



# Exploring Edge C2 Approaches: ELICIT & POW-ER Tools

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- *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

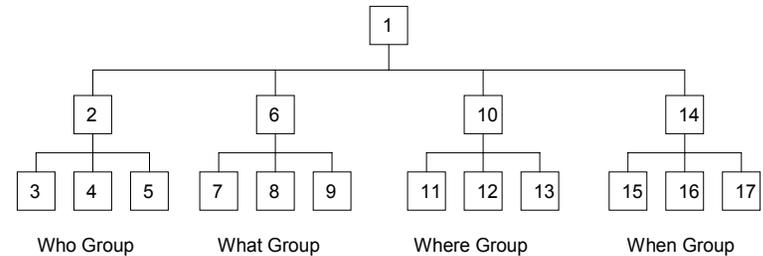
- OASD-NII CCRP sponsor
  - Part of virtual institute for C2 research
  - Naval Postgraduate School (NPS) host
- Activities
  - Promotes, sponsors & conducts C2 R (BAA)
  - World-class, multidisciplinary, multi-university, multi-year research stream
  - Translates via education, application & outreach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

# ELICIT Game

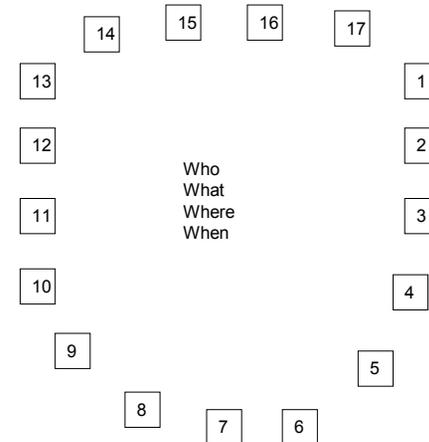
- Multiplayer intelligence game
  - Networked “intelligence analysts”
  - Uncover fictitious terrorist plots
  - Distributed clues require collaboration
  - Fully instrumented lab environment
- Developed by Parity via CCRP
  - Runs on LAN-networked PCs
  - Distributed freely – share data
  - Used at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

- 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

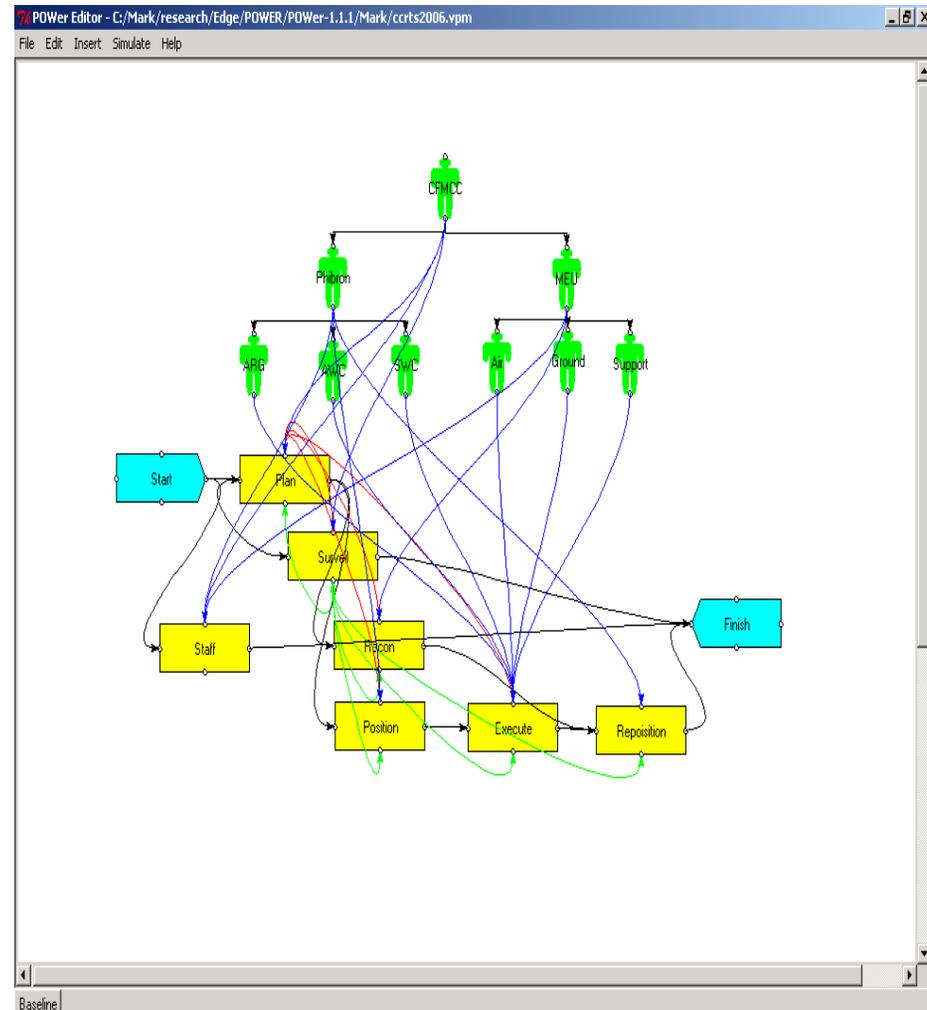
- Users' group meeting Friday AM
- Experiment extensions
  - Study different org forms, work processes, personnel/team characteristics, technologies, environmental conditions, performance dimensions, other aspects of C2 approaches
  - Extend & elaborate on experiment designs
  - Pool & analyze data across 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

