Exploring Effects of C2 Warfare on C2 Ability in a Simulated Environment
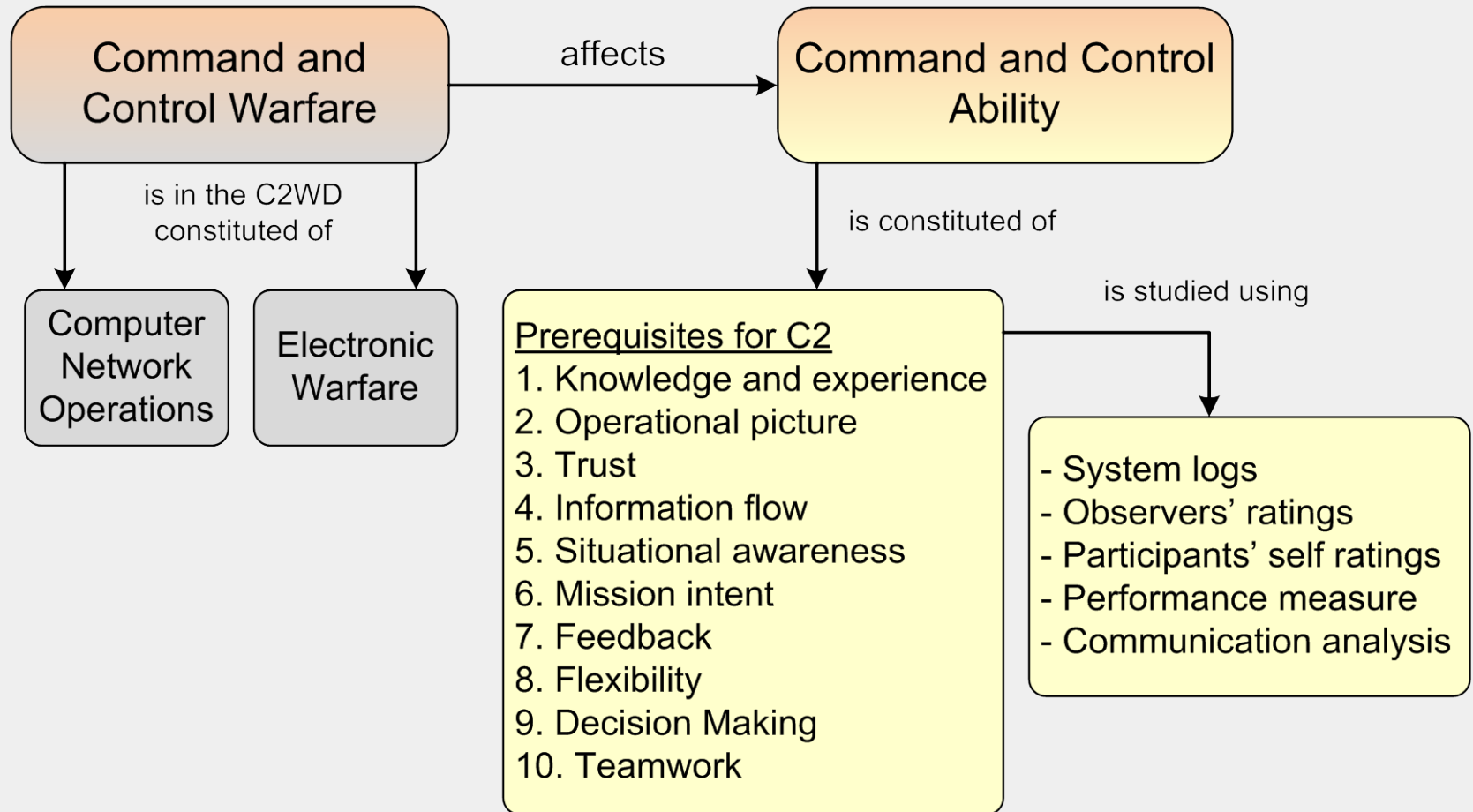
Magdalena Granåsen, Patrik Lif, Per-Anders Oskarsson, Peter Klum, Lars Tydén & Niklas Hallberg

