Designing for Soft Constraints in Human-Agent Coordination

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Achieve operational excellence, obtain competitive advantage. The promise of autonomous systems.
Three popular approaches
1. Proceduralize
2. Shift control
3. Add technology
Procedures address the knowns, reduce ambiguity, and lead to rule following.
Front-end control enables discretion when unknowns occur, and requires expertise.
Technology increases efficiency, consistency, reduces workload, and introduces system gaps.
Technology should not be evaluated on their internal structure alone, but on their role as coordination mechanisms.

(Garbis & Artman, 1998)
System resilience is graceful extensibility in the face of unexpected events
System resilience requires people to make the right decisions in under-defined circumstances.
Three proposed approaches

1. Trust
2. Cooperation
3. Accountability
Trust is useful in the absence of complete control.

Trust guides – but does not completely determine – reliance and compliance.
Cooperation is the willingness to forgo individual goals for shared goals.

Cooperation requires trust; coordination is dependency management.
Accountability refers to social pressures that impact decisions. An obligation to justify conduct, especially when procedural or social sanctions are present.
Agent behaviors affect human behaviors

An agent that maximized for individual goals resulted in similar behaviors from participants, undermining joint performance; this was also true when faced with high workload (Chiou & Lee, 2016)

Under high workload, participants were less proactive, but still cooperated reactively (Chiou & Lee, 2016)
Interaction structures affect joint performance

A reciprocal exchange structure led to more efficient but lower-quality resource sharing behaviors compared to a negotiated exchange structure (Chiou, Lee, & Su, 2019)
Increasing accountability pressures can reduce errors of omission and commission (Skitka, Mosier, & Burdick, 2000) and increase cooperative behaviors, but at some costs to efficiency (Salehi, Chiou, & Wilkins, 2018).
Consider process-based performance and the ability to resolve conflicting goals.

The promise of autonomy in complex systems: Does your organization have the superior doctrine and understanding of soft constraints?
Conclusion:
Build capabilities that allow for graceful extensibility

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1. What are the key problems your field thinks about?
Lack of human system integration, interoperability

2. What are problems that your field views as solved?
Need to conduct studies in naturalistic settings, theory development must connect with implementation science

3. What are the current research trends in your field?
Designing for worker empowerment, human-machine interdependence and system resilience

4. What are problems that your field views as unsolved but important?
How to keep the human in-the-loop, not just for their attention and control, but also accountability
Types of Accountability Systems

<table>
<thead>
<tr>
<th>Source of Agency Control</th>
<th>Internal</th>
<th>External</th>
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<tbody>
<tr>
<td>High</td>
<td>1. Bureaucratic</td>
<td>2. Legal</td>
</tr>
<tr>
<td>Low</td>
<td>3. Professional</td>
<td>4. Political</td>
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(Romzek & Dubnick, 1987, p. 229)