


IMINT/ SIGINT/
/MASINT/HUMINT/ REPORTS/
IMAGER/ ACOUSTICS/

NORTH CAROLINA A&T STATE

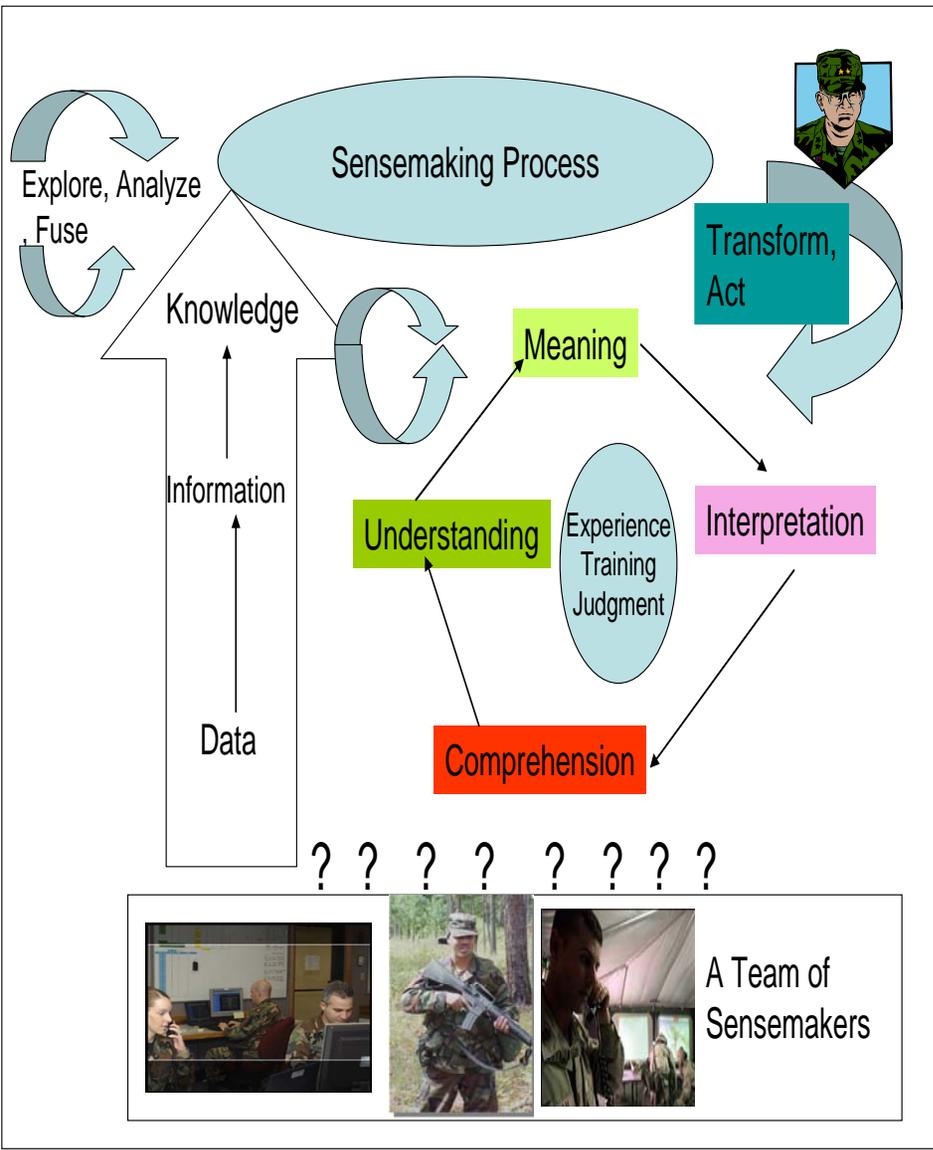


NORTH CAROLINA A&T STATE UNIVERSITY

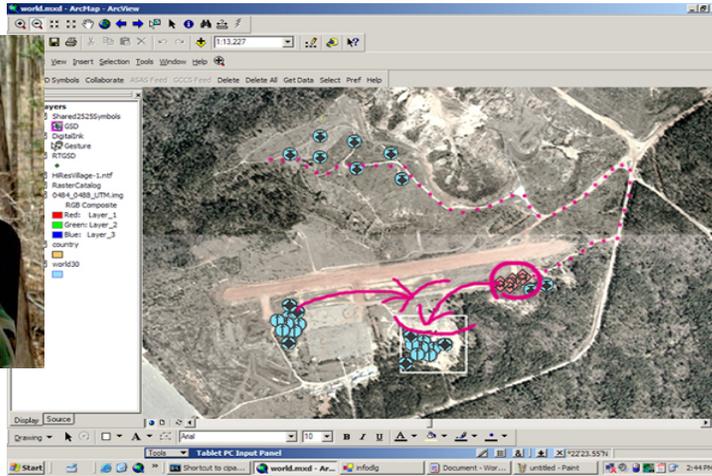


COLLABORATIVE SENSEMAKING

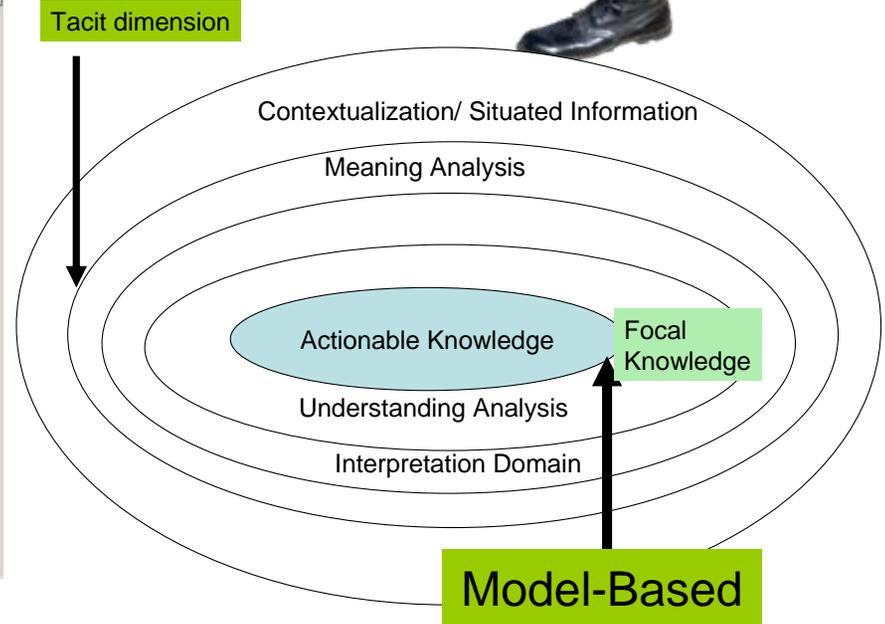
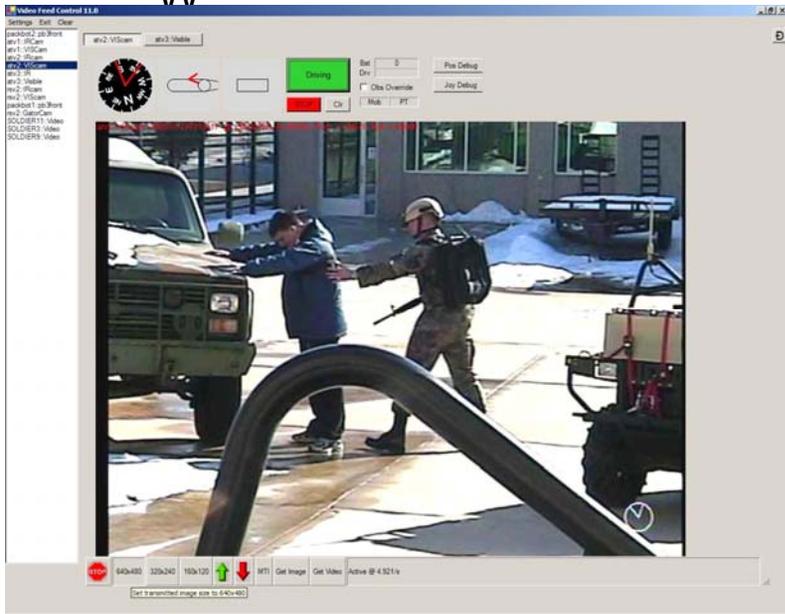
THE FRAMEWORK



1. Identify contextual information
2. Identify a common process in assigning meanings to context
3. Identify the process for interpreting information
4. Identify process for understanding information
5. Define a common framework for sharing individual tacit knowledge.