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Outline

- C2 Warfare Demonstrator technology and methods

- Method

- Results

- Conclusions

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Hypothesis

Command and Control Warfare — affects → Command and Control Ability

is in the C2WD constituted of

Computer Network Operations

Electronic Warfare

is constituted of

Prerequisites for C2
1. Knowledge and experience
2. Operational picture
3. Trust
4. Information flow
5. Situational awareness
6. Mission intent
7. Feedback
8. Flexibility
9. Decision Making
10. Teamwork

is studied using

- System logs
- Observers' ratings
- Participants' self ratings
- Performance measure
- Communication analysis

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C2W Demonstrator

- Electronic Warfare and Computer Network Operations

  - Detection, countermeasures, prevention

  - Radar, signal intelligence, Infra red search and track (IRST), jammers (radio, radar, mobile telephones)...

  - Network scan, Denial of Service, spyware, Intrusion detection system (IDS)…

- Communication

  - Radio, mobile telephone, satellite, e-mail

- Three-dimensional terrain model

- Web pages

- Views – Network, sensors, e-mail inbox, internet
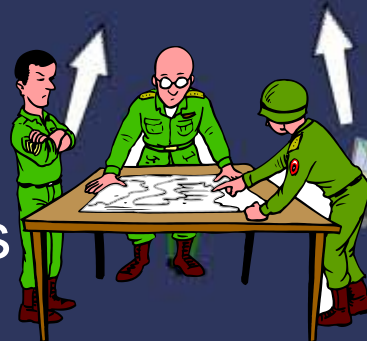
Radar sensor

IRST sensor

ESM sensor
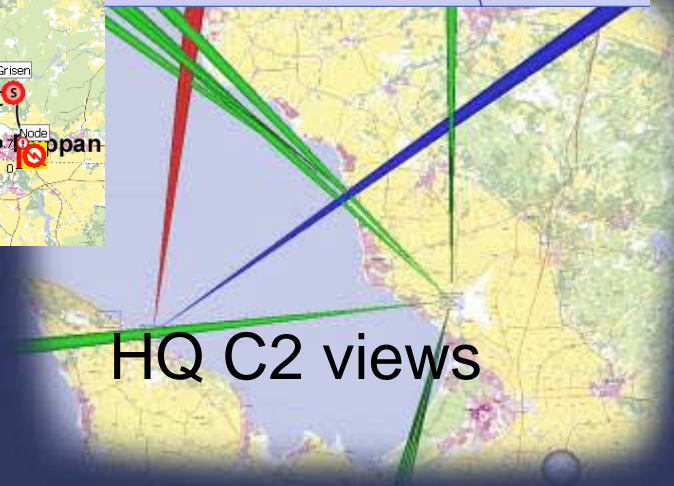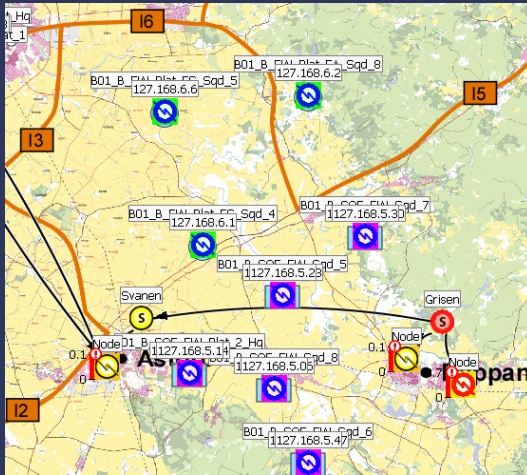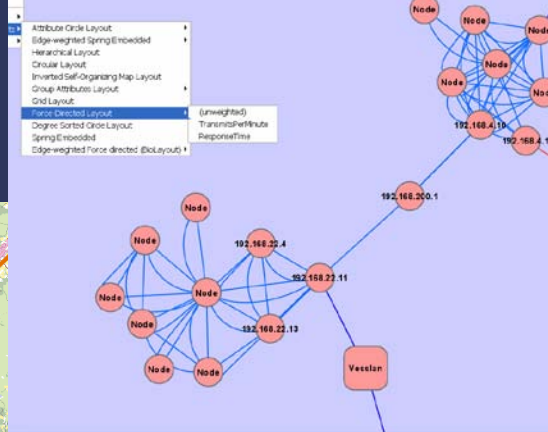
HQ C2 views

