When Do Organizations Need to Change (Part I)?
Coping with Incongruence

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Questions & Objectives

- Do model-based predictions of (in) congruence produce measurable difference in process and outcome?
- Measure the effects of congruence on organizational performance and processes
- Lay the foundation for further work on adaptation
  - Establish the conditions for change
  - Identify leading indicators of incongruence
    - How do we support/induce adaptation?
## Organizational Structures

### Functional (F)

<table>
<thead>
<tr>
<th>Platform</th>
<th>1 Platform</th>
<th>2 Platform</th>
<th>3 Platform</th>
<th>4 Platform</th>
<th>5 Platform</th>
<th>6 Platform</th>
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</thead>
<tbody>
<tr>
<td>CVN</td>
<td>STRIKE</td>
<td>BMD</td>
<td>ISR</td>
<td>AWC</td>
<td>SuWC/MINES</td>
<td>SOF/SAR</td>
</tr>
<tr>
<td>DDGA</td>
<td>8TLAM</td>
<td>3ABM,4TTOM</td>
<td>1UAV</td>
<td>2F18A, E2C</td>
<td>1FAB, 1MH53</td>
<td>1HH60</td>
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<td>DDGB</td>
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<td>6SM2</td>
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<td>8TLAM</td>
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<td>1HH60</td>
</tr>
<tr>
<td>FFG*</td>
<td>2F18S</td>
<td>xxx</td>
<td>1UAV</td>
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- Asset “ownership” and control shape team structure:
  - Multi-function vs. single-function responsibilities
  - Geographic Area of Responsibility: Local vs. Global
- Heterarchical, not Hierarchical, organization
Scenarios

- Congruence Manipulation
  - Capitalizes on Roles and Geography (task and asset locations)

- Strategies for Manipulation of Congruence
  - Coordination Requirements
  - Task Phasing
  - Boundary Splitting
  - Limited Assets
Functional (f) Scenario

- **Task Resource Reqmts**
  - **SDG:** 2 ASuW
  - **SPT, SPH:** 1 ASuW
  - **SGUN:** 2 FAB
  - **SSAR:** 2 SAR
  - **SMIN:** 2 MINES
  - **GEVA:** 2 SAR
  - **GCDL, GSML:** 1 STRK
  - **GSAM:** 2 TLAM (from 2 different platforms)
  - **GSA3:** 2 STRK (1 F18S)
  - **GSA6:** 2 TLAM (from 2 different platforms)
  - **GRGF:** 3 STRK
  - **AAC, APH, ACDM, AXOC:** 1 AAW
  - **ACAP:** 3 AAW
  - **AMIS:** 1 ABM

- Other unanticipated tasks via HELP

* indicates that these must be distinguished from neutral (or decoy) counterparts

- **Task Type**
  - **=** aggregated defend task, showing possible subtasks
  - **=** aggregated encounters task, with possible subtasks
  - **=** mission tasks (that must be done); known in advance
  - **=** GEVA may spawn as a result of performing task
**Divisional (d) Scenario**

- **= aggregated defend task, showing possible subtasks**
- **= aggregated encounters task, with possible subtasks**
- **= mission tasks (that must be done); known in advance**
- **M** = GEVA may spawn as a result of performing task

**Task Resource Reqmts**

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<th>Task</th>
<th>Resource Reqmts</th>
</tr>
</thead>
<tbody>
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<td><strong>SDG:</strong></td>
<td>1 ASuW + 1 AAW</td>
</tr>
<tr>
<td><strong>SPT, SPH:</strong></td>
<td>1 ASuW</td>
</tr>
<tr>
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- other/unanticipated tasks via HELP

* indicates that these must be distinguished from neutral (or decoy) counterparts
Experimental Design

- 48 participants organized into eight 6-person teams

Independent Variables
- Structure is a between subjects variable
  - Divisional (D) vs. Functional (F)
- Scenario is a within subjects variable
  - Divisional favoring (d) vs. Functional favoring (f)

→ Congruence is the interaction of structure and scenario.
## Experimental Design

### Procedure
- “Buttonology” (2 hours)
- “Hash” (2 hours)
- First Replication (2 hours)
- Second Replication (2 hours)

### Design

<table>
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<tr>
<th>Structure</th>
<th>Scenario</th>
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<tbody>
<tr>
<td>D</td>
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<tr>
<td>F</td>
<td>f</td>
</tr>
<tr>
<td>4 Teams</td>
<td>f</td>
</tr>
<tr>
<td>4 Teams</td>
<td>d</td>
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</table>
Results

- Analyses focused on communications, workload, and performance.
  - Emphasis on model-based predictions
  - Emphasis on patterns
  - Emphasis on communications because they directly reflect strategy adaptations, and are thus a strong candidate for leading indicators

- Overall, results showed that in the incongruent cases, communications increased, workload increased, and performance worsened.

