

1 **Redistributing Interdependence in Organizational Knowledge Work: Lessons**
2 **from Deploying an LLM Mediator in Research Labs**

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6 Large Language Models (LLMs) are increasingly embedded in collaborative workflows, yet their structural effects on the relationships
7 between human stakeholders in data-intensive knowledge work remain underexplored. In this position paper, we reinterpret findings
8 from a month-long field deployment of an LLM-based chatbot that mediates organizational memory across four university research
9 labs (N=21) through the lens of Interdependence Theory. Our analysis reveals two key dynamics. First, the LLM redistributes the
10 *dependence structure* between students and lab directors: while students gain autonomous access to institutional knowledge, directors
11 lose visibility into knowledge gaps, shifting bilateral dependence toward unilateral dependence. This redistribution is moderated by
12 organizational culture, amplifying *mutual responsiveness* in psychologically safe environments while dampening it where students
13 default to private interaction. Second, the system fails to support the *transformation of motivation* needed for collaborative knowledge
14 stewardship: students consistently avoid contributing to documentation due to role perceptions and temporal asymmetry between
15 individual costs and collective benefits. We derive design implications including privacy-preserving awareness mechanisms, graduated
16 contribution pathways, and designing for the LLM's dual role as a boundary object across stakeholder groups.
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19 CCS Concepts: • **Human-centered computing → Collaborative and social computing systems and tools.**
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21 Additional Key Words and Phrases: human–LLM collaboration, interdependence theory, organizational memory, chatbot, knowledge
22 management
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24 **1 Introduction**
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26 Modern data and knowledge workflows are rarely solo efforts. They bring together people with different expertise,
27 vocabularies, and degrees of trust in automation [1]. University research labs exemplify this dynamic: lab directors
28 maintain institutional knowledge, while students must locate, interpret, and contribute to that knowledge as part of
29 their academic work [2, 13]. These workflows are inherently *collaborative* and *data-intensive*, involving the ongoing
30 collection, curation, and retrieval of organizational knowledge distributed across documents, conversations, and human
31 memory.
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33 At the same time, Large Language Models (LLMs) are increasingly embedded in tools for data processing, knowledge
34 retrieval, and documentation [8]. Yet their potential role as *collaborators* that help align goals, translate between
35 communities, and coordinate decisions in knowledge work remains largely unexplored. When an LLM is introduced
36 as an intermediary in a collaborative knowledge workflow, it does not merely provide answers; it *reconfigures* the
37 relationships among the people involved.
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39 In this position paper, we draw on findings from a month-long field deployment of an LLM-based chatbot designed
40 to mediate organizational memory in university research labs [7]. Rather than treating the deployment solely as a
41 systems evaluation, we revisit its findings through the lens of *Interdependence Theory* [5, 12], a framework from social
42 psychology that analyzes how actors' outcomes are mutually contingent on one another's actions.
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44 We argue that Interdependence Theory offers a productive lens for understanding human–LLM collaboration in
45 knowledge work because it foregrounds questions that purely technical evaluations often overlook: *How does the*
46 *introduction of an LLM change who depends on whom? What happens to mutual responsiveness when an AI mediates*
47 *communication? How do shared outcomes shift when individual actors can bypass collective channels?* We present an
48 interdependence-theoretic analysis of these findings and derive design implications for LLM-mediated collaborative
49 systems.
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53 2 Background

54 2.1 The Deployed System and Key Findings

55 The system analyzed in this paper is an LLM-based chatbot embedded in Slack that supports organizational memory
 56 in university research labs [7]. It provides document-grounded Q&A via retrieval-augmented generation [8], peer
 57 knowledge sharing with optional anonymity, conversational knowledge extraction, and director-approved document
 58 updates. All documentation changes require explicit director approval, ensuring that the director retains final authority
 59 over the organizational memory.