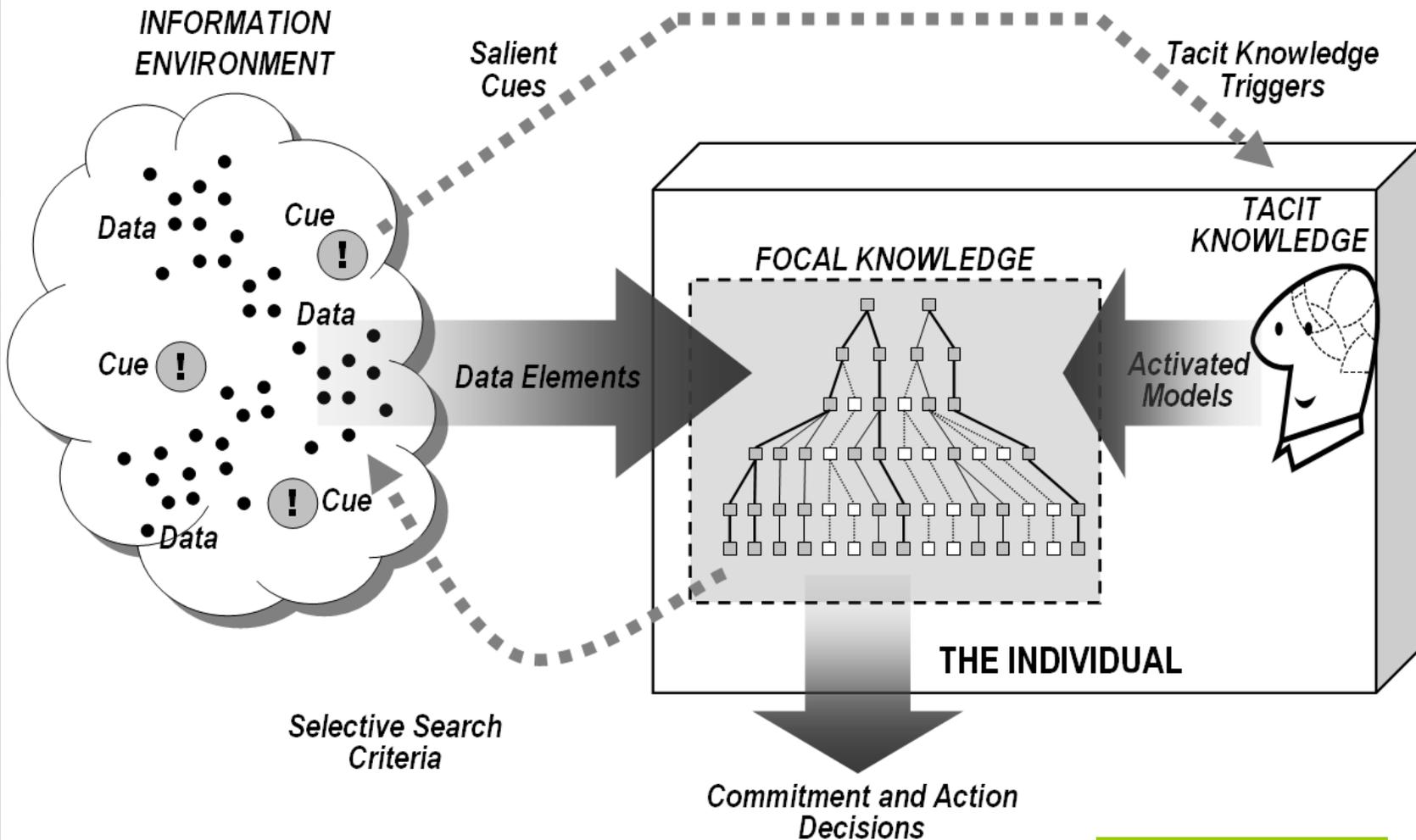


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THE FRAMEWORK

