

AI and Group Decision Making: An Information Processing Perspective

Thomas E. Gorman^{1,2} and Torsten Reimer³

¹Communication and Cognition Lab, Purdue University, USA

²College of Liberal Arts Research Academy

³Communication and Cognition Lab, Purdue University, USA

Author note

Thomas E. Gorman,  <https://orcid.org/0000-0001-5366-5442>

Torsten Reimer,  <https://orcid.org/0000-0002-7419-0076>

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Introduction

- (Steyvers & Kumar, 2024)
- (Lai et al., 2023)
- (Burton et al., 2024)
- (Rastogi et al., 2023)

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Inputs

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Group Member Roles

Deciding how best to assign team members to roles is crucial in group decision-making, particularly when learning who is best suited for what role within a team. Marjeh et al. (2024) explore how humans allocate tasks within teams comprising both human and AI agents to maximize overall performance. The central theme of their research is understanding the mechanisms by which individuals discern and act upon their own strengths and those of their team members in a dynamic task allocation setting. In their experimental paradigm, participants had to repeatedly allocate three different types of tasks (visual, auditory, and lexical tasks) between themselves and two AI agents. Unbeknownst to participants, each AI agent was configured to have high competence (70% success rate) in one task type but low competence (15% success rate) in others.

Building upon this, McNeese et al. (2023) argue that human-autonomy teams (HATs) should be recognized as distinct from traditional human teams. They emphasize that HATs should

not strive to replicate human-human team dynamics but instead should leverage the unique capabilities of AI agents. The authors propose several research trajectories to advance our understanding of HATs, including exploring diverse teaming models, redefining roles for AI teammates, expanding communication modalities, focusing on AI behavior design, developing specialized training, and emphasizing teamwork in AI design. These insights highlight the necessity of adjusting our approaches to team composition and role assignment when AI agents are involved, ensuring that both human and AI strengths are optimized in the decision-making process.

Recent advances in large language models have dramatically expanded the potential roles of AI in group decision-making, enabling AI agents to move beyond simple advisory functions to serve as mediators, devil's advocates, and active discussion participants

Chiang et al. (2024) investigated the potential of Large Language Models (LLMs) to act as devil's advocates in AI-assisted group decision-making - in the hopes of fostering more critical engagement with AI assistance. In their experimental task, participants were first individually trained on the relationship between defendant profiles and recidivism. For each defendant, participants were also shown the prediction of a recommendation AI model (RiskComp). Participants were then sorted into groups of three, where they reviewed and discussed novel defendant profiles, before making a group recidivism assessment. In the group stage, the recommendations from the RiskComp model were biased against a subset of the defendants (black defendants with low prior crime counts). Of interest was whether the inclusion of an LLM-based devil's advocate in the group discussions could help mitigate the bias introduced by the RiskComp AI model (note that the LLM devils advocate and RiskComp AI are separate AI models). The experimental ma-

nipulation consisted of four variants of an LLM-based devil’s advocate using, varying both the target of objection (challenging either RiskComp recommendations or majority group opinions) and the level of interactivity (static one-time comments versus dynamic engagement throughout the discussions). Their findings revealed that the dynamic devil’s advocate led to higher decision accuracy and improved discernment of when to trust the RiskComp model’s advice.

- (Marjieh et al., 2024)
- (Kumar et al., 2024)
- (Lu et al., 2024)
- (McNeese et al., 2023)

Information Processing

Information Search

- (Gao & Zhang, 2024)

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Communication; information sharing

Transactive memory systems (TMS) represent a critical aspect of group cognition, referring to the shared understanding within a group regarding the distribution of knowledge and expertise among its members (Wegner, 1987). A well-functioning TMS enables team members not only to know who possesses specific knowledge but also to access and share this distributed expertise efficiently.