60 The system was deployed for one month across four university research labs (N=21). Participants submitted 107
 61 questions, 42% of which were answered using existing documentation. Lab directors made 38 documentation commits,
 62 adding 1,994 words to the organizational memory. The key findings that motivate our analysis include: (a) a *privacy-*
 63 *awareness tension*, where the majority of student questions were asked through private direct messages, limiting
 64 directors' visibility into knowledge gaps; (b) *culture-dependent usage*, where one lab's culture of psychological safety led
 65 to predominantly public questioning and significantly more documentation updates; and (c) *persistent barriers to student*
 66 *contribution*, where students hesitated to suggest documentation updates despite the system's collaborative features.
 67

72 2.2 Interdependence Theory

73 Interdependence Theory, originating from the work of Kelley and Thibaut [12], provides a framework for analyzing
 74 situations in which two or more actors' outcomes are mutually contingent on one another's actions [5, 10]. The theory
 75 characterizes the *dependence structure* between actors, meaning the degree and direction of influence each party's actions
 76 have on the other's outcomes. It further examines *mutual responsiveness*, the extent to which actors attend and adapt to
 77 each other's needs, and *transformation of motivation*, the process by which actors shift from self-interested behavior
 78 ("given preferences") toward behavior that accounts for the partner's or group's welfare ("effective preferences"). The
 79 theory also considers *correspondence of outcomes*, whether actors' interests are aligned or in conflict. While originally
 80 formulated for human-human dyads, the theory's emphasis on structural features of interaction situations, rather than
 81 on cognitive capacities, makes it applicable to analyzing human-LLM configurations.
 82

86 3 An Interdependence-Theoretic Analysis

87 3.1 Redistribution of Dependence and Disrupted Mutual Responsiveness

88 Prior to the introduction of the LLM chatbot, the *dependence structure* in research labs was relatively straightforward.
 89 Students depended on lab directors for access to institutional knowledge (policies, procedures, implicit norms), and
 90 lab directors depended on students' questions to understand their knowledge needs and to maintain awareness of
 91 documentation gaps. This created a bilateral dependence structure: each party's outcomes (effective knowledge access
 92 for students; well-maintained documentation for directors) were contingent on the other's actions.
 93

94 The introduction of the LLM mediator fundamentally restructured this dependence. Students' dependence on directors
 95 for routine knowledge retrieval was partially displaced onto the system, as 42% of their questions could be answered
 96 directly from existing documentation. This displacement was welcomed by students, who described the chatbot as
 97 "a senior in the lab" or "a librarian," a dependable knowledge source that reduced the social cost of asking questions.
 98 However, this redistribution simultaneously attenuated directors' dependence on student questions as a source of
 99 awareness. When students obtained answers privately, the informational signal that directors relied upon (observing
 100 what students asked and where they struggled) was no longer available. This asymmetric redistribution created a
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105 new interdependence structure in which students' outcomes (knowledge access) improved while directors' outcomes
106 (documentation awareness) were inadvertently diminished. In Interdependence Theory terms, this represents a shift
107 from bilateral to more unilateral dependence: the LLM, in absorbing one pathway of dependence, inadvertently severed
108 a feedback loop that sustained the collaborative maintenance of organizational knowledge.

109 Critically, this redistribution manifested differently depending on organizational culture. In one lab (Lab A), where
110 a culture of psychological safety led members to ask questions publicly, the LLM amplified *mutual responsiveness*:
111 directors could observe student needs, discussions fed into documentation updates, and Lab A's director made the
112 most commits (19). In the remaining three labs, where students predominantly used private direct messages, the LLM
113 dampened mutual responsiveness; one director expressed surprise upon learning how actively students had been
114 using the system privately. The same LLM system can either amplify or dampen mutual responsiveness depending on
115 the organizational culture in which it is embedded. From an interdependence-theoretic perspective, organizational
116 culture functions as a moderator of the situation structure [5], producing different effective situations depending on the
117 interpersonal norms, trust levels, and power dynamics of the group.
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122 3.2 Failures of Transformation in Knowledge Contribution

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124 The findings reveal systematic failures of what Interdependence Theory calls *transformation of motivation*, the process
125 by which actors shift from self-interested behavior ("given preferences") to prosocial behavior that considers the
126 group's welfare ("effective preferences"). Students recognized that contributing their knowledge to organizational
127 documentation would benefit future lab members, yet they consistently prioritized their given preferences: avoiding
128 the risk of documenting inaccurate information, protecting themselves from social evaluation, and minimizing the
129 effort of generalizing personal experiences. As one student noted, the concern was that contributed knowledge "would
130 stay in the database forever" and could "mislead all the students."