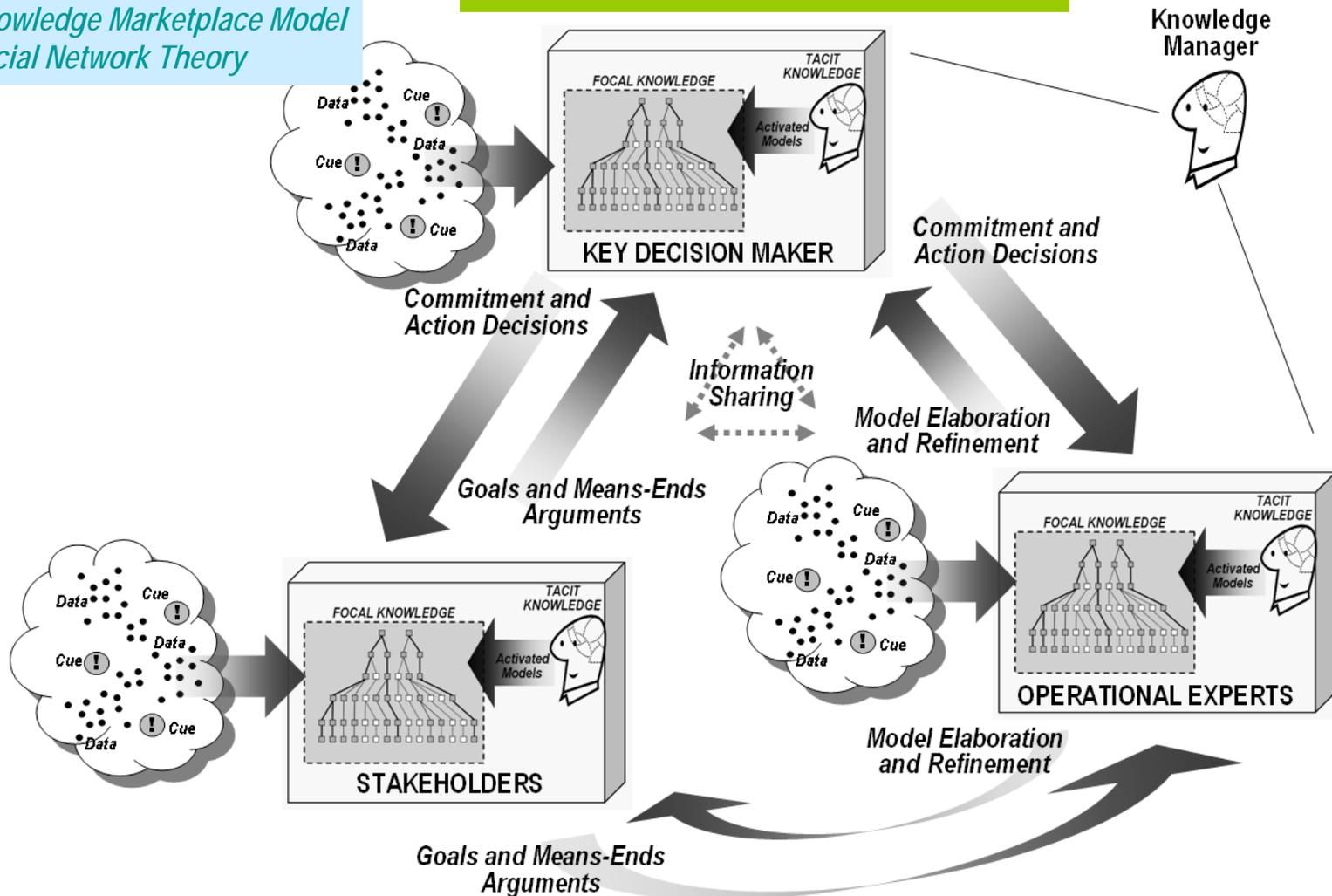
Relevant Paradigms:
Data/Frame Model
Multi-Thread/Multi-Trace Model



Leedom, 2005

THE FRAMEWORK

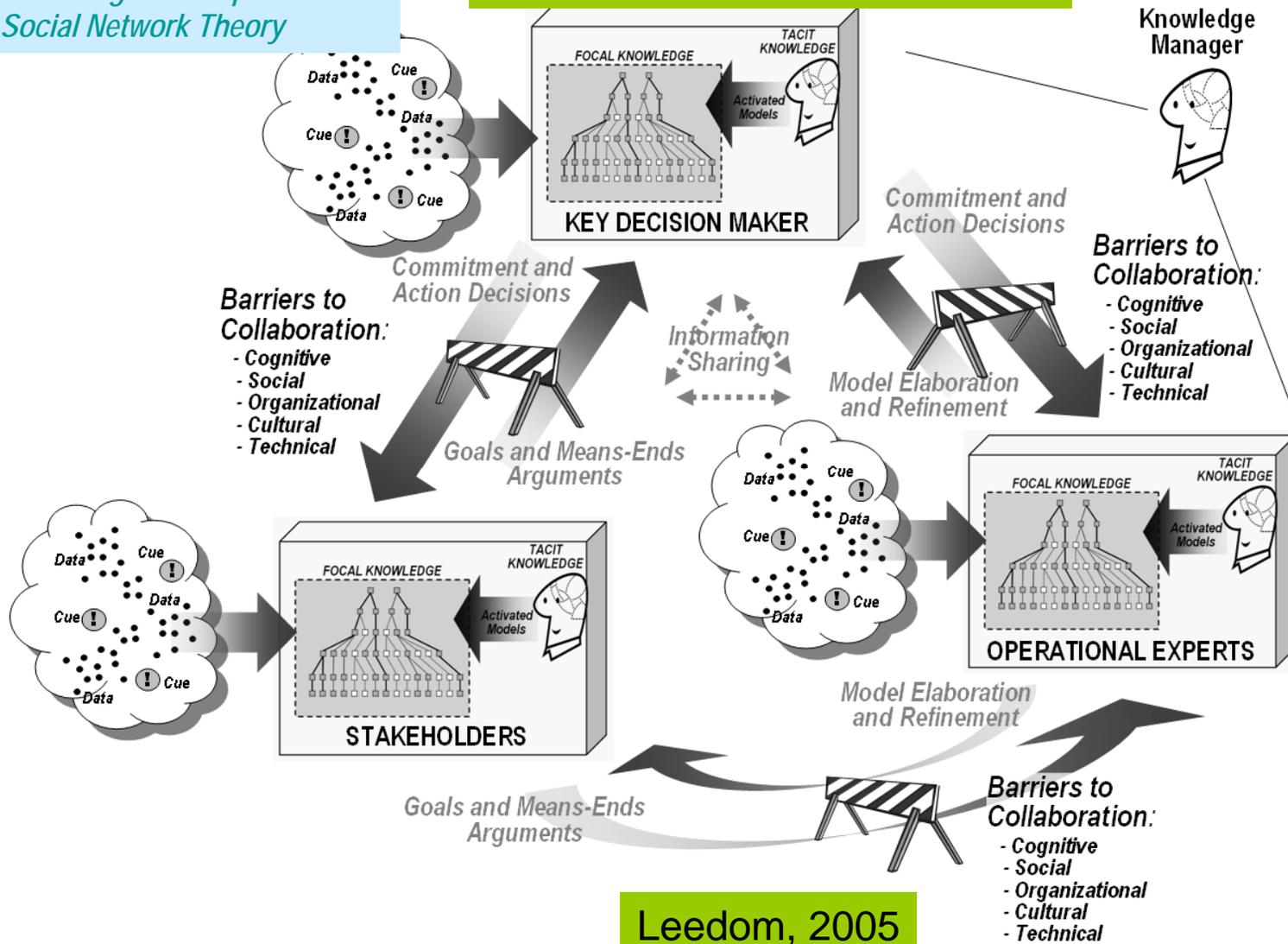
Relevant Paradigms:
Knowledge Marketplace Model
Social Network Theory



Leedom, 2005

Relevant Paradigms:
Knowledge Marketplace Model
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THE FRAMEWORK



Challenges: Collaborative Sensemaking

Concept is that of a social construction of knowledge. Social construction denotes the structure or the epistemology of team semantic knowledge, and, the process or the ontology of team syntactic knowledge.

**Ntuen, C.A. A Model of Sensemaking in Dynamic Organizations:
A Review and Implications for Military Decision Making
Process (ARO Report, August 30, 2005)**

Multicultural Collaboration

Barriers

- Lack of training
- Warfighting Mindset
- Lack of technologies to support full spectrum operations
- Culturally-based differences in:
 - Cognitive Processes
 - Organizational Procedures

Challenges

- Little information exchange
 - Limited understanding of team member roles and responsibilities
 - Poor team coordination
 - Little giving or receiving of assistance
 - Little motivation to work with others on the team
-
- Inaccurate team situation awareness
 - Increased conflict
 - Limited trust
 - Low psychological safety
 - Lack of commitment to the team
 - Little innovation or risk taking
 - Poor team performance



The ability to interoperate is necessary but not sufficient to insure effective collaboration.

SUMMARY / CONCLUSIONS

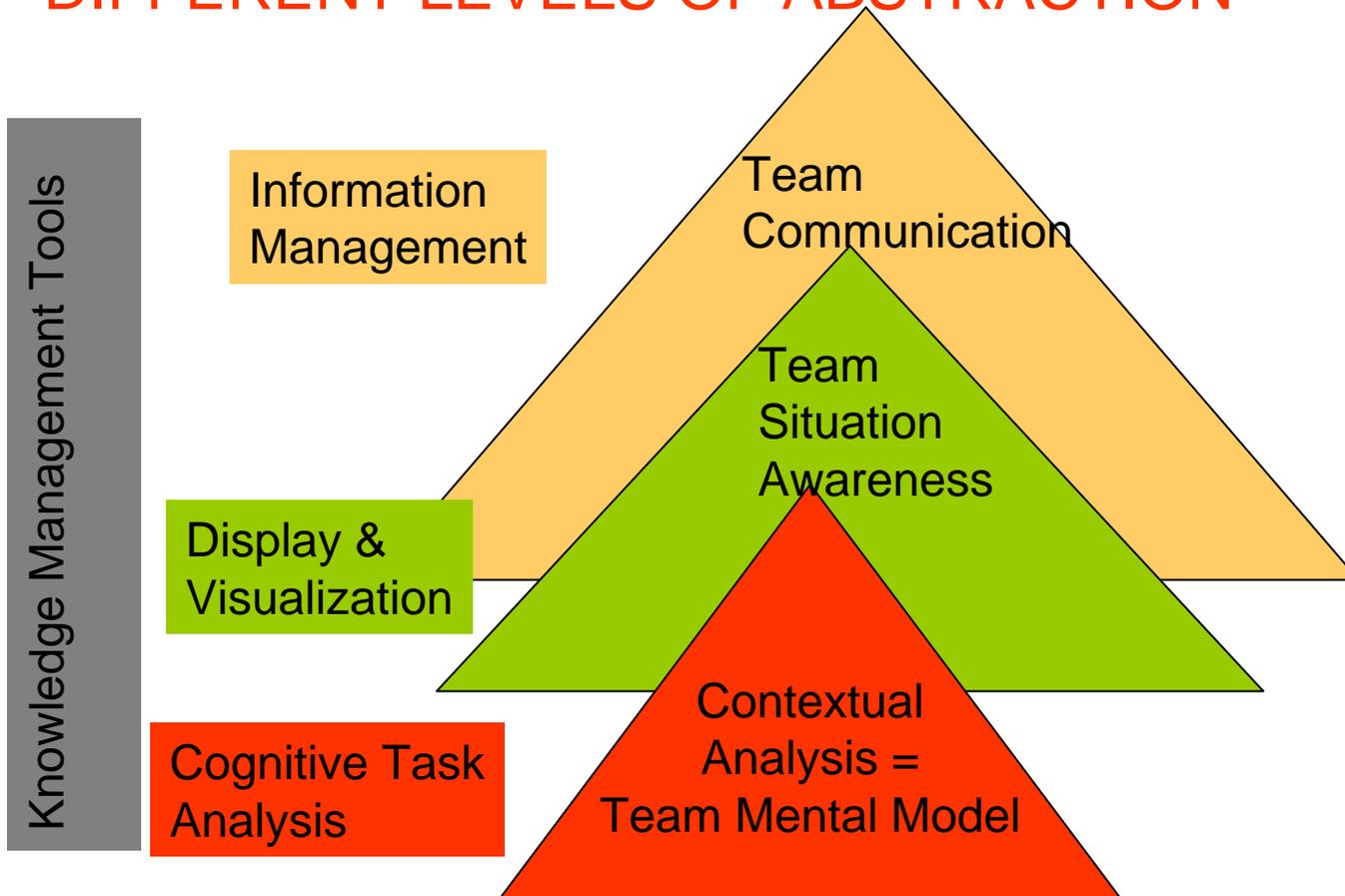
1. COLLABORATIVE SENSEMAKING IS PERVASIVE IN EVERYDAY TEAM PROBLEM SOLVING

2. MANY FACTORS AFFECT COLLABORATIVE SENSEMAKING PROCESS:

1. Group Dynamics
2. Dynamic Tasks
3. Availability of Technology
4. Expertise and Experience of the Stakeholders
5. Cultural Mix of the Sensemakers
6. Communication / Language