Order

Action

Operators

Rules

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Scenario

- International force deployed in a fictitious country
- Staff responsible for EW and CNO resources
- Irregular and regular forces, criminal actors
- Task: Support the evacuation of NGO:s
  - Intelligence phase, evacuation phase
- Keys to success
  - Social network analysis
  - Locate spoilers to peace process
  - Neutralise spoilers

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Method

- Two experiments conducted
- Three days
    - Training
    - Intelligence phase
    - Evacuation phase
- Participants: Staff of 3-4 persons
    - CNO and EW experts
- Game control
    - Higher chief in command
    - Staff assistants
    - Opposing actors
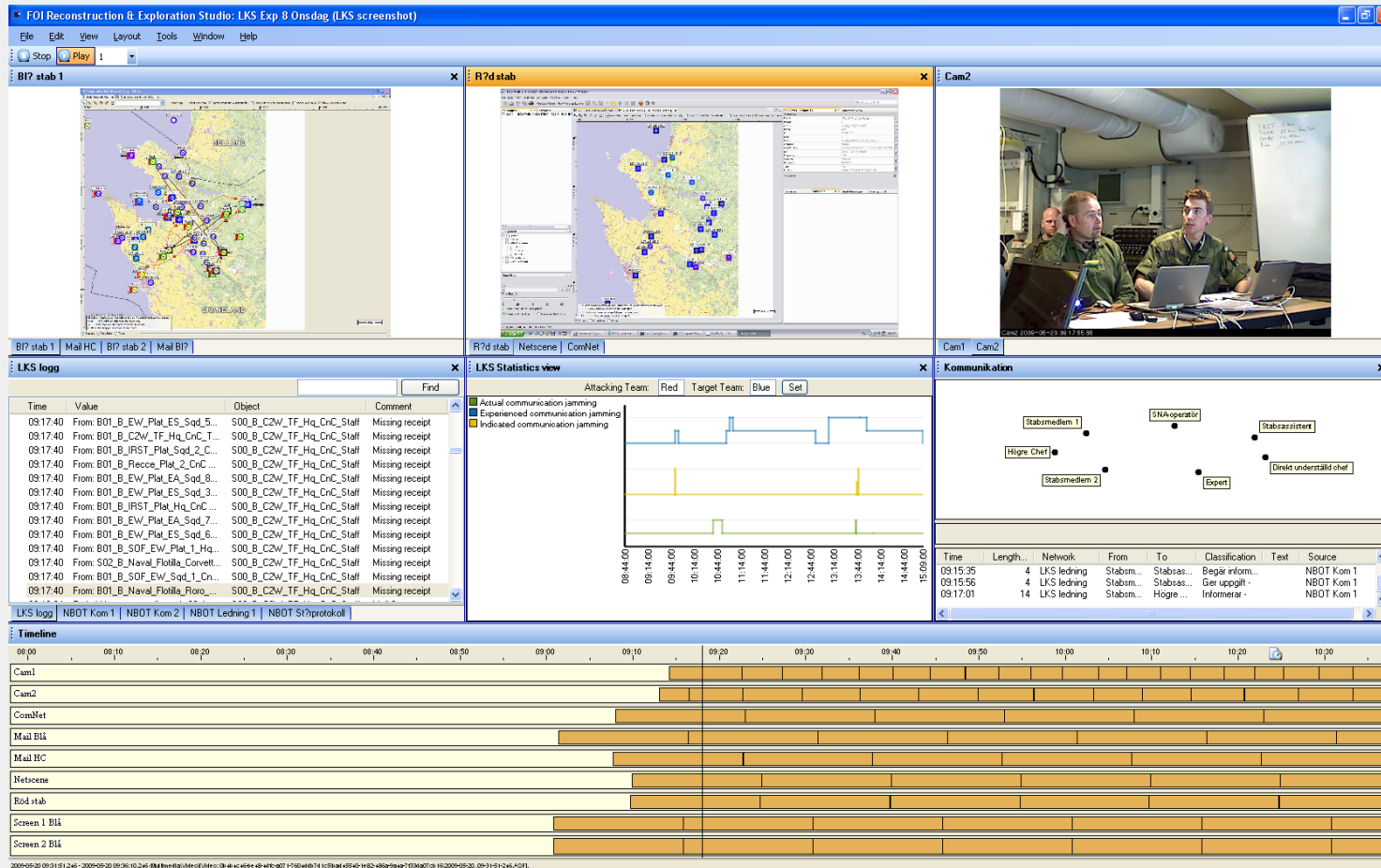- Observers

