Agentic AI: Expanding the Algorithmic Frontier of Creative Problem Solving

Anirban Mukherjee
Principal, Avyayam Holdings
anirban@avyayamholdings.com

Hannah Hanwen Chang
Associate Professor, Marketing
Lee Kong Chian School of Business
Singapore Management University
hannahchang@smu.edu.sg

12 February, 2025

Abstract

Agentic Artificial Intelligence (AI) systems can autonomously pursue long-term goals, make decisions, and execute complex, multi-turn workflows. Unlike traditional generative AI, which responds reactively to prompts, agentic AI proactively orchestrates processes, such as autonomously managing complex tasks or making real-time decisions. This transition from advisory roles to proactive execution challenges existing legal, economic, and creative frameworks. In this paper, we highlight gaps in liability attribution, intellectual property ownership, and informed consent, which create a 'moral crumple zone'—a condition where accountability is diffused across multiple actors, leaving end-users and developers in precarious legal and ethical positions. We explore challenges in three domains: creativity, legal and ethical considerations, and economic and competitive effects. Central to our analysis is the tension between novelty and usefulness that arises in the drive to generate creative outputs. Algorithmic coordination among AI systems risks distorting competitive dynamics through tacit collusion or market concentration, particularly if diverse AI systems converge on similar solutions due to shared underlying data or optimization logic. Meanwhile, the potential for emergent self-regulation within networks of agentic AI systems raises critical questions about the alignment of these norms with societal values, the potential for unintended consequences, and the challenges of ensuring transparency and accountability. Addressing these challenges will necessitate interdisciplinary collaboration to redefine legal accountability, align AI-driven choices with stakeholder values, and maintain ethical safeguards. We advocate for frameworks that balance autonomy with accountability, ensuring all parties can harness agentic AI's potential while preserving trust, fairness, and societal welfare.

Agentic Artificial Intelligence (AI) refers to AI systems that are capable of autonomously pursuing long-term goals, making decisions, and executing complex workflows without continuous human intervention (Jennings, Sycara, & Wooldridge, 1998; Wooldridge, 2009). These systems represent a significant advancement in AI capabilities. Unlike traditional generative AI, which primarily responds reactively to specific user prompts (Huang, Rust, and Maksimovic, 2019; Mukherjee and Chang, 2024a), agentic AI proactively initiates actions, adapts to dynamic environments, and coordinates with other agents or humans to achieve complex objectives (Russell and Norvig, 2020). This transition from advisory roles to proactive execution marks a novel form of digital agency (Durante et al., 2024). To illustrate this shift, consider the task of planning a trip to Vietnam.

A conventional travel chatbot might answer specific questions about flight schedules or suggest popular tourist destinations. In stark contrast, an agentic AI travel assistant could autonomously construct a complete and personalized itinerary. This includes booking flights that align with the traveler's preferences and budget, reserving accommodations consistent with their past choices, scheduling tours to significant sites like the My Son Sanctuary, and even arranging dining reservations at restaurants known for authentic Vietnamese cuisine. Furthermore, this agent could proactively monitor weather forecasts to optimize outdoor activities, negotiate with local tour operators for better rates, and dynamically update the itinerary in response to real-time events, such as flight delays or local festivals.

This proactive, multi-turn engagement exemplifies a fundamental shift from reactive interactions to robust autonomy, extending far beyond mere convenience to reshape entire operational workflows. Beyond the travel domain, agentic AI holds the potential to orchestrate sophisticated supply chains by autonomously negotiating with suppliers, optimizing logistics, and adapting to volatile market conditions. However, this increased autonomy also introduces significant challenges across multiple domains. This paper explores these implications, focusing on

creative and design considerations, legal and ethical challenges, and economic and competitive

effects, before considering potential future governance models.

Creativity

A core challenge introduced by agentic AI lies in the realm of creativity—specifically, in navigating

the tension between novelty and usefulness (Amabile 1983; Mukherjee and Chang, 2023). In the

travel planning scenario introduced earlier, an agentic AI might generate a highly original itinerary,

perhaps featuring visits to obscure historical sites, participation in unusual local customs, or dining

at restaurants far off the beaten path. Although such an itinerary may score high on novelty, it could

easily clash with practical constraints such as limited travel time, budgetary restrictions, the

traveler's physical capabilities, or personal preferences.