Bienefeld et al. (2023) conducted an observational study to examine the role of transactive memory systems and speaking-up behaviors in human-AI teams within an intensive care unit (ICU) setting. In this study, ICU physicians and nurses, divided into groups of four, who

collaborated with an AI agent named “Autovent.” Autovent is an auto-adaptive ventilator system that autonomously manages patient ventilation by processing continuous, individualized data streams. Participants, all with a minimum of six months’ experience using Autovent, engaged in simulated clinical scenarios that required diagnosing and treating critically ill patients. Using behavioral coding of video recordings, the researchers analyzed how team members accessed information from both human teammates and the AI system, investigating how these human-human and human-ai interactions related to subsequent behaviors like hypothesis generation and speaking up with concerns. The researchers found that in higher-performing teams, accessing knowledge from the AI agent was positively correlated with developing new hypotheses and increased speaking-up behavior. Conversely, accessing information from human team members was negatively associated with these behaviors, regardless of team performance. These results suggest that AI systems may serve as unique knowledge repositories that help teams overcome some of the social barriers that typically inhibit information sharing and voice behaviors in purely human teams.

Bastola et al. (2024) further explored the potential of AI-mediated communication by examining how an LLM-based Smart Reply (LSR) system could impact collaborative performance in professional settings. They developed a system utilizing ChatGPT to generate context-aware, personalized responses during workplace interactions, aiming to reduce the cognitive effort required for message composition in multitasking scenarios. In their study, participants engaged in a cognitively demanding Dual N-back task while managing scheduling activities via Google Calendar and responding to simulated co-workers on Slack. The findings indicated that the use of the LSR system not only improved work performance—evidenced by higher accuracy in the N-back task—but also increased messaging efficiency and reduced cognitive load, as participants

could more readily focus on primary tasks without the distraction of composing responses. However, it is important to note that participants expressed concerns about the appropriateness and accuracy of AI-generated messages, as well as issues related to trust and privacy. Thus, while AI-mediated communication tools like the LSR system may facilitate information sharing and alleviate cognitive demands in collaborative work, these benefits must be balanced against potential user experience challenges to fully realize their potential advantages.

- (Yang et al., 2024)
- (Ma et al., 2024)
- (Radivojevic et al., 2024)
- (Sidji et al., 2024)
- (Nishida et al., 2024)
- (Chuang et al., 2024)

Shared Mental Models

- (Collins et al., 2024)

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Cognitive Load

Buçinca et al. (2021) examined how interface design might influence cognitive engagement with AI recommendations through what they term “cognitive forcing functions.” Drawing on dual-process theory, they implemented three distinct interface interventions (e.g., requiring explicit requests for AI input, mandating initial independent decisions, introducing temporal delays) designed to disrupt automatic processing and promote more analytical engagement with AI suggestions. Their findings demonstrated that while these interventions successfully reduced

overreliance on incorrect AI recommendations, they also increased perceived cognitive load and decreased user satisfaction. Of particular methodological interest was their systematic investigation of individual differences in cognitive motivation: participants with high Need for Cognition (NFC) showed substantially greater benefits from these interventions, suggesting that the effectiveness of such cognitive load manipulations may be moderated by individual differences in information processing preferences.

Decision-Making Output

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Consensus Formation

Tessler et al. (2024) investigated the potential of AI in facilitating consensus formation through their development of the “Habermas Machine” (HM), an LLM-based system fine-tuned to mediate human deliberation. The HM system receives input statements from individual participants, and attempts to generate consensus statements which will maximize group endorsement. The findings revealed that the AI-generated group statements were consistently preferred over comparison statements written by human mediators. Participants rated the AI-mediated statements higher in terms of informativeness, clarity, and lack of bias. This suggests that AI can effectively capture the collective sentiment of a group and articulate it in a way that resonates with its members. Notably, the researchers also verified that the HM system reliably incorporated minority opinions into the consensus statements, preventing dominance by majority perspectives. These results were replicated in a virtual citizens’ assembly with a demographically representative sample of the UK population. The AI-mediated process again resulted in high-quality group statements and facilitated consensus among participants on contentious issues.

Decision Accuracy and Confidence

- ([Becker et al., 2022](#))
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Trust, Risk and Reliance

Trust in AI

- Westphal et al. ([2023](#))
- ([Koehl & Vangsness, 2023](#))
- ([Banerjee et al., 2024](#))

Reliance

- ([Narayanan et al., 2023](#))

Recent work has begun examining how people attribute responsibility in human-AI collaborative contexts where control is shared and actions are interdependent ([Tsirtsis et al., 2024](#)). Their study employs a stylized semi-autonomous driving simulation where participants observe how a ‘human agent’ and an ‘AI agent’ collaborate to reach a destination within a time limit. In their setup, the human and AI agents shared control of a vehicle, with each agent having partial and differing knowledge of the environment (i.e., the AI knew about traffic conditions but not road closures, while humans knew about closures but not traffic). Participants observe illustrated simulations of a variety of commute scenarios, and then make judgements about how responsible each agent was for the commute outcome (reaching the destination on time, or not). The study reveals that participants’ responsibility judgments are influenced by factors such as the unexpectedness of an agent’s action, counterfactual simulations of alternative actions, and the actual contribution of each agent to the task outcome.

Utilization

Recent work by Buçinca et al. (2021) presents an innovative approach to addressing overreliance on AI systems through interface design rather than explanation quality. Their study evaluated three “cognitive forcing functions” - interface elements designed to disrupt quick, heuristic processing of AI recommendations. Although these interventions significantly reduced overreliance on incorrect AI recommendations, an important trade-off emerged: interfaces that most effectively prevented overreliance were also rated as most complex and least preferred by users. Moreover, their analysis revealed potential equity concerns, as the interventions provided substantially greater benefits to individuals with high Need for Cognition. These findings suggest that while interface design can effectively modulate AI utilization patterns, careful consideration must be given to both user experience and potential intervention-generated inequalities.

- (Cui & Yasseri, 2024)
- (Stadler et al., 2024)

Risk

- (Bhatia, 2024)
- (Zhu et al., 2024)

References

- Banerjee, D., Teso, S., Sayin, B., & Passerini, A. (2024). *Learning To Guide Human Decision Makers With Vision-Language Models* (arXiv:2403.16501). arXiv. <https://arxiv.org/abs/2403.16501>
- Bastola, A., Wang, H., Hembree, J., Yadav, P., Gong, Z., Dixon, E., Razi, A., & McNeese, N. (2024). *LLM-based Smart Reply (LSR): Enhancing Collaborative Performance with ChatGPT-mediated Smart Reply System* (arXiv:2306.11980). arXiv. <https://arxiv.org/abs/2306.11980>

- Becker, F., Skirzyński, J., van Opheusden, B., & Lieder, F. (2022). Boosting Human Decision-making with AI-Generated Decision Aids. *Computational Brain & Behavior*, 5(4), 467–490. <https://doi.org/10.1007/s42113-022-00149-y>
- Bhatia, S. (2024). Exploring variability in risk taking with large language models. *Journal of Experimental Psychology: General*, 153(7), 1838–1860. <https://doi.org/10.1037/xge0001607>
- Bienefeld, N., Kolbe, M., Camen, G., Huser, D., & Buehler, P. K. (2023). Human-AI teaming: Leveraging transactive memory and speaking up for enhanced team effectiveness. *Frontiers in Psychology*, 14. <https://doi.org/10.3389/fpsyg.2023.1208019>
- Buçinca, Z., Malaya, M. B., & Gajos, K. Z. (2021). To Trust or to Think: Cognitive Forcing Functions Can Reduce Overreliance on AI in AI-assisted Decision-making. *Proceedings of the ACM on Human-Computer Interaction*, 5(CSCW1), 1–21. <https://doi.org/10.1145/3449287>
- Burton, J. W., Lopez-Lopez, E., Hechtlinger, S., Rahwan, Z., Aeschbach, S., Bakker, M. A., Becker, J. A., Berditchevskaia, A., Berger, J., Brinkmann, L., Flek, L., Herzog, S. M., Huang, S., Kapoor, S., Narayanan, A., Nussberger, A.-M., Yasserli, T., Nickl, P., Almaatouq, A., ... Hertwig, R. (2024). How large language models can reshape collective intelligence. *Nature Human Behaviour*, 1–13. <https://doi.org/10.1038/s41562-024-01959-9>
- Chiang, C.-W., Lu, Z., Li, Z., & Yin, M. (2024). Enhancing AI-Assisted Group Decision Making through LLM-Powered Devil’s Advocate. *Proceedings of the 29th International Conference on Intelligent User Interfaces*, 103–119. <https://doi.org/10.1145/3640543.3645199>
- Chuang, Y.-S., Harlalka, N., Suresh, S., Goyal, A., Hawkins, R., Yang, S., Shah, D., Hu, J., & Rogers, T. T. (2024). *The Wisdom of Partisan Crowds: Comparing Collective Intelligence in Humans and LLM-based Agents*.

- Collins, K. M., Sucholutsky, I., Bhatt, U., Chandra, K., Wong, L., Lee, M., Zhang, C. E., Zhi-Xuan, T., Ho, M., Mansinghka, V., Weller, A., Tenenbaum, J. B., & Griffiths, T. L. (2024). Building machines that learn and think with people. *Nature Human Behaviour*, 8(10), 1851–1863. <https://doi.org/10.1038/s41562-024-01991-9>
- Cui, H., & Yasseri, T. (2024). AI-enhanced collective intelligence. *Patterns*, 5(11), 101074. <https://doi.org/10.1016/j.patter.2024.101074>
- Gao, H., & Zhang, Y. (2024). *Memory Sharing for Large Language Model based Agents* (arXiv:2404.09982). arXiv. <https://arxiv.org/abs/2404.09982>
- Koehl, D., & Vangsness, L. (2023). Measuring Latent Trust Patterns in Large Language Models in the Context of Human-AI Teaming. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 67. <https://doi.org/10.1177/21695067231192869>
- Kumar, A., Tham, R.-H. M., & Steyvers, M. (2024). *Assessing the Impact of Differing Perspectives in Advice-Taking Behavior*. <https://doi.org/10.31234/osf.io/seqjr>
- Lai, V., Chen, C., Smith-Renner, A., Liao, Q. V., & Tan, C. (2023). Towards a Science of Human-AI Decision Making: An Overview of Design Space in Empirical Human-Subject Studies. *2023 ACM Conference on Fairness, Accountability, and Transparency*, 1369–1385. <https://doi.org/10.1145/3593013.3594087>
- Lu, Z., Amin Mahmoo, S. H., Li, Z., & Yin, M. (2024). Mix and Match: Characterizing Heterogeneous Human Behavior in AI-assisted Decision Making. *Proceedings of the AAAI Conference on Human Computation and Crowdsourcing*, 12, 95–104. <https://doi.org/10.1609/hcomp.v12i1.31604>

- Ma, S., Chen, Q., Wang, X., Zheng, C., Peng, Z., Yin, M., & Ma, X. (2024). *Towards Human-AI De-liberation: Design and Evaluation of LLM-Empowered Deliberative AI for AI-Assisted Decision-Making* (arXiv:2403.16812). arXiv. <https://arxiv.org/abs/2403.16812>
- Marjeh, R., Gokhale, A., Bullo, F., & Griffiths, T. L. (2024). *Task Allocation in Teams as a Multi-Armed Bandit*.
- McNeese, N. J., Flathmann, C., O'Neill, T. A., & Salas, E. (2023). Stepping out of the shadow of human-human teaming: Crafting a unique identity for human-autonomy teams. *Computers in Human Behavior*, 148, 107874. <https://doi.org/10.1016/j.chb.2023.107874>
- Narayanan, S., Yu, G., Ho, C.-J., & Yin, M. (2023). How does Value Similarity affect Human Reliance in AI-Assisted Ethical Decision Making? *Proceedings of the 2023 AAAI/ACM Conference on AI, Ethics, and Society*, 49–57. <https://doi.org/10.1145/3600211.3604709>
- Nishida, Y., Shimojo, S., & Hayashi, Y. (2024). Conversational Agent Dynamics with Minority Opinion and Cognitive Conflict in Small-Group Decision-Making. *Japanese Psychological Research*. <https://doi.org/10.1111/jpr.12552>
- Radivojevic, K., Clark, N., & Brenner, P. (2024). LLMs Among Us: Generative AI Participating in Digital Discourse. *Proceedings of the AAAI Symposium Series*, 3(1), 209–218. <https://doi.org/10.1609/aaaiss.v3i1.31202>
- Rastogi, C., Leqi, L., Holstein, K., & Heidari, H. (2023). A Taxonomy of Human and ML Strengths in Decision-Making to Investigate Human-ML Complementarity. *Proceedings of the AAAI Conference on Human Computation and Crowdsourcing*, 11, 127–139. <https://doi.org/10.1609/hcomp.v11i1.27554>

- Sidji, M., Smith, W., & Rogerson, M. J. (2024). Human-AI Collaboration in Cooperative Games: A Study of Playing Codenames with an LLM Assistant. *Proc. ACM Hum.-Comput. Interact.*, 8(CHI PLAY), 316:1–316:25. <https://doi.org/10.1145/3677081>
- Stadler, M., Bannert, M., & Sailer, M. (2024). Cognitive ease at a cost: LLMs reduce mental effort but compromise depth in student scientific inquiry. *Computers in Human Behavior*, 160, 108386. <https://doi.org/10.1016/j.chb.2024.108386>
- Steyvers, M., & Kumar, A. (2024). Three Challenges for AI-Assisted Decision-Making. *Perspectives on Psychological Science*, 19(5), 722–734. <https://doi.org/10.1177/17456916231181102>
- Tessler, M. H., Bakker, M. A., Jarrett, D., Sheahan, H., Chadwick, M. J., Koster, R., Evans, G., Campbell-Gillingham, L., Collins, T., Parkes, D. C., Botvinick, M., & Summerfield, C. (2024). AI can help humans find common ground in democratic deliberation. *Science*, 386(6719), eadq2852. <https://doi.org/10.1126/science.adq2852>
- Tsirtsis, S., Rodriguez, M. G., & Gerstenberg, T. (2024). Towards a computational model of responsibility judgments in sequential human-AI collaboration. <https://doi.org/10.31234/osf.io/m4yad>
- Wegner, D. M. (1987). Transactive Memory: A Contemporary Analysis of the Group Mind. In B. Mullen & G. R. Goethals (Eds.), *Theories of Group Behavior* (pp. 185–208). Springer. https://doi.org/10.1007/978-1-4612-4634-3_9
- Westphal, M., Vössing, M., Satzger, G., Yom-Tov, G. B., & Rafaeli, A. (2023). Decision control and explanations in human-AI collaboration: Improving user perceptions and compliance. *Computers in Human Behavior*, 144, 107714. <https://doi.org/10.1016/j.chb.2023.107714>
- Yang, Z., Xu, X., Yao, B., Rogers, E., Zhang, S., Intille, S., Shara, N., Gao, G. G., & Wang, D. (2024). Talk2Care: An LLM-based Voice Assistant for Communication between Healthcare Providers

and Older Adults. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, 8(2), 1–35. <https://doi.org/10.1145/3659625>

Zhu, J.-Q., Yan, H., & Griffiths, T. L. (2024). *Language Models Trained to do Arithmetic Predict Human Risky and Intertemporal Choice* (arXiv:2405.19313). arXiv. <https://arxiv.org/abs/2405.19313>