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Data collection

- System logs
- Video and audio
- Surveys
- Observers
  - C2 aspects
  - Communication
- Performance measure
- Experienced jamming/CNO
- Estimations of prerequisites for C2

Results
Analysis of Situational Awareness and Performance
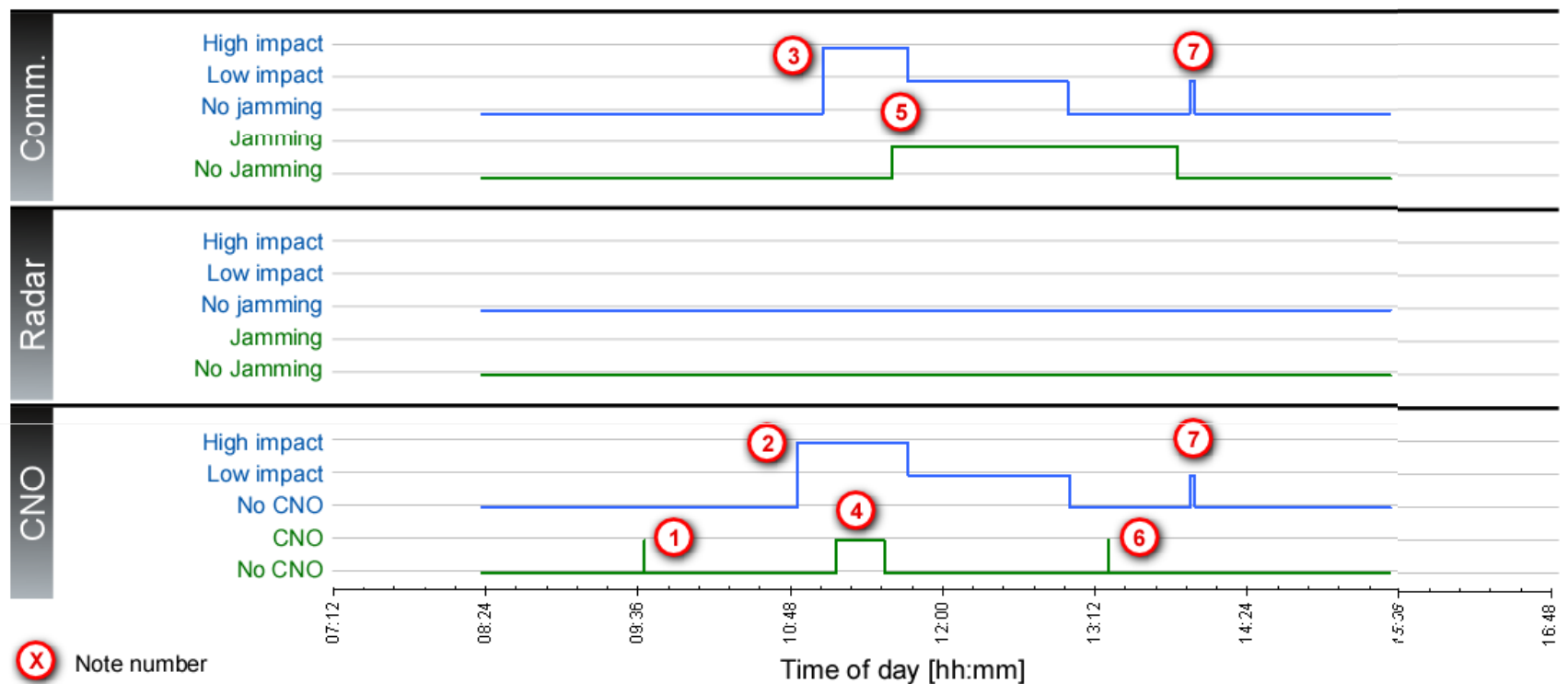
Results
Actual and experienced Jamming/CNO