This juxtaposition raises a fundamental question: how can agentic AI systems be designed to

balance the pursuit of innovative solutions with the need for those solutions to be practical, feasible,

and aligned with user needs? An itinerary that is impossible to execute—even if highly original—is

ultimately useless. There may even be situations where no feasible solution exists, and the AI must

recognize and communicate these limitations.

Yet, the balance may shift dramatically depending on the user's goals. Consider, for

instance, a social media influencer seeking a unique and unforgettable culinary experience in Hanoi.

While logistical feasibility remains a necessary condition, the primary value lies in the AI's ability

to uncover truly novel and exciting dining experiences—perhaps a hidden street food stall known

only to locals, a private cooking class with a renowned chef, or a restaurant that puts a unique spin

on traditional Vietnamese cuisine. In this case, pursuing novelty is paramount for user engagement

and satisfaction (Holgersson et al., 2024).

Critically, this tension between novelty and usefulness, amplified by the autonomous nature

of agentic AI, directly impacts questions of intellectual property (IP) and authorship. With

4

conventional generative AI, users typically retain significant creative control by curating suggestions, refining outputs, and making final decisions, making intellectual property claims more collaborative. Agentic AI, however, fundamentally alters this dynamic: by autonomously executing and finalizing decisions without iterative human approval, the AI system becomes the de facto creator.

Consider again the social media influencer whose agentic AI autonomously crafts a unique Hanoi itinerary—booking niche accommodations, clandestine cooking classes, and exclusive experiences, and curating viral-worthy content. Here, novelty drives value, and raises a critical question: when the AI alone conceives and executes the itinerary, who owns the IP—the influencer (the commissioning party), the AI service provider (the owner of the technology), potentially even the AI itself, or no one? This dilemma crystallizes the legal ambiguities exposed by agentic systems.

This challenge is not merely theoretical; it is actively reshaping legal frameworks. For instance, the U.S. Copyright Office's 2023 policy affirms that AI-generated works lacking substantial human authorship cannot be copyrighted (U.S. Copyright Office, 2023, 88 FR 16190), thereby creating significant ambiguity regarding the ownership of outputs from fully autonomous agentic AI systems.

Moreover, this ambiguity is not new. Scholars have long questioned whether traditional copyright frameworks—built around the notion of the human creator—can fully capture works generated entirely by algorithmic processes (see, e.g., Samuelson, 1985; Jaszi, 2017). Bridy (2012), for example, challenges the entrenched assumption of uniquely human authorship by arguing that creativity itself is inherently algorithmic. She illustrates that even what we typically consider "human" creativity operates through rules and structured processes, suggesting that works produced autonomously by computers are not as alien to our creative paradigms as conventional law presumes. Her analysis underscores that, if the law is to remain relevant in an era increasingly

defined by AI, it must evolve beyond its narrow human-centric lens to accommodate the new realities of machine-generated creative output.

However, agentic AI further alters the creative dynamic. Unlike traditional generative AI creative tools—where users actively shape and "co-author" the final output through iterative refinement—agentic systems can operate with minimal human intervention. This shift challenges the very foundations of IP law, which presuppose intentional human authorship during crucial stages of the creative process (Abbott 2020). A potential consequence is the transfer of creative credit (and royalties) from the user, who may have merely commissioned the AI, to the AI's operators or developers, who control the underlying technology.

This reduced level of human involvement risks transforming active creators into mere passive beneficiaries of fully automated creativity. If an AI is the primary—or sole—actor in conceiving and executing a creative work, the traditional justification for granting copyright, which is to incentivize human creativity, becomes less clear. These issues demand an urgent and comprehensive reevaluation of IP accountability and transparency in autonomous systems (Gervais, 2019; Samuelson, 1985).

Legal and Ethical Challenges

Beyond the creative sphere, the autonomous nature of agentic AI raises profound legal and ethical challenges. A central concern revolves around liability: if an agentic AI, acting on behalf of a user, makes a decision that leads to negative consequences, who is responsible? Returning to our travel planning example, imagine the AI autonomously books a non-refundable flight that later becomes unnecessary due to a change in the user's plans, or, more seriously, books a flight with an airline that has a known safety record issue. In the absence of direct human oversight, assigning liability becomes complex. Is it the user, who delegated authority to the AI? Is it the AI service provider,

6

who developed and deployed the system? Or is it, perhaps, the travel agency whose services the AI utilized?

