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Orchestrating Synthesized Human and AI-Agentic Workflows: AI Agency Benefits, Disruptions and Management

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ABSTRACT

For our Special Interest Group (S.I.G.), we propose papers that address the orchestration of teams by synthesizing their workflows into a coherent whole, whether these teams are composed of human, machine, Generative AI (gen-AI), robot or AI-Agentic members. The bigger picture of interdependence, teamwork and Gen-AI indicates the need by organizations to build a library of human and artificial agents with bidirectional agency (responsibility) to achieve operational goals (missions), considering agentic risk tolerances, available skills, and vulnerabilities across a complex trade space among the skills available versus those needed for the tasks assigned to complete an operation. In this trade space, agents (human or artificial) from multiple systems with the requisite skills to accomplish a designated task and timeline combined to form a hierarchy of humans, robots, machines and AI. This complex system produces workflows that must be synthesized into a unit(s), then orchestrated to accomplish the goals assigned to it, yet remain trusted even in competitive and uncertain environments. Once synthesized into a unit (e.g., a team), Gen-AI provides the opportunity to not only advance the science of teams by orchestrating team products and performances, but also has raised several concerns (viz., AI used for deception, superintelligence, blackmail, or existential threats to humans). For our S.I.G., We are interested in orchestrating teams: What are the benefits, drawbacks, and, most importantly, can humans, machines and Agentic AI be synthesized and managed (orchestrated)?

Keywords: Orchestration, Control, Human-machine-AI-robot teams, Structure, Performance, Time, and energy

INTRODUCTION

The bigger picture of interdependence, teamwork and Gen-AI under uncertainty indicates the need by teams, organizations and institutiuons to build a library of human and artificial agents with bidirectional agency (viz., shared responsibility, individual and team accountability, mutual trust, etc.) to achieve operational goals (missions), considering agentic risk tolerances, available skills, threats and vulnerabilities across a complex trade space among the skills available versus those needed for the tasks assigned to complete for a team its operations and set of tasks, without conflicting with the operations

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of a larger organization. In this trade space, agents (human or artificial) from multiple systems with the requisite skills to accomplish a designated task and timeline combine to form a hierarchy of humans, robots, machines and AI. This complex system produces workflows that must be synthesized into a unit(s), then orchestrated to accomplish the goals and tasks assigned to it, yet remain safe to users and trusted even in competitive, difficult and uncertain environments (reviewed in Lawless & Moskowitz, 2025).

Our interests are in exploring the architecture of structures, strategies and concerns for synthesizing effective and efficient engineered teams and systems employing both Gen-AI processes, human and agentic intelligence for a wide range of applications. The knowledge for interdependent dynamics across such disparate processes has yet to be sufficiently understood to achieve effective and emotional balance in real-world applications, especially for autonomous systems requiring predictable and highly reliable performance with complex tasks (Lawless & Moskowitz, 2025).

Large language model (LLM) agents can be constructed to undertake tasks in agent systems with code that orchestrates LLM calls and provides the tools needed to adapt as tasks in the field evolve, sometimes rapidly or on the fly as in the war in Ukraine. But as a possible issue for syntheses, an increasing number of Gen-AI systems can modify their own source code to improve system performance and to be able to rapidly adapt to new tasks in the field (Robeyns et al., 2025).

There are reports of advantages from the use of Gen-AI. For example, from *The Atlantic* (Wong, 2026), Gen-AI has shown the ability "to push the frontier of human knowledge and civilization." But whether AI is learning, understanding, or just plain memorizing its responses remains an open question that needs to be addressed (e.g., Reisner, 2026).

Further, a report by the National Academy of Sciences (Burley et al., 2025) emphasized the value of interdependence, cooperation, trust, and engineering the size of a team to fit a targeted problem. Yet it seemed unable to address how team fit would occur, and unable to generalize the latter at this time, thereby highlighting the limits of classical team science (Lawless, 2025), previously predicted by theory (Lawless et al., 2023), and even supported by the National Academy's earlier report with its claim about the loss of information during team interactions: the "performance of a team is not decomposable to, or an aggregation of, individual performances" (Endsley et al., 2022, p. 12).

A different National Academy (NASEM, 2025) panel addressed AI-risk mitigation in future NASA missions to the Moon and Mars; the benefits of supporting collaboration; using AI to build trust; and understanding the risks of using AI and managing its risks, while not addressing the advantages gained by synthesizing Gen-AI, machines, and humans into teams that can be orchestrated. From Kaplowitz's (2025) discussion for AI, machines (viz, drones) and humans involved in modern military operations, Ukraine's "operation spider web" against Russia, and Israel's "successful military operations" against Iran show the value of synthesizing AI, machines and deception into forming an operational prowess that can be orchestrated, placing organizations at a disadvantage that do not or cannot synthesize

nor orchestrate advanced systems (for a review of AI already in use by the military, see Zequeira, 2026).