131 Notably, this reluctance persisted even though the system's design included a safeguard: all documentation updates
132 required explicit approval from the lab director before being applied. Students were aware of this review process, yet
133 the knowledge that a director would see and evaluate their contribution did not alleviate their hesitation; if anything, it
134 added a layer of social evaluation. More fundamentally, students perceived documentation maintenance as the director's
135 prerogative and responsibility rather than a shared endeavor. This framing positioned students as passive consumers of
136 organizational knowledge and directors as sole curators, reinforcing an asymmetric dependence structure in which
137 students depended on directors for both knowledge access and knowledge maintenance. Even when the system provided
138 technical pathways for student contribution, the perceived role boundary limited the transformation of motivation
139 necessary for collaborative knowledge stewardship.

140 This failure of transformation also reflected a structural property of the interdependence situation. Contributing to
141 documentation creates a temporal asymmetry: the costs (effort, risk of error, social exposure) are borne immediately by
142 the contributor, while the benefits accrue to future, often unknown, lab members. In Interdependence Theory terms, this
143 is a *low-correspondence* situation where the contributor's immediate interests diverge from the collective's long-term
144 interests. The chatbot's Knowledge Extraction feature partially addressed this by lowering the cost of contribution,
145 transforming ongoing conversations into documentation without requiring separate writing effort. However, the
146 psychological barriers persisted, suggesting that LLM-mediated systems must go beyond reducing technical friction
147 and actively address the role perceptions and social dynamics that inhibit prosocial transformation.

157 4 Design Implications

158 Our interdependence-theoretic analysis yields several design implications for LLM-mediated collaborative systems,
 159 particularly those operating in knowledge-intensive, data-rich organizational contexts.
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161 *Privacy-preserving interdependence mechanisms.* The privacy-awareness tension represents a fundamental design
 162 challenge: how to maintain the informational interdependence that directors need for effective documentation main-
 163 tenance without compromising students' autonomy and psychological safety. We recommend *aggregated awareness*
 164 *mechanisms*, such as periodic, anonymized summaries of question patterns, knowledge gaps, and documentation
 165 usage, that preserve the interdependence signal without exposing individual behavior. This approach maintains the
 166 structural interdependence between stakeholders while respecting individual preferences for privacy, aligning with
 167 what participants in the study explicitly suggested.
 168

169 *Graduated transformation support.* To address the observed failures of transformation, LLM-mediated systems should
 170 provide graduated pathways for knowledge contribution [6]. Rather than requiring contributors to immediately produce
 171 universally applicable documentation, systems should support a spectrum, from low-commitment annotations ("this
 172 worked for me") to collaborative refinement (peer discussion and director review) to formal documentation. Crucially,
 173 the design must also address role perceptions: when students view documentation as exclusively the director's domain,
 174 even well-designed contribution mechanisms may go unused. Systems could reframe contribution as a normal part of
 175 membership in the organization rather than an encroachment on managerial authority.
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177 *Designing for the LLM's dual role as boundary object.* The deployment revealed that users simultaneously experienced
 178 the LLM as a social agent—students described it as "a senior in the lab"—and as a communication medium through
 179 which directors broadcast documentation updates. This duality suggests that LLM mediators in organizational contexts
 180 function as boundary objects [11]: artifacts that maintain shared identity across different social worlds while serving
 181 each group's situated needs [3, 4, 9]. Designers should account for this dual role, ensuring that the same system
 182 can support private, low-stakes knowledge retrieval for individual users while also enabling collective knowledge
 183 maintenance and organizational awareness for managers.
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