Actual and Experienced Jamming/CNO
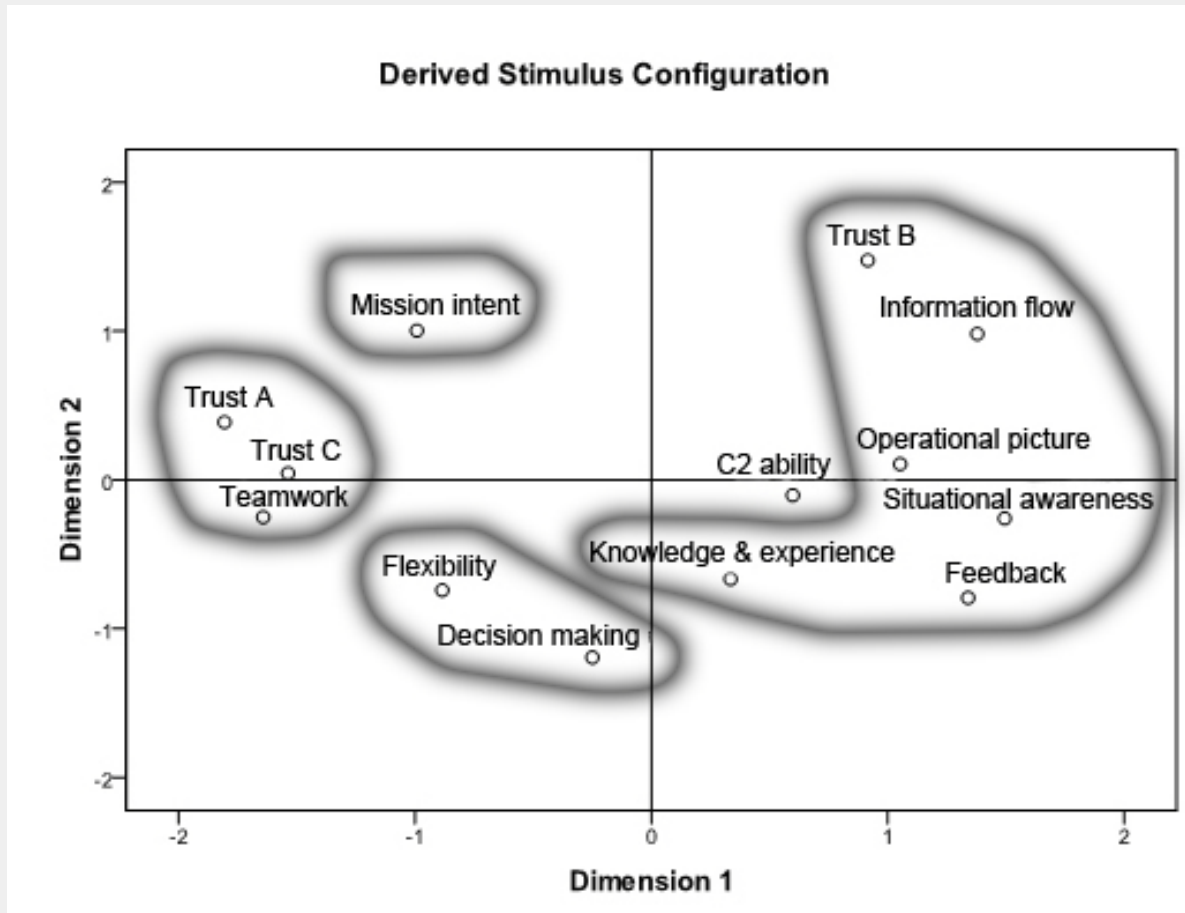
Evacuation phase (Experiment 1 Day 2)