SUMMARY / CONCLUSIONS

3. REQUIRES MODELLING METHODS THAT CAPTURES THE SENSEMAKING PROCESS AT DIFFERENT LEVELS OF ABSTRACTION



SUMMARY / CONCLUSIONS

Operational thinking

Interpret

METT-C
PMSEII
DIME
SWEAT

relations

Problem Structuring

Decision/
Action
Steps

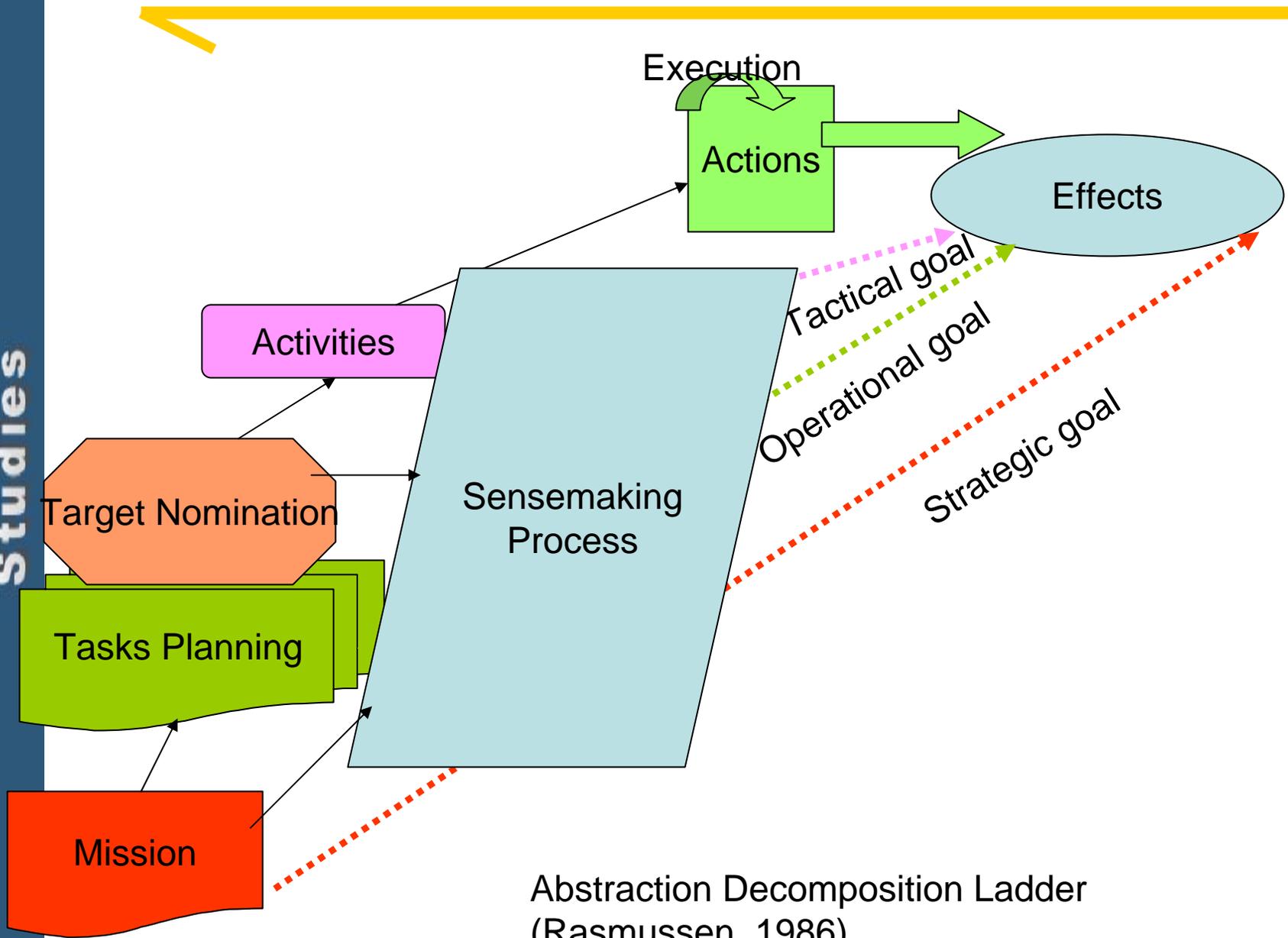
Force/Power
intensity
management

CoG and Effect
Space:
Tactical thinking

Activate

Execute

Procedural thinking
Institutional thinking



Abstraction Decomposition Ladder (Rasmussen, 1986)

SUMMARY & CONCLUSIONS

Sample SM System to Support Collaboration

The screenshot displays the Sensemaking Support System (S3) - Map interface. The main window shows a map of Iraq with various regions and cities labeled. The map includes a legend for Iraq, showing international boundaries, governorate boundaries, national capital, governorate capital, railroad, expressway, and road. The map also shows neighboring countries: Turkey, Syria, Jordan, Iran, and Kuwait. A sidebar on the right provides details for an event in Arbil:

- Arbil
- 1. Risk Constraints :
RPGs 0.4
- 2. Event :
Traffic Jam
05-Jul-06 2:00:00 PM - 5:00:00 PM
- 3. Comments :
Shoulder-fired Rocket Propelled Granades.
Usually there is traffic jam in downtown area around this time.

Below the event details, there are buttons for 'Prev.' and 'Next.' and a list of units with checkboxes:

- Baghdad Inf. Unit Scout Unit
- Karbala Inf. Unit Scout Unit
- Najaf Inf. Unit Scout Unit
- Mosul Inf. Unit Scout Unit
- Arbil Inf. Unit Scout Unit
- Basrah Inf. Unit Scout Unit
- Fallujah Inf. Unit Scout Unit

At the bottom of the sidebar, there are buttons for 'Mark' and 'Clear'.

SUMMARY & CONCLUSIONS

Analytical Model to help in information management

The screenshot displays the 'Einterface' software window, titled 'Surface Viewer: Attack Leadership'. The interface is divided into several sections:

- Sensemaking Variables:** A control panel with a color-coded legend (Low: purple, Medium: yellow, High: red) and four groups of sliders:
 - Chairman:** Attack Leadership (8), Destroy NBC (8), Attrit Republican Guard (10), Attrit Iraqi Troops (8), Protect Saudi Arabia (8).
 - CINC:** Attack Leadership (8), Destroy NBC (9), Attrit Republican Guard (10), Attrit Iraqi Troops (10), Protect Saudi Arabia (8).
 - Operation Chief:** Attack Leadership (9), Destroy NBC (8), Attrit Republican Guard (8), Attrit Iraqi Troops (8), Protect Saudi Arabia (8).
 - Target Intel:** Leadership (8), NBC (6), Republican Guard (5), Iraqi Troops (4), Saudi Arabia Capability (8).
- Output:** A list of variables with their corresponding values:
 - Attack Leadership: 8
 - Destroy NBC: 8
 - Attrit Republican Guard: 8
 - Attrit Iraqi Troops: 7
 - Protect Saudi Arabia: 8
- 3D Surface Plot:** A 3D plot showing the relationship between variables. The X-axis is 'Chair', the Y-axis is 'CINC', and the Z-axis is 'Itr'. The surface is colored with a gradient from blue (low) to yellow (high).
- Controls:** 'Evaluate Decision' and 'Reset All Indicators' buttons are located below the output section. A 'Ref. Input' field contains '(null)\n(1)\n(5)\n(5)'. A 'Ready' status bar is at the bottom.

SUMMARY & CONCLUSIONS



QUESTION?