



Exploring Edge C2 Approaches: ELICIT & POW-ER Tools

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Dr. Mark E. Nissen

Center for Edge Power

US Naval Postgraduate School

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Motivation

- *Edge* is relatively new C2 approach
 - Putative advantages over Hierarchy
 - Need to understand approaches' relative appropriateness, behavior & performance
- Research challenges
 - Few (if any) exemplars to study in field
 - “C2 approach” crosses many disciplines
 - “Inside” & “outside” research cultures
 - Edge R not guided by campaign plan

Some Progress

- Limited research *streams*
 - Adaptive Architectures for C2 (A2C2)
 - Center for Edge Power (CEP)
- New research tools
 - ELICIT – instrumented intelligence game
 - POW-ER – enterprise modeling & sim
- Draft Research Campaign Space/Plan
 - Link “inside-outside,” multidisciplinary R
 - Guide myriad, “uncoordinated” studies



Center for Edge Power

- OASD-NII CCRP sponsor
 - Part of virtual institute for C2 research
 - Naval Postgraduate School (NPS) host
- Activities
 - Promotes, sponsors & conducts C2 R (BAA)
 - World-class, multidisciplinary, multi-university, multi-year research stream
 - Translates via education, application & outreach
 - Creates & distributes scholarly research products
 - Catalyzes uses of new tools (ELICIT, POW-ER)

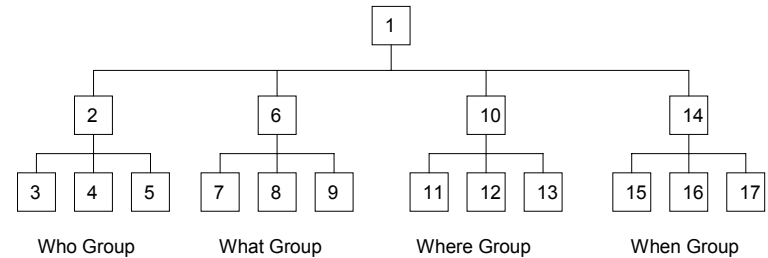
ELICIT Game

- Multiplayer intelligence game
 - Networked “intelligence analysts”
 - Uncover fictitious terrorist plots
 - Distributed clues require collaboration
 - Fully instrumented lab environment
- Developed by Parity via CCRP
 - Runs on LAN-networked PCs
 - Distributed freely – share data
 - Used at BU, NPS, USMA, others

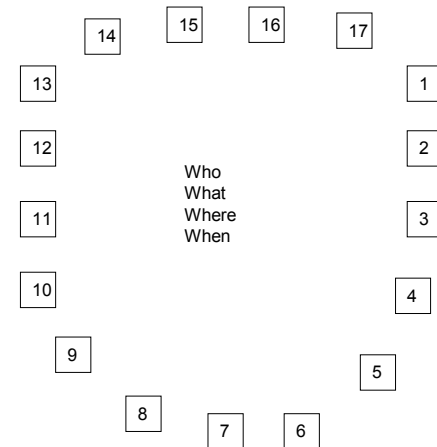
ELICIT uses

- Compare C2 approaches:
 - Control task (factoid set)
 - & comms (post, pull, share)
 - Manipulate org form (H vs. E)
 - & exchange (K vs. I)
 - Measure performance (sp, ac)
 - & learning (multiple factoid sets)
 - See CCRP/CEP papers
- Experiment design is open:
 - Any controls, manipulations, protocols, measurements

Hierarchy



Edge



ELICIT Extensions

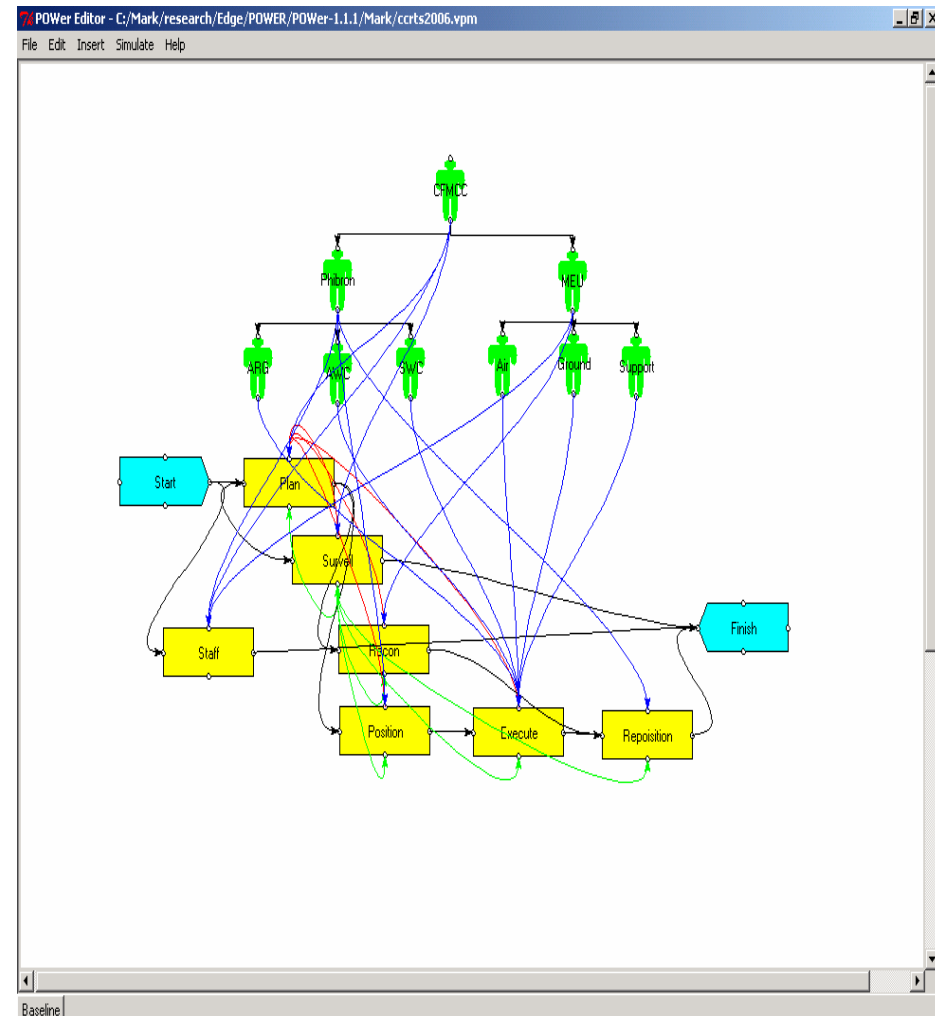
- Users' group meeting Friday AM
- Experiment extensions
 - Study different org forms, work processes, personnel/team characteristics, technologies, environmental conditions, performance dimensions, other aspects of C2 approaches
 - Extend & elaborate on experiment designs
 - Pool & analyze data across studies
 - Use to guide field research & practice
- Edge Center expertise – happy to help

POW-ER Application

- Enterprise modeling & simulation
 - Simulate orgs, processes, people & techs
 - Validated environment – project focus
 - Controlled experimentation
 - SOTA computational social science
- Developed by Stanford via CCRP
 - Runs on PCs
 - Distributed freely (gov) – share models
 - Used at Stan, NPS, USMC, others

POW-ER uses

- Compare C2 approaches: POW-ER CFMCC Model
 - 100+ variables to control, manipulate & measure
 - Theoretically grounded org forms, processes & techs
 - Validated org behaviors
 - See CCRP/CEP papers
- Modeling is open:
 - Any orgs, processes, people & techs
 - Even those yet to exist!*



POW-ER Extensions

- C2 validation & calibration ongoing
 - Interested in more C2 models from field
 - Inform C2 decisions, policies, research
- Application extensions
 - Study diverse C2 contexts & approaches
 - Map C2 Context-Approach Space
 - Pool & analyze data across studies
 - Use to guide lab experimentation, field research & practice
- Edge Center expertise – happy to help

C2 Campaign Space/Plan

- Help C2 R self-organize & -synchronize
 - Link “inside-outside,” multidisciplinary R
 - Guide myriad, “uncoordinated” studies
- Use dimensions from “C2” research
 - Draw from “outside” + “inside” lits
 - Ground in theory + practice
 - Address diverse levels of analysis, C2 approaches, measures & methods
- Enable visualization + guidance

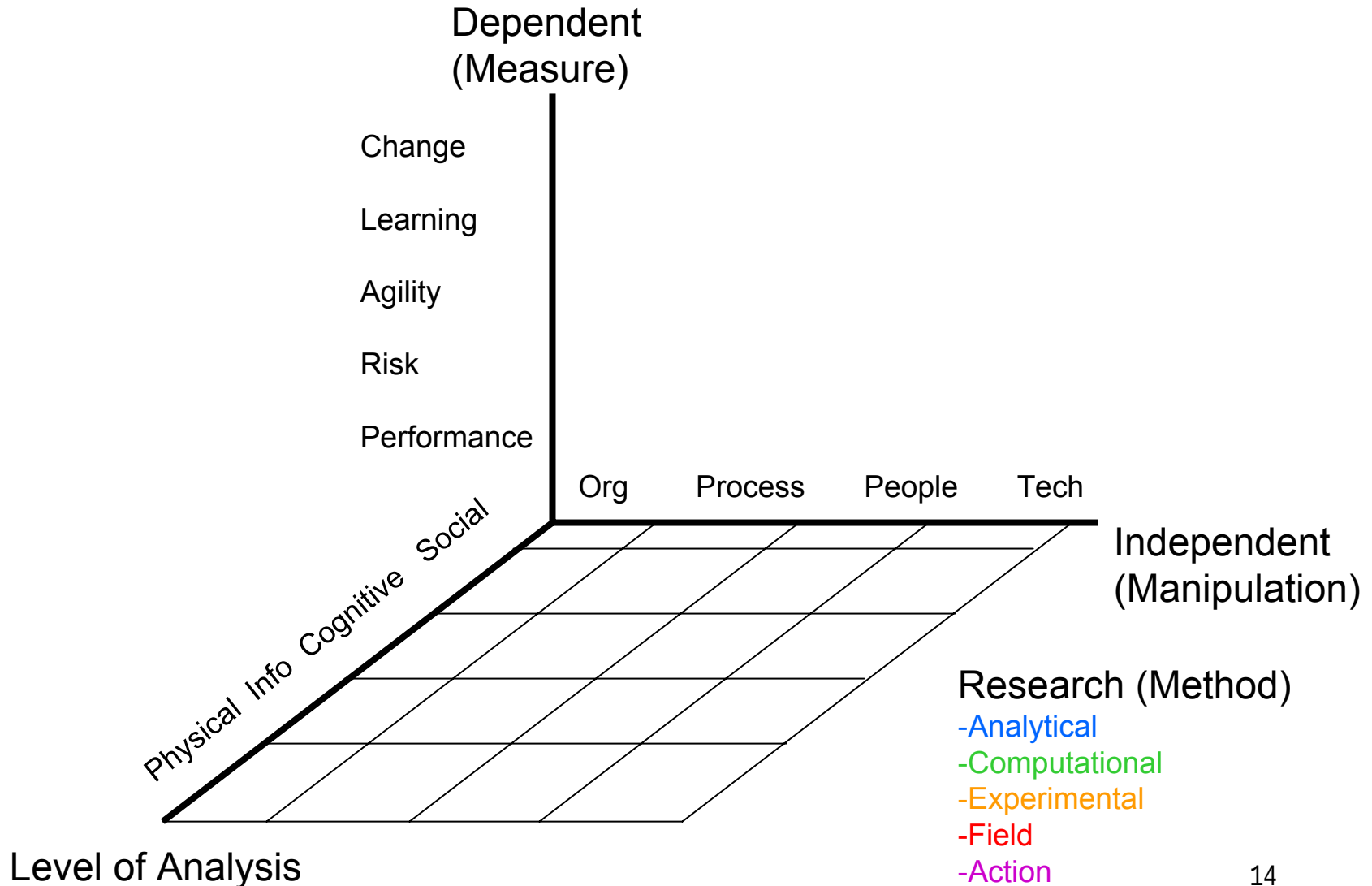
Campaign Dimensions

<i>Level of Analysis¹</i>	<i>Independent² (C2 Approach)</i>	<i>Dependent³ (Measure)</i>	<i>Research⁴ (Method)</i>
		Performance	Analytical
Social	Organization	Risk	Computational
Cognitive	Process	Agility	Experimental
Information	People	Learning	Field
Physical	Technology	Change	Action

Unpacking Dimensions

- Independent (C2 approach)
 - Organization ~ central, formal, special, coord, train, indoctrin, leadership, others*
 - Process ~ workflow, task interdep, task decomp, quality, rework, comm, others*
- Dependent (measure)
 - Performance ~ speed, accuracy, cost, backlog, coord, rework, errors, others*
 - Agility ~ robust, resilient, responsive, flexible, innovative, adaptive, others*
- Others

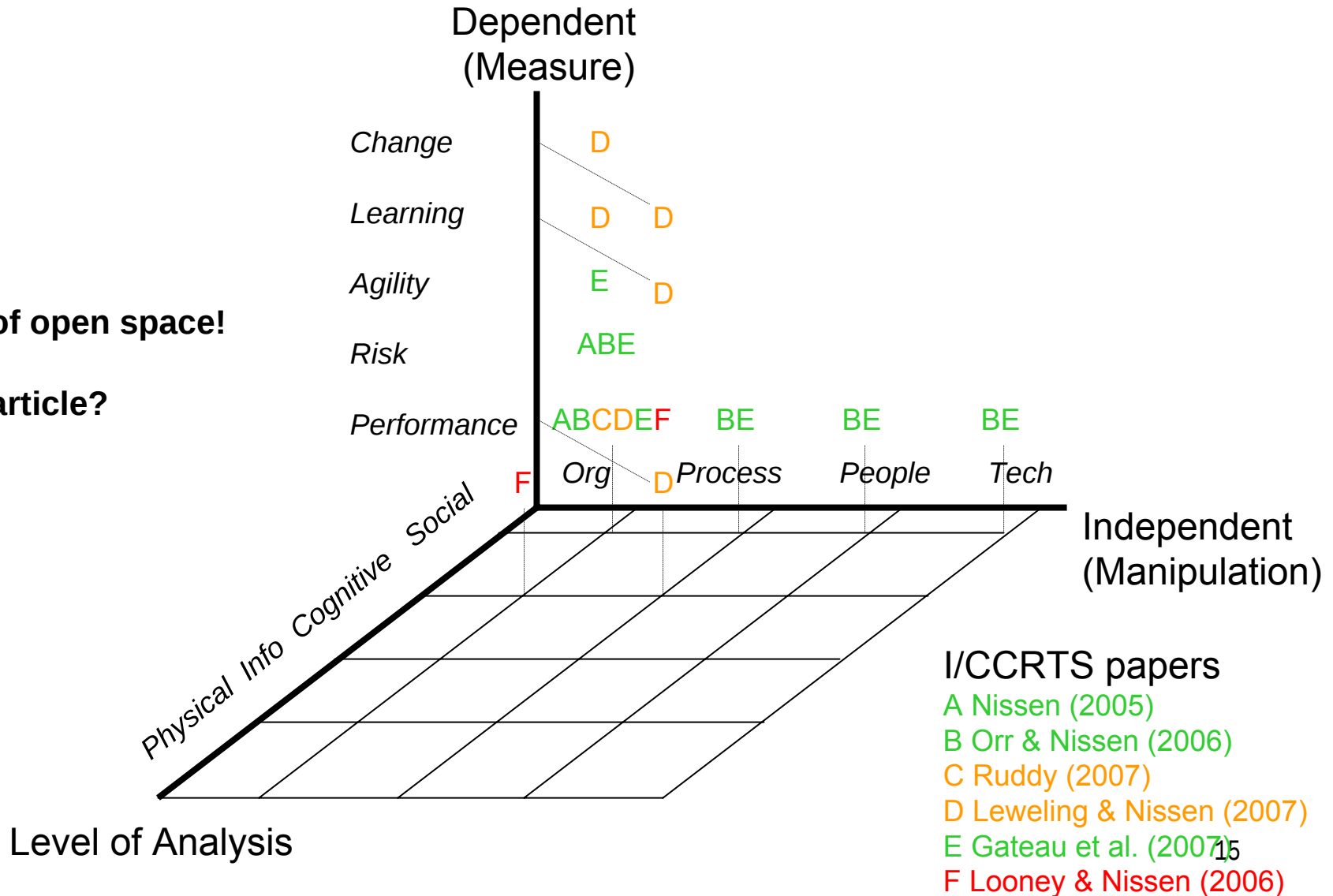
Campaign Space Viz



Campaign Space Viz

Lots of open space!

IC2J article?



Next Steps

- *Edge-like approach*
 - Providing guidance & tools
 - Encouraging self-org & -synch
 - Sharing & interacting
 - Assessing & refining over time
- Need your help
 - Encourage your participation
 - Contribute to research stream
 - Let us know how we can assist



Questions?

- Thank you!
- MNissen@nps.edu