Results
Performance

- Experiment 1

  - Intelligence phase 60%

  - Evacuation phase 60%

- Experiment 2

  - Intelligence phase 70%

  - Evacuation phase 70%

- Overall good performance, most issues solved
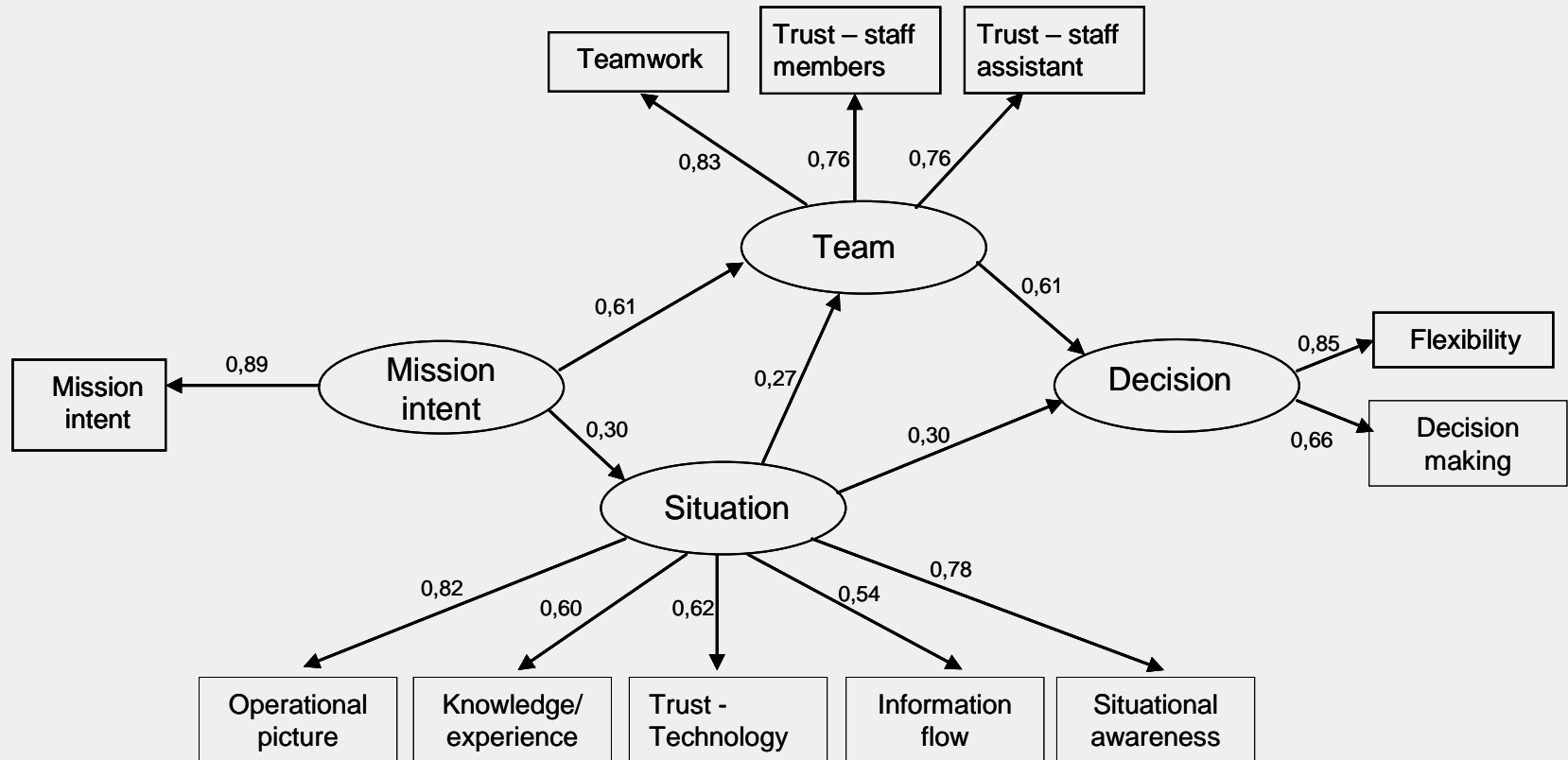
- Staff in experiment 2 more familiar with each other?

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Results
Multidimensional scaling of prerequisites

Derived Stimulus Configuration

Results
LISREL model of prerequisites

Conclusions

- Actual/experienced jamming
    - Good overview of Team SA
    - 1. Automatically generated statistics, 2. FREX analysis
- Performance measure
    - Aided in comparing the teams
    - Resource consuming – automate?
- Prerequisites
    - Separate, but can be clustered
    - Team issues higher impact on decision than SA

Questions?

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