- However, the context mattered.
  - Structure/scenario pairings influenced reaction to incongruence.
Overall Performance

- As predicted based on the model design process, performance was worse in the incongruent cases.
Communications (Talking More?)

- The manipulation of congruence hinged on coordination requirements.
  - Model-Based Prediction: Since more coordination required in incongruent cases, there should be more communication in incongruent cases.

→ Bigger change in Functional
Communication Patterns

Organizational Structure Mattered

- In response to incongruence:
  - Divisional teams talked more.
  - However, Functional teams talked a lot more, and there were stronger differences in who talked to who about what.
    - The context of structure and scenario mattered.
Communications: Who is Talking to Who?

Green's Communication with Other Team Members

Purple's Communication with Other Team Members

Orange's Communication with Other Team Members

Blue's Communication with Other Team Members

Red's Communication with Other Team Members

Brown's Communication with Other Team Members

Large Changes in Functional
Communications: Talking About What?

• **Incidence Rate Analysis of Communication Patterns**
  
  • For Divisional, the “role-relative” incidence rates for communications by player and type did not change drastically between the congruent and incongruent conditions.

  **Divisional RIR-I/RIR-C Ratio**
  (Indicates change in role-relative communication probability from congruent to incongruent scenarios)

<table>
<thead>
<tr>
<th>DM</th>
<th>All</th>
<th>Task</th>
<th>Asset</th>
<th>Req</th>
<th>Xfer</th>
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<td>Brown</td>
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  • For Functional, there were strong changes in communication types for many players → Talking about different things…

  **Functional RIR-I/RIR-C Ratio**

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Communications: Talking About What?

- Communication & Cooperation Networks illustrate interaction patterns within the team
  - Player-Player networks are created when:
    - A Player sends a communication to another Player
    - Players cooperate to process a task

- For the Divisional structure the association is about the same in congruent and incongruent conditions
- For the Functional structure the association is quite different between congruency conditions and largest in the incongruent condition

- In Divisional there is little evidence for strategy adaptation. However, in Functional there is a radical change in the association of communication and cooperation
Perceived Workload

- The manipulation of congruence hinged on coordination requirements.
  - Model-Based Prediction: Since more coordination in incongruent cases, there should be a higher perceived workload in incongruent cases.

![Graph showing workload comparison between divisional and functional organizational structures.](image)

- Divisional: 4
- Functional: 3

p = 0.08
Performance

- The manipulations of congruence were successful in changing communications and perceived workload.
  - These changes were predicted by the model-based manipulation of coordination requirements.
- Given these changes in response to coordination needs, we expected performance to be worse in the incongruent conditions.
  - Will performance be different across the structure and scenario pairings?
When coping with incongruence, performance changes were dependent on the structure & scenario pairings.
- Percent of attacks processed by latency for tasks processed
  - Changes in tasks processed for each structure
  - No changes in latency for either structure
Performance

- Percent of tasks processed by accuracy for tasks processed
  - Changes in tasks processed for each structure
  - Changes in accuracy for Divisional only

Divisional

Functional

- Congruent
- Incongruent
Accuracy by latency for tasks processed
- No changes in latency
- Changes in accuracy for Divisional only

**Divisional**

- Congruent
- Incongruent

**Functional**

- Congruent
- Incongruent
Conclusions

- The organizations and scenarios studied here set the stage for further work on structural adaptation.
  - Based on modeling work we successfully created the conditions under which change is needed.
- The strategic adaptations to incongruence depended on the organizational structure & scenario pairings.
  - The leading indicators may be complex and context dependent, especially when larger and more complex command and control organizations are considered.