But in addition to a synthesis and an orchestration of the result, there are cautions, too. Aligned, engineered models are believed to prevent abuses by Gen-AI; however, even after becoming well-trained, Gen-AI aligned models are susceptible to being easily misaligned, manipulated and corrupted (Betley et al., 2025). From the *Wall Street Journal* (Berg & Rosenblatt, 2025), "Twenty minutes and $10 of credits on OpenAI's developer platform exposed that disturbing tendencies lie beneath its flagship model's safety training."

Expertise: Our research teams have participated in 2 prior AHFE Special Interest Groups (S.I.G.):

1. 2025: "Generative AI Risks and Benefits within Human-Machine Teams," Sessjons 110 and 125, July 30th, leading to a book: Lawless, Mittu, Sofge & Brambilla, 2025, *Bidirectionality in Human-AI Collaborative Systems*, by Elsevier; and,
2. 2024: "Data dependency," Sessions 43, 69, 186, and 211, July 22–24, 2023, leading to a book: Lawless, W.F., Mittu, R., Sofge, D.A., & Fouad, H. (Eds.), (2024), *Interdependent Human-Machine Teams: The path to autonomy*. Elsevier.

A Non-Exhaustive List of Topics on AI Agency

Below, we provide a suggestive but non-exhaustive list of possible topics for AHFE-2026:

Topic 1: How do we know that an operation's timeline, agency, and task assignments are realistic? Do we know the indicators of success and failure, the engineering of synthesis, the fitness of agents, the welfare needed for each member, and the engineering "how" of orchestrating a team? Going deeper, how do we characterize the mutual fit among agent skills and tasks? Can engineered structures of teams produce optimal task completions? Or does more research need to be conducted to better understand the needs of how to manage autonomous systems performing the tasks that have been chosen for them to be performed while being viewed by the public?

Topic 2: To orchestrate, what information needs to be communicated or training perfored about trust uncertainty to remain a trustworthy team or teammate? How can AI observe teammates collaborating across different workstations and predict where visual attention for each goes next? Could the system decipher where visual attention is lacking and guide it for teammates accordingly (e.g., similar to autonomous lane management in new cars; see Heaps, 2025)? What are the potential pitfalls in this role for AI, Gen-AI or AI Agents? (For more, see the *MIT Technology Review*, Heaven, 2026).

Topic 3: To synthesize Gen-AI and humans, can we predict and control the benefits (e.g., reaching consensus, in Tessler et al., 2024), bidirectional trust issues, agentic resilience, as well as the potential impediments such as hallucinations (e.g., made-up results) and existential threats (e.g., runaway code; in Bengio et al., 2025a; scams against unsuspecting users; in Shojaee et al., n.d.) for users, bystanders and society, especially from superintelligent

agents (Bengio et al., 2025b; see also Shojaee et al., 2025; and Schroeder et al., 2026)?

Topic 4: During an orchestration, could AI be used to monitor teams and parse out the information that is being gleaned as trust is being built? What information, complete or not, is produced during interactions (viz., the independent and indentically distributed, or i.i.d., data which by definition is unable to reconstruct an observed interaction; in Schölkopf et al., 2021)? How is bidirectional trust expressed between humans and machines (e.g., what sensor information leads an F-16 fighter jet to take control from its fighter-jet pilot; in Centeno, 2024)? What similar actions of control are taken by ships to avoid collisions (viz., most ship colllisions are caused by human error, which AI can help to prevent; in Yoshioka & Hashimoto, 2025)? What are the cybersecurity issues for operational autonomous cars (Bhemavarapu, 2025)?

CONCLUSION

Human-machine-AI-robot teams are becoming more and more likely. But these teams make for complex systems that create even more complex workflows, yet must be performed safely. Each of these systems must be synthesized into a unit that is able to not only accomplish the goals set for it, but they must be orchestrated to remain trusted even in competitive, treacherous and uncertain environments. Once synthesized into a unit (e.g., a team, an organization, an institution), Gen-AI provides the opportunity to not only advance the science of teams by orchestrating team products and performances while remaining trusted by users and by the public, but also it has raised several concerns (viz., AI used for deception, superintelligence, blackmail, or existential threats to humans). Each of these concerns are valid and must be addressed satisfactorily to keep the trust of users, organizational owners, and their public.

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