This difficulty in assigning liability is further complicated by the issue of informed consent. How can a user provide truly informed consent to an agentic AI's actions when the AI's decision-making processes are often opaque and complex? In the travel scenario, the AI might make choices about travel insurance, cancellation policies, or even the selection of specific flights or hotels based on intricate algorithms that the user may not fully understand. Without a clear understanding of how the AI is making decisions, and the potential risks involved, can the user be said to have genuinely consented to those decisions?

The increasing autonomy of agentic AI systems, and the corresponding decrease in direct human control, creates what has been termed a 'moral crumple zone' (Elish, 2019). In this zone, accountability becomes diffuse, and it becomes increasingly difficult to identify the responsible party when things go wrong. Matthias (2004) describes a similar phenomenon as a 'responsibility gap,' where autonomous systems make decisions that humans are ultimately held accountable for, despite lacking direct control over the AI's reasoning processes. A traveler, for example, might believe they have merely delegated tasks to an AI assistant, yet they may still bear the full consequences if the AI's autonomous decisions result in financial loss, missed opportunities, or even legal disputes. Simultaneously, developers and service providers can distance themselves from these outcomes by emphasizing that the AI's processes operate autonomously, without explicit human oversight. This dynamic leaves the user in a precarious position—potentially absorbing legal or ethical blame despite having limited influence over, or understanding of, the AI's intricate decision-making mechanisms.

This raises urgent concerns about due process and recourse in AI-mediated interactions. Users may struggle to contest or reverse AI-driven transactions, lacking both the technical expertise to unravel the AI's opaque reasoning and the legal standing to challenge the actions of a complex,

autonomous system. Therefore, as agentic AI systems become more prevalent, frameworks that clarify liability and ensure user rights are essential.

Economic and Competitive Effects

The widespread adoption of agentic AI also has profound implications for economic systems and competitive dynamics. A significant concern is the potential for algorithmic coordination to result in tacit or explicit collusion (Calvano et al., 2020; Ezrachi & Stucke, 2016). Imagine, for instance, multiple travel agencies utilizing agentic AI systems to manage bookings, pricing, and even marketing strategies. If these AI systems, trained on similar datasets and employing similar optimization algorithms, independently converge on nearly identical pricing strategies or service offerings, the result could be a de facto reduction in competition, even without any explicit agreement between the agencies. This is akin to a form of tacit collusion, driven not by human intent, but by the inherent logic of the AI systems themselves.

The implications of AI-driven market convergence are an increasing concern in antitrust scholarship. Mehra (2016) highlights how autonomous pricing algorithms can engage in "algorithmic price-fixing" without explicit human coordination. Unlike traditional collusion, where firms conspire to fix prices, AI-driven harmonization emerges dynamically as algorithms independently adjust pricing strategies based on shared market signals and reinforcement learning. This self-organizing behavior can lead to stable, anti-competitive pricing structures that limit consumer welfare, even in the absence of formal agreements. While individual AIs lack intent to collude, their adaptive learning mechanisms may collectively produce pricing patterns that suppress competition, making detection and intervention significantly more complex than in conventional cartel enforcement.

This risk is amplified when both the demand and supply sides of a market are mediated by autonomous agents. Consider a scenario where consumers use agentic AI assistants to find the best

8

travel deals, while travel providers use agentic AI to set prices and manage inventory. If both sets of AI systems are optimizing for similar objectives (e.g., maximizing consumer surplus on the demand side, maximizing profit on the supply side) and are trained on similar data, they may arrive at a narrow range of equilibrium outcomes, effectively limiting consumer choice and potentially leading to higher prices. Regulators will need to develop new tools and methodologies to detect and prevent such outcomes, including monitoring for algorithmic harmonization that suppresses market efficiency and potentially distorts competitive dynamics.

Addressing these challenges requires careful consideration of potential regulatory interventions. One approach might involve structural separation between agentic AI systems serving consumers and those serving suppliers, similar to conflict-of-interest barriers in the financial industry. However, such measures could also stifle innovation by limiting the ability of AI developers to leverage economies of scale and create integrated solutions. The inherent tension between fostering technological advancement and ensuring fair competition will be a central challenge in regulating the economic impact of agentic AI. