Experimentation Support to Innovation and Transformation

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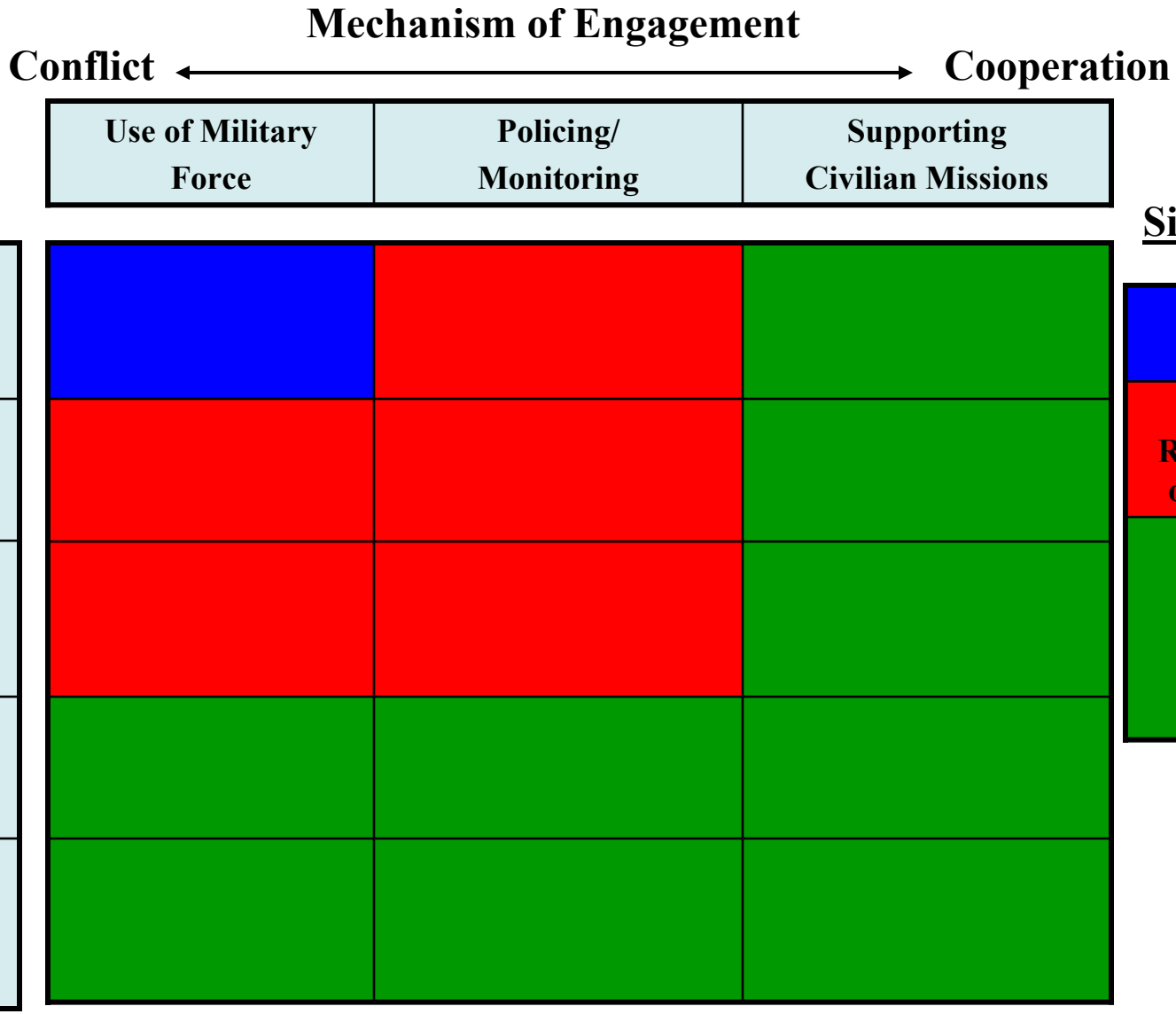
Introduction and Outline

- Sampling the operating environment
- Industrial Age vs. Information Age Approaches
- Mission Capability Packages
- Experimentation and Campaigns of Experimentation
- Illustrative Examples
- Ideal vs. Transformational Experiments
- Key Dimensions of Command and Control Approach

Scenarios in Transformation Experimentation

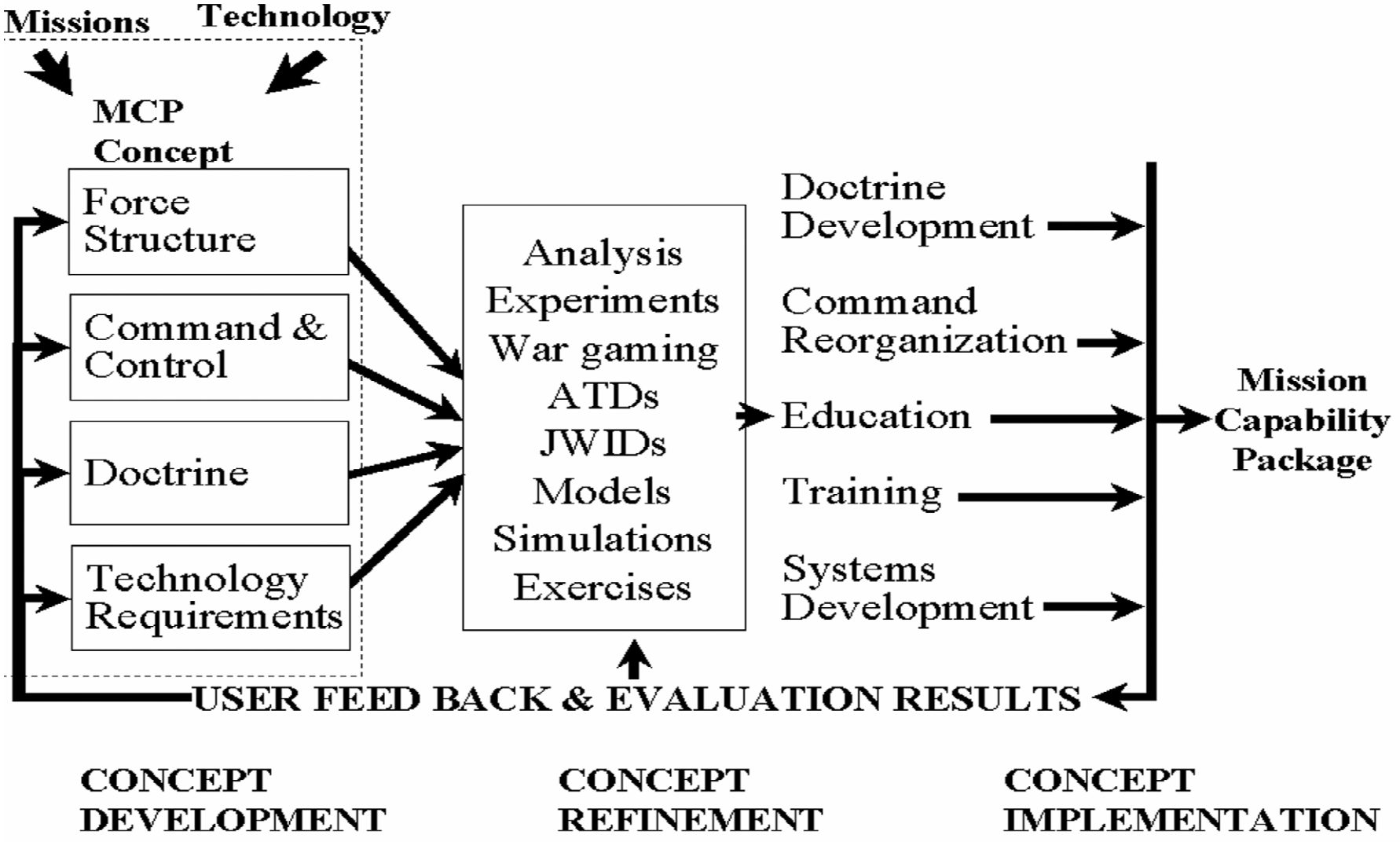
Sampling the Operating Environment



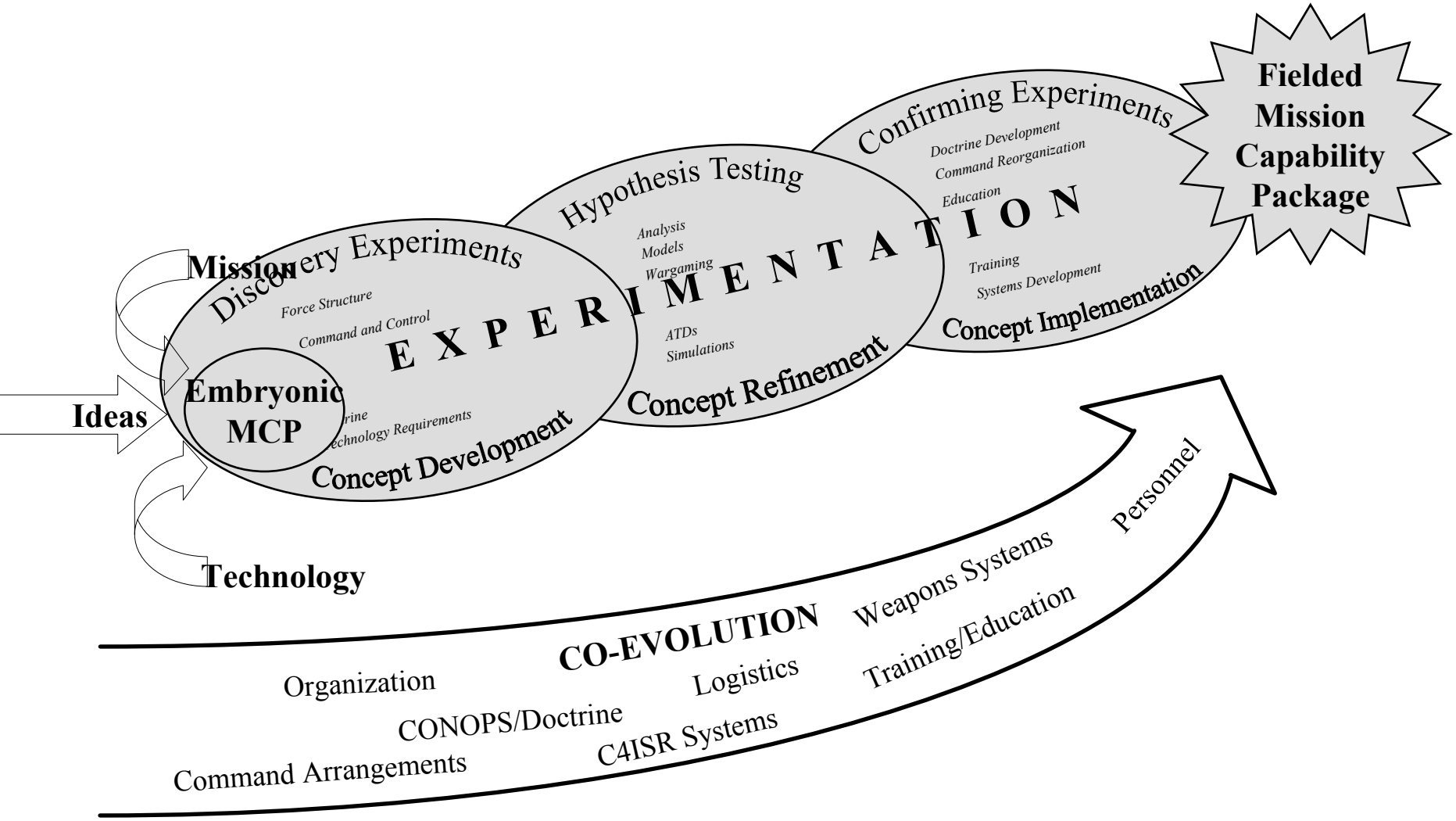
Industrial Age vs. Information Age Mindset

	Industrial Age	Information Age
Dealing with the future	Predict/Plan	Prepare/Adapt
	Perfect Tasks	Develop Agility
Developing Capabilities	Define Requirements	Experiment
	Engineer	Grow
	Insert Technology	Co-evolve MCPs
	Test Systems	Assess Operations
	Applications centric	Data Centric
Command…	Do what I tell you	Do what makes sense
Control…	Synchronize	Self-synchronize
	Control	Converge
	Constrain Subordinates	Enable Subordinates
	Staff	Collaborate
Dealing with Information	Push	Pull
	Use & Distribute	Post in Parallel
	Server-Client	Peer to Peer

Mission Capability Packages



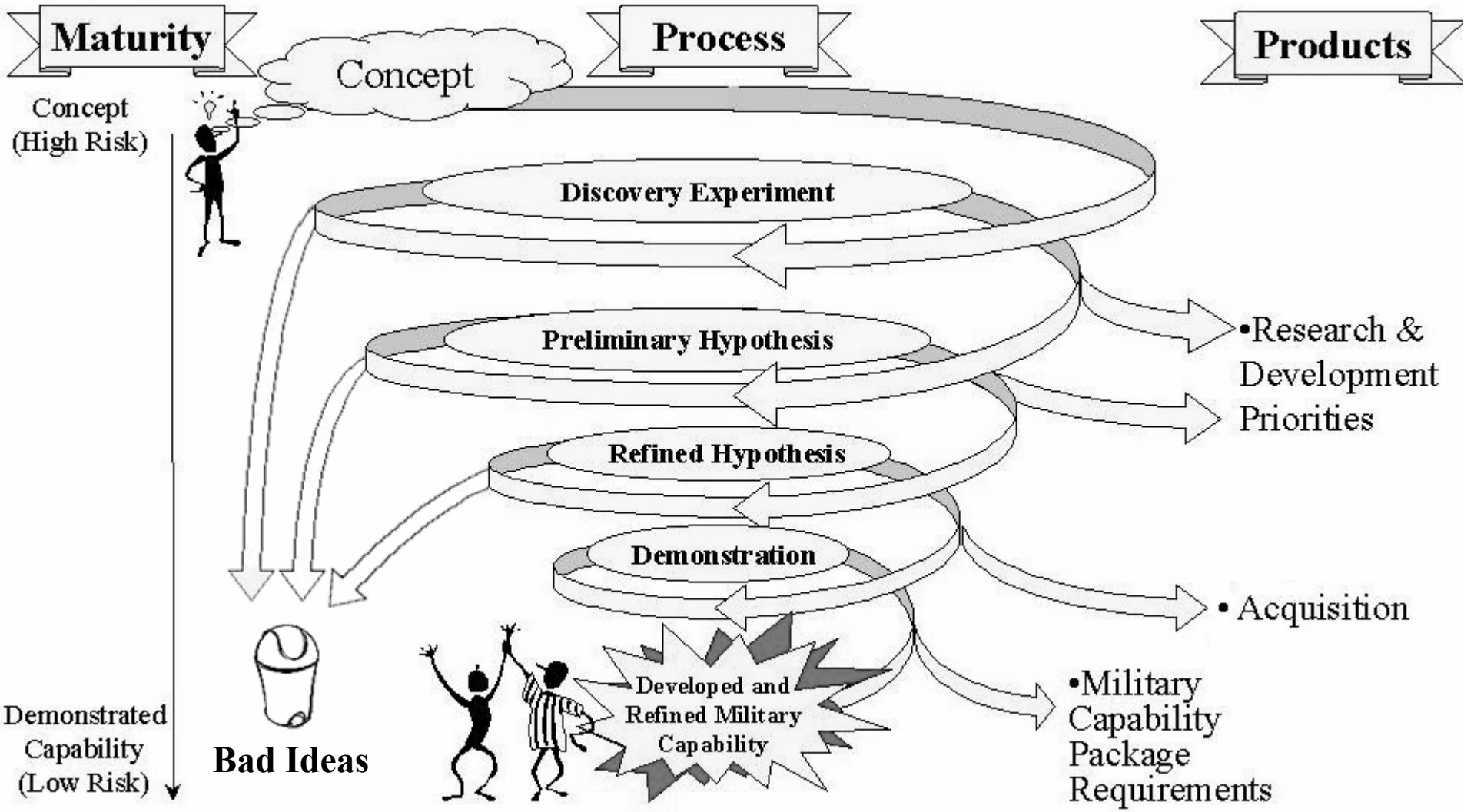
Mission Capability Package Creation



Criteria for Good Experiments

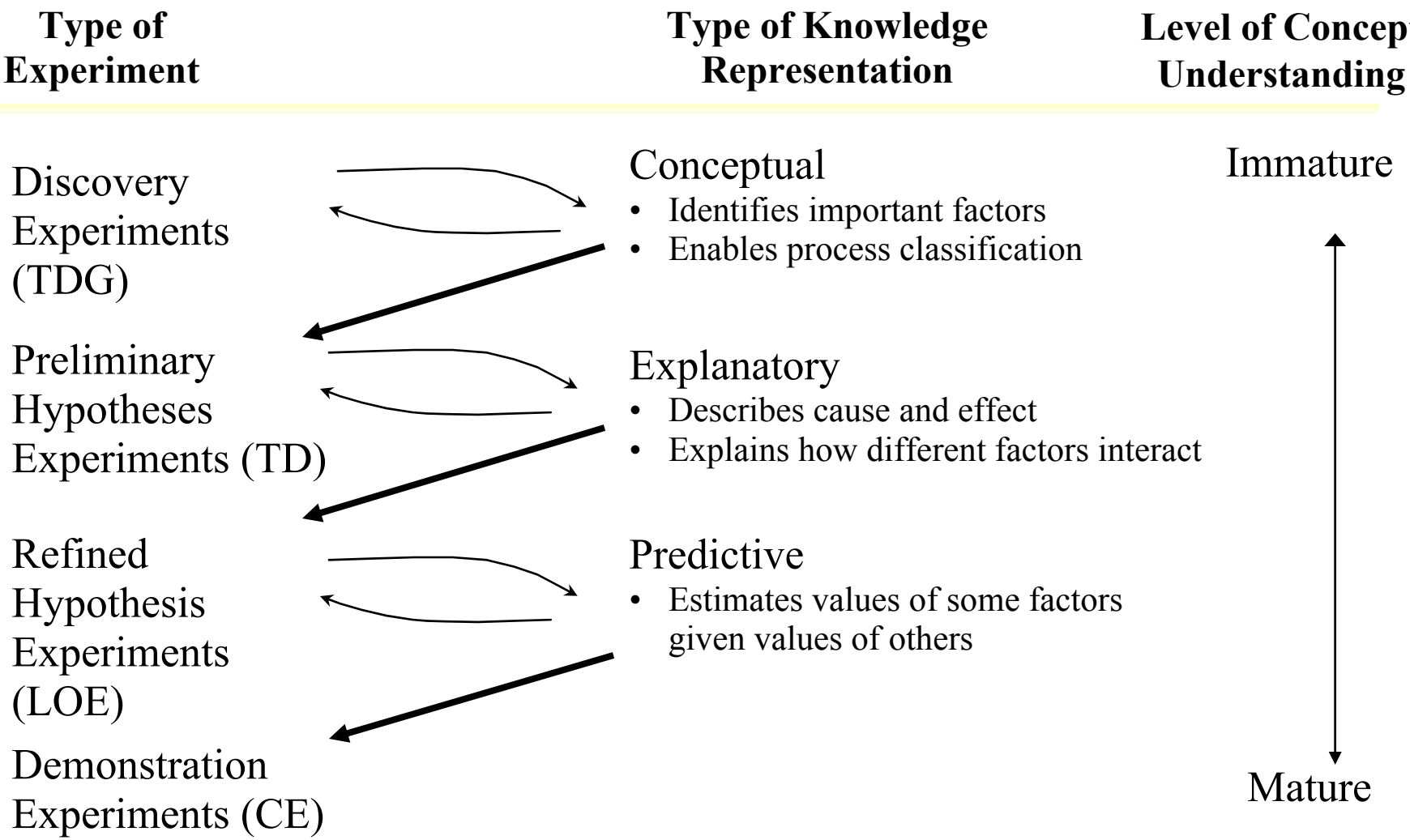
- Experiments have a clear focus, based on existing knowledge, they are structured, valid, reliable and credible
- Excludes, or controls for, all relevant extraneous or intervening variables
- Manipulates only one independent variable at a time- the dimensions of the variable are measured
- Involves valid, reliable, precise, and credible measurement of all variables
- Generates findings, interpretations, and insights

Experimentation: From Theory to Practice



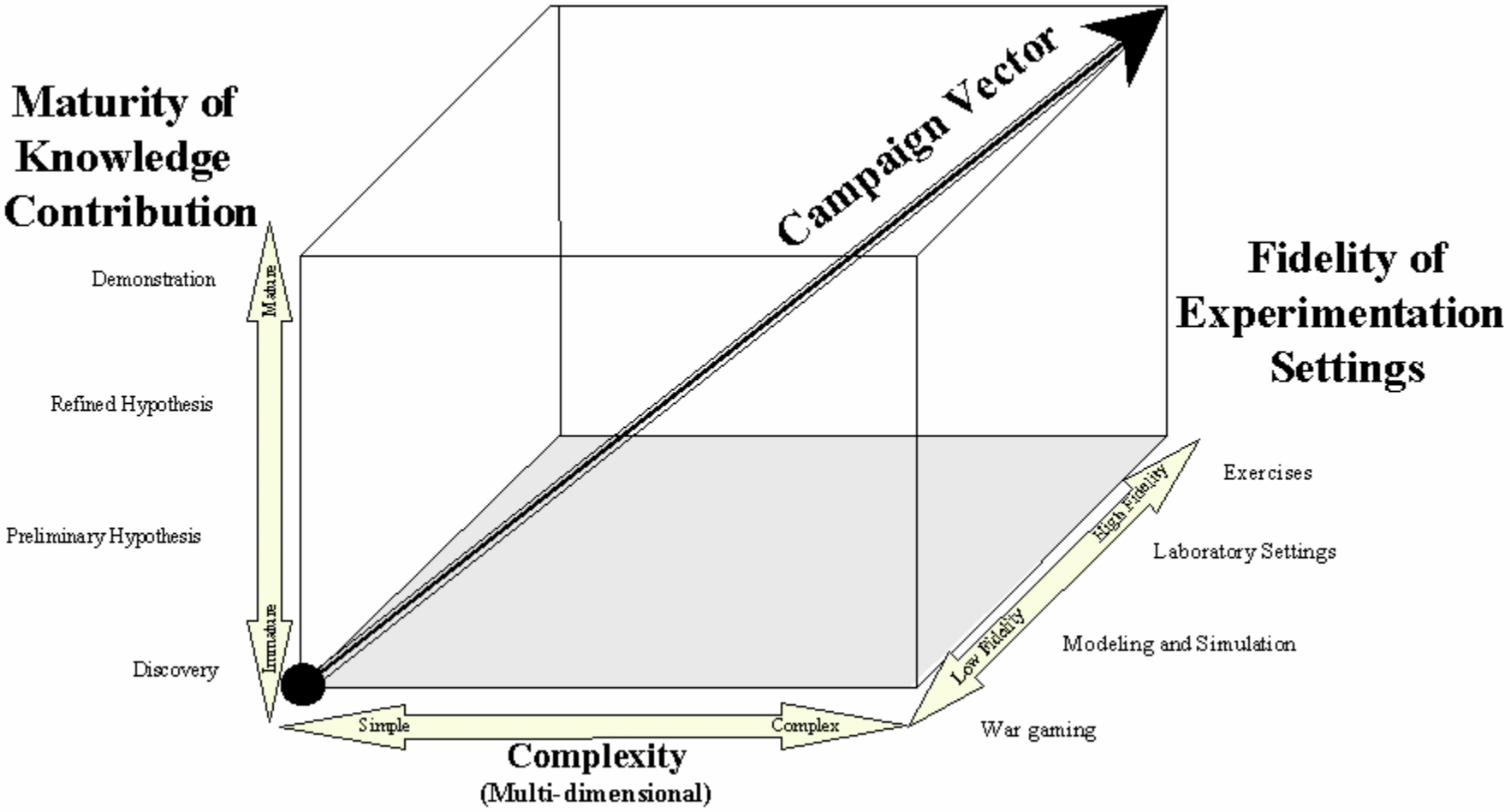
CPOF Experimental Campaign:

Co-evolution of concepts and experiments



Model develops incrementally as part of concept development process

The Experimentation Campaign Space



Definitions Of Experimentation

- Purpose of Experimentation: “To determine the efficacy of something previously untried,” “to examine the validity of an hypothesis,” or “to demonstrate known truth.”
- Always empirical
- Campaigns of experiments build knowledge
- Results of poor transformation experiments
  - Money will be wasted
  - Lives will be at risk
  - Better ideas will be lost
  - Progress will be delayed

Illustrative Examples

- Command Post of the Future (DARPA)
- JFCOM Limited Objective Experiments
- Millennium Challenge 02
- Navy Fleet Battle Experiments Alpha to Kilo
- Army's Future Combat System Experiments

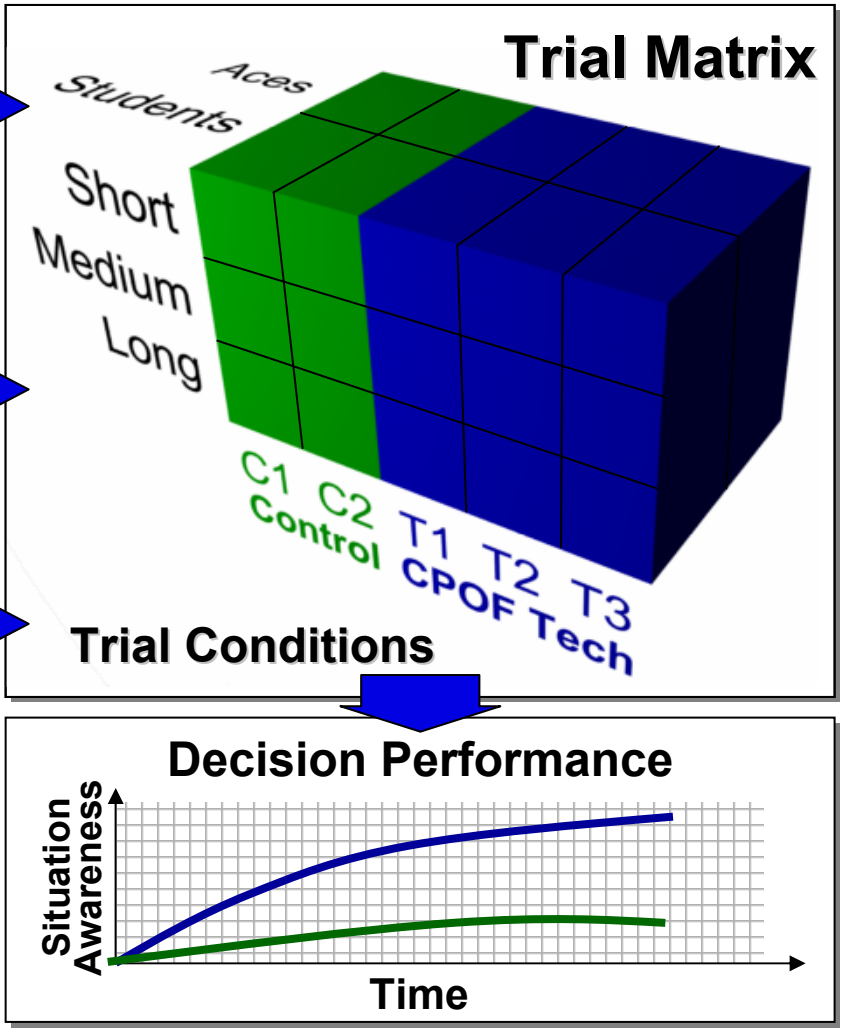
CPOF Experiments

Hypotheses

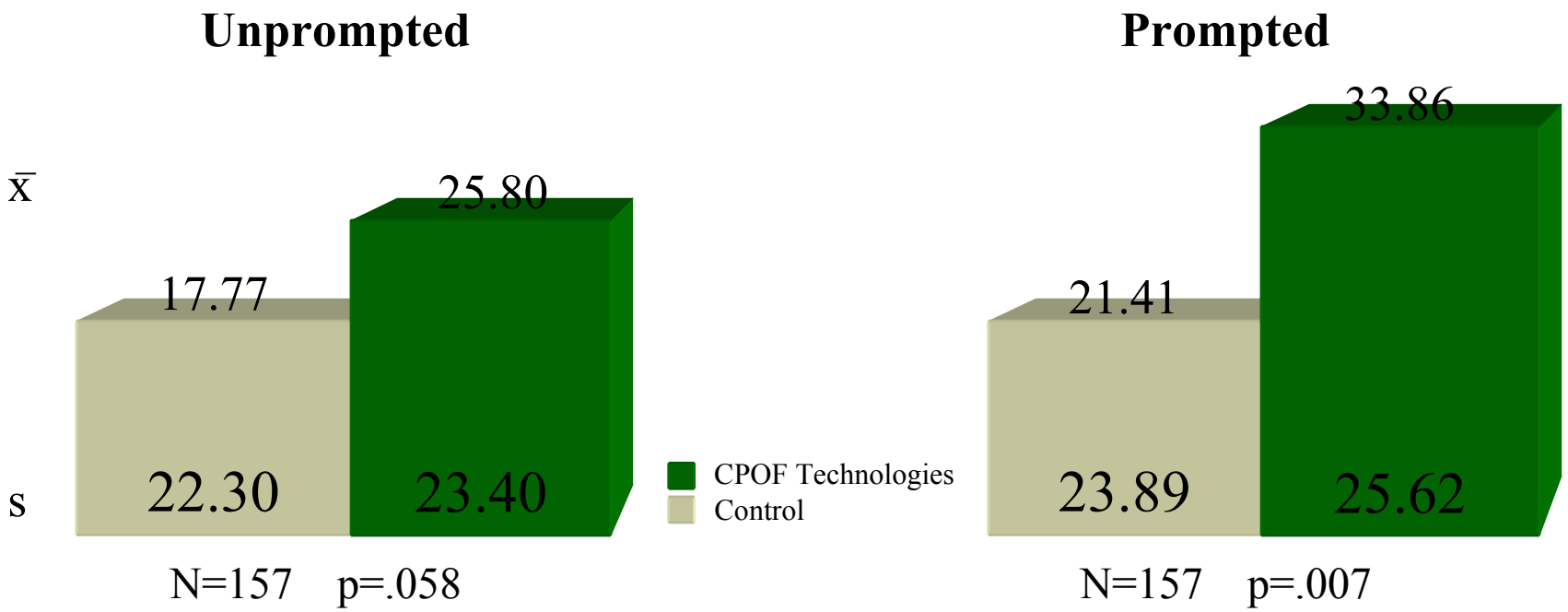
Objective: Increase decision speed & quality

- **H1: Improve Situation Awareness**
  - H1.1: Situation Awareness Acquisition
  - H1.2: Uncertainty in Situation Awareness
  - H1.3: Situation Awareness projection into the near term
  - H1.4: Situation Awareness monitoring and updating
  - H1.5: Anomaly detection with respect to execution
- **H2: Improve COA Generation and capture**
  - H2.1: Natural input modalities
  - H2.2: Assumption, constraint, opportunity, and failure mode highlighting
- **H3: Improve COA Selection**
  - H3.1: Mission understanding
  - H3.2: Single COA comprehension
  - H3.3: Multiple COA comparison
- **H4: Improve COA communication**
  - H4.1: Communication dialogs
  - H4.2: Clarity of commander's intent
  - H4.3: Complimentary understanding

The Experiment



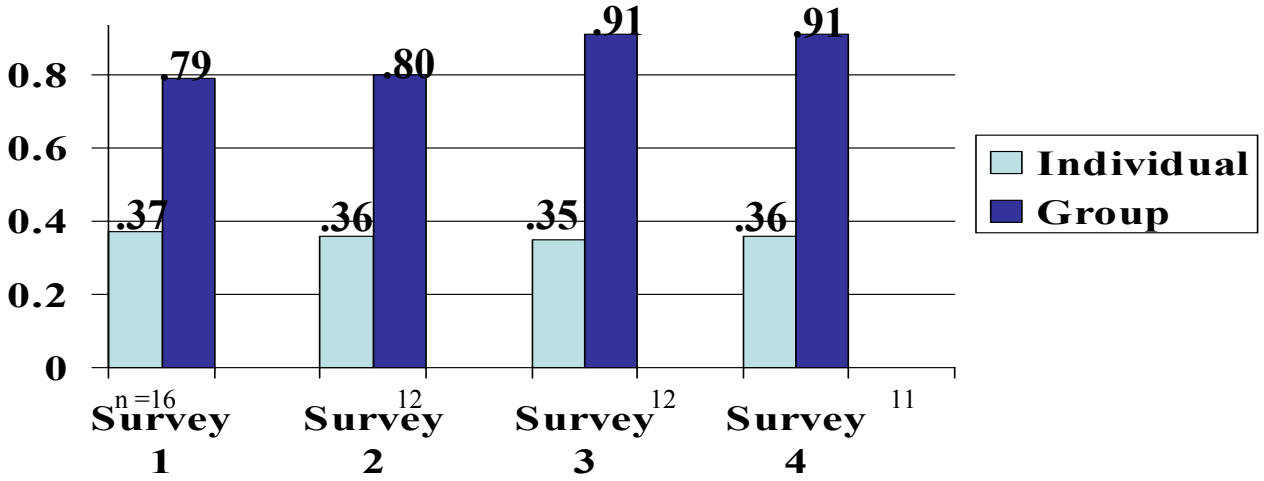
CPOF Technologies Significantly Outperform Control in Overall Scores



Interpretation

- CPOF Technologies generated:
  - *Better situation awareness* (higher mean or $\bar{x}$)
  - *CPOF Technologies performance improves for prompted*

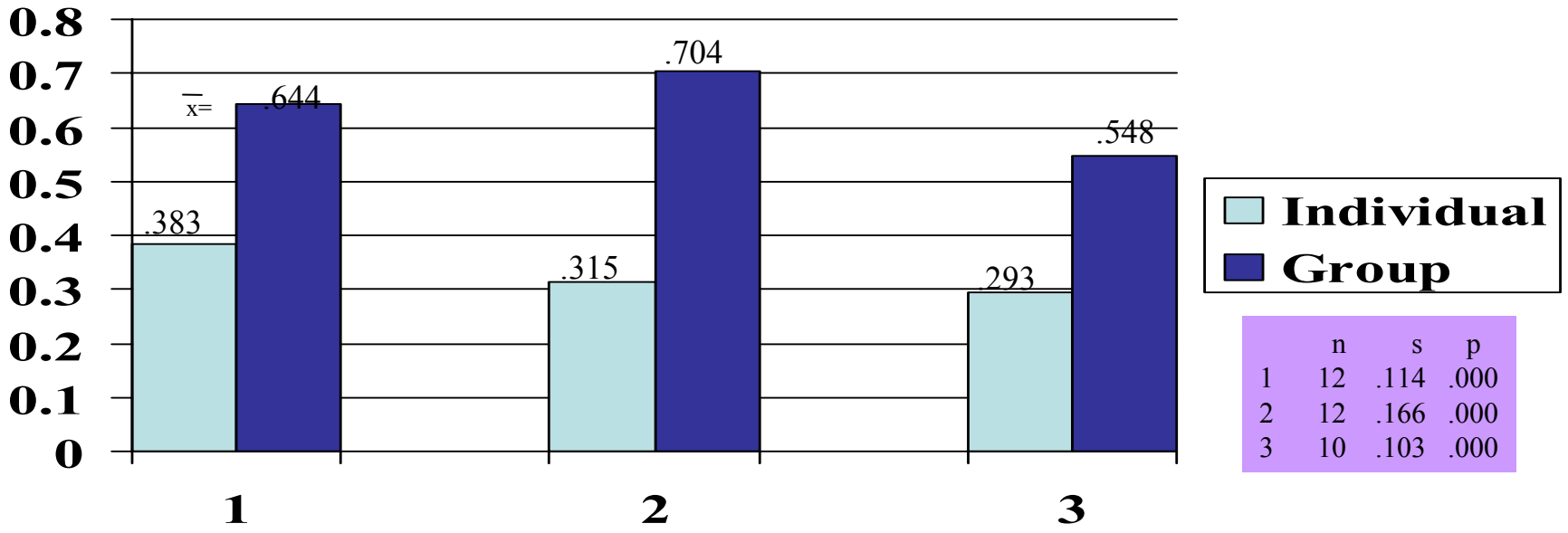
Millennium Challenge 02
Individual/Group SA Scores During MC02



- **Participation**
  - Individuals: Principle staff function positions
  - Group: Results based on JCB and Commander's Update briefings
- **Findings**
  - Individual situation awareness consistent over the four surveys
  - Group scores consistently much higher than individual scores
- **Interpretation**
  - No learning curve for individuals
  - Individuals have only a partial awareness.
  - Comparison of group and individual scores indication of positive effect of collaboration

JFCOM Presentation LOE

Individual VS Group SA Scores By Group



	n	s	p
1	12	.114	.000
2	12	.166	.000
3	10	.103	.000

Findings

Group Briefings sorted by group scored significantly higher than prompted individuals on Situation Assessment

Interpretation

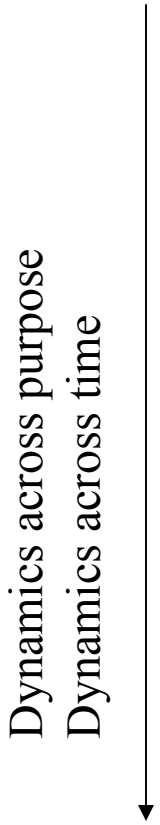
Collaboration required to generate an integrated briefing creates richer situation assessments than those held by individuals on the team, Suggests collaborative processes enrich Situation Assessment

Ideal Versus Transformational Experimentation

- Ideal experimentation (The gold standard)
  - Tests well formed hypothesis and proposition
  - Controls explicitly all independent and intervening variables
  - Has clarity in outcomes and measurement
- Transformational experimentation (The reality)
  - Finite resources
  - Has unexpected consequences
  - Necessarily involves “messy” data and circumstances
- Two major differences between Transformational experimentation and Ideal experimentation
  - Transformation will not be accomplished by small, isolated changes
  - The pace of change required for DoD transformation will not allow for a large number of sequential experiments designed explore every nook and cranny of possible alternatives

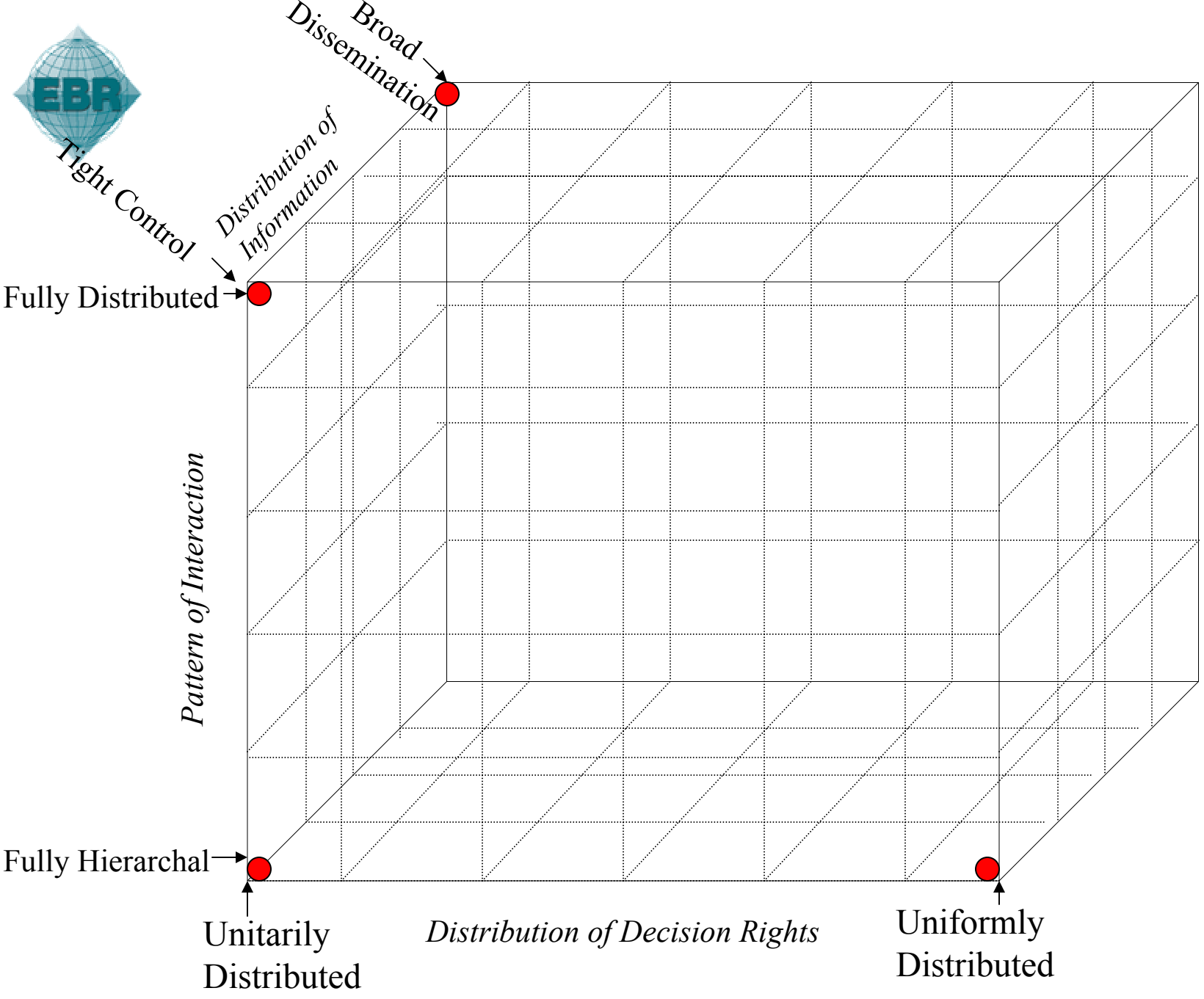
Key Dimensions of Command and Control Approach

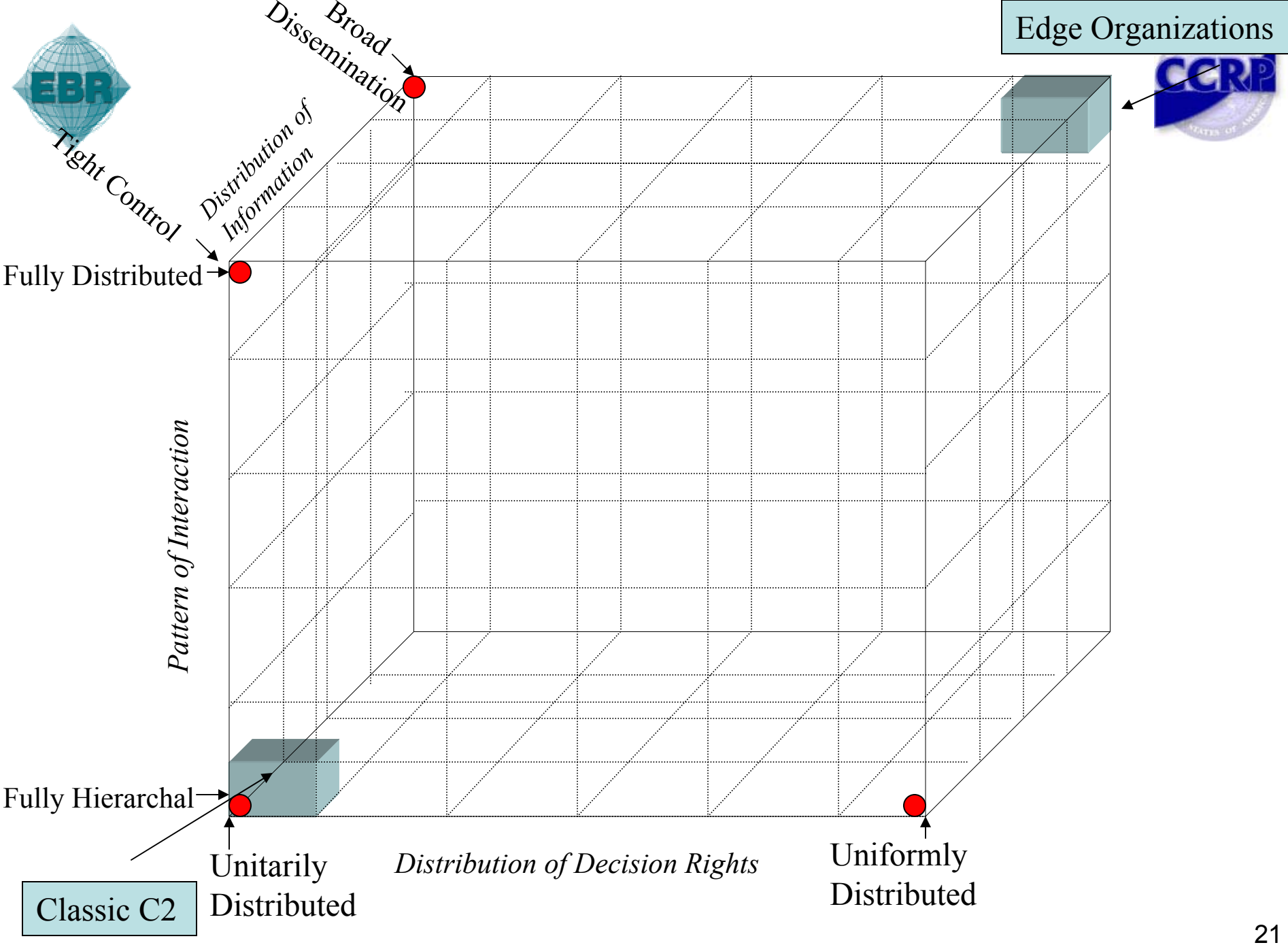
Essential Dimensions of C2 Approach

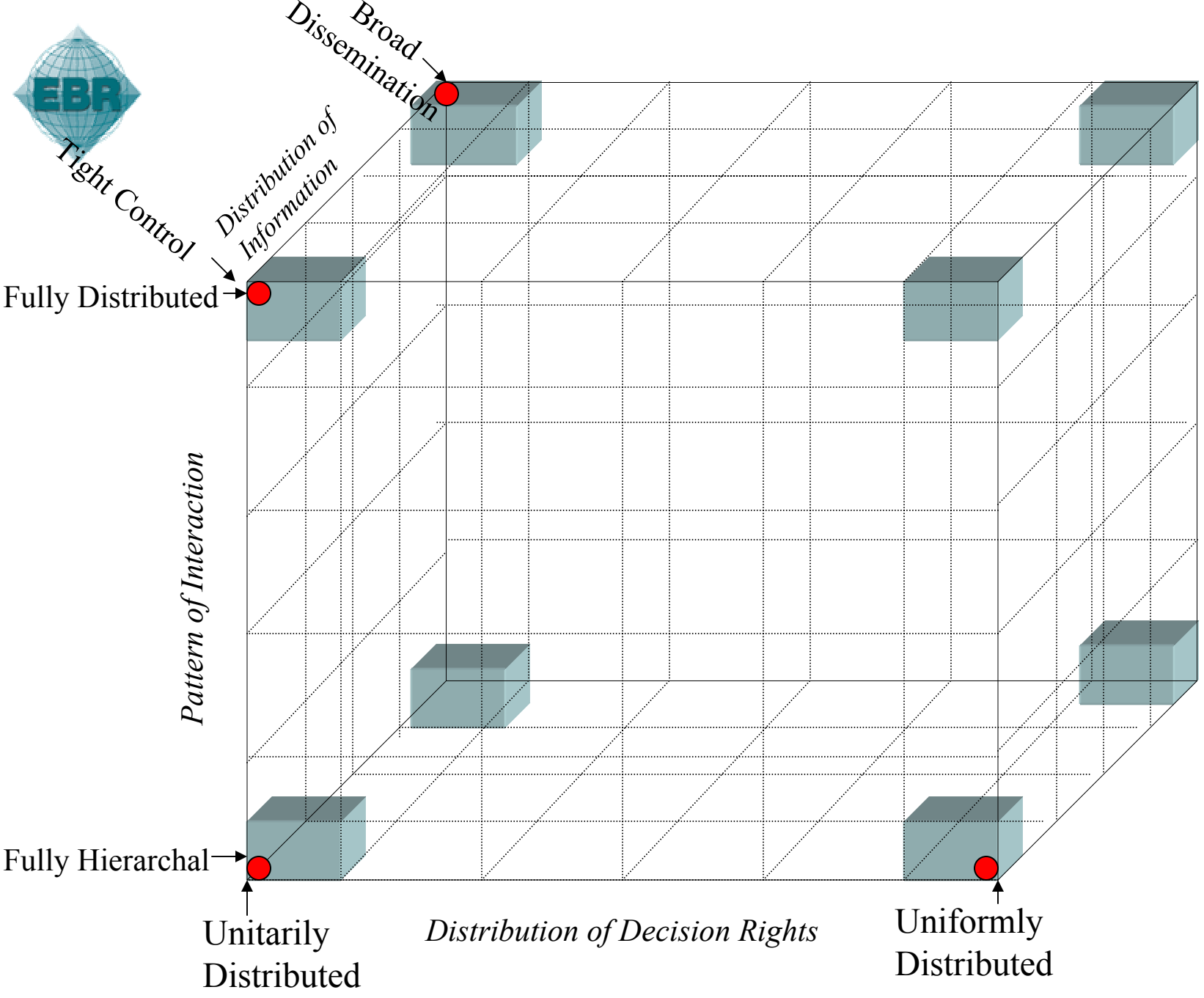


Constraints ("Allowances")

- Allocation of Decision Rights
  - Explicit
  - Implicit
- Patterns of Interactions
- Distribution of Information
  - Ownership
  - Access


Broad Dissemination
Tight Control
Distribution of Information
Fully Distributed
Pattern of Interaction
Fully Hierarchal
Unitarily Distributed
Distribution of Decision Rights
Uniformly Distributed


Edge Organizations
Broad Dissemination
Tight Control
Distribution of Information
Fully Distributed
Pattern of Interaction
Fully Hierarchal
Unitarily Distributed
Distribution of Decision Rights
Uniformly Distributed
Classic C2


Broad Dissemination
Tight Control
Distribution of Information
Fully Distributed
Pattern of Interaction
Fully Hierarchal
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Uniformly Distributed

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