- 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

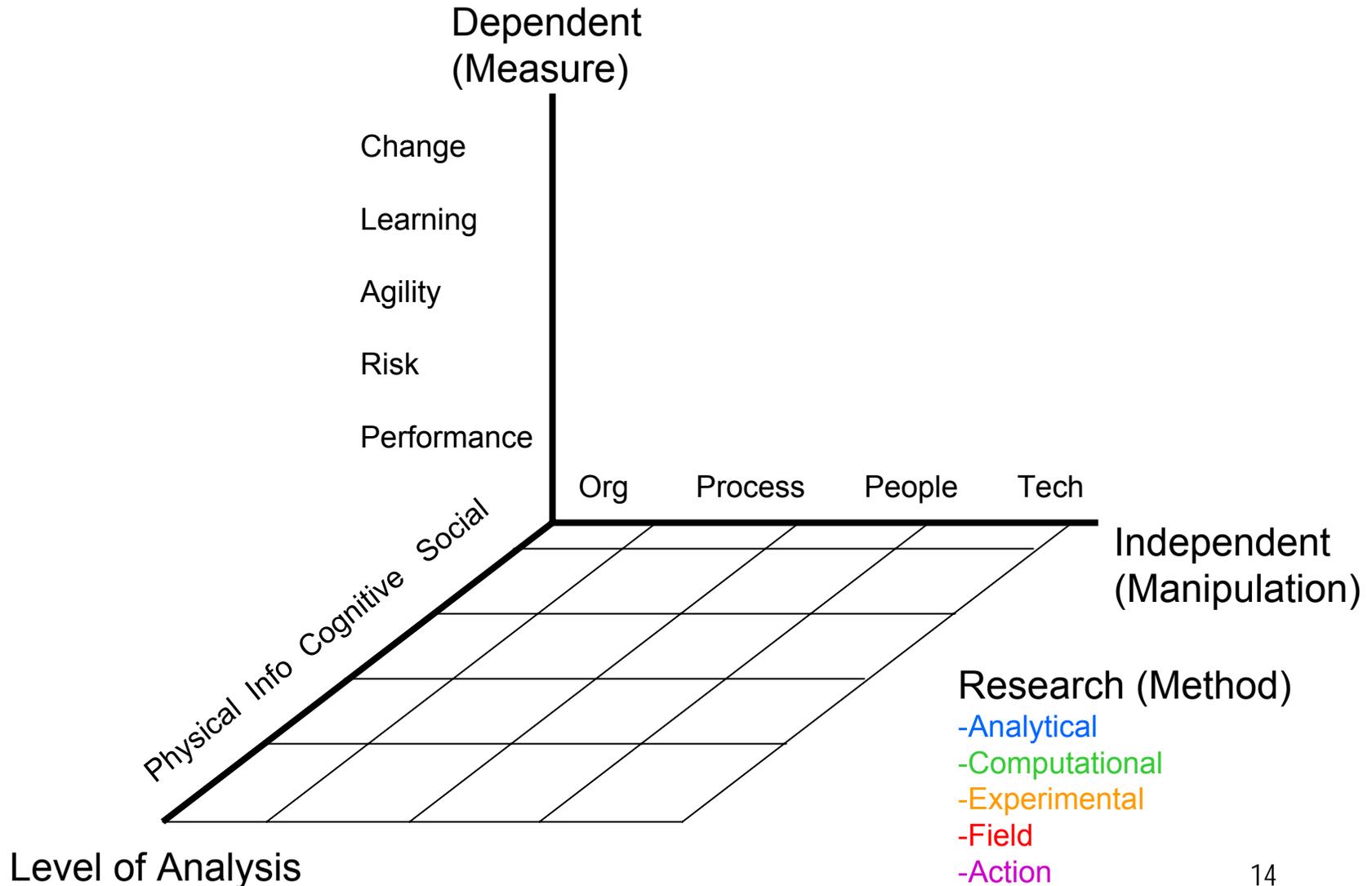
# Campaign Dimensions

<i>Level of Analysis<sup>1</sup></i>	<i>Independent<sup>2</sup> (C2 Approach)</i>	<i>Dependent<sup>3</sup> (Measure)</i>	<i>Research<sup>4</sup> (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

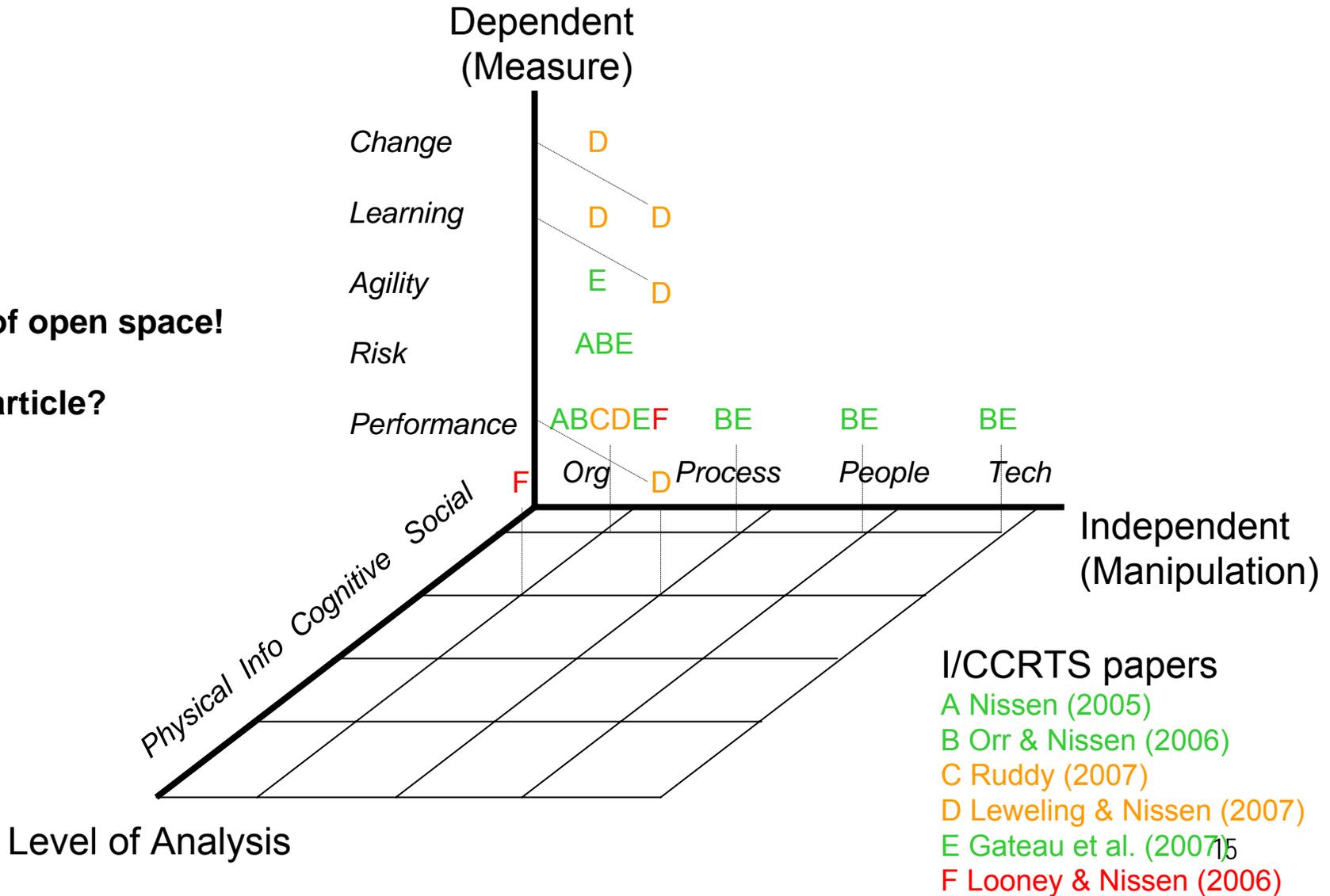
# Campaign Space Viz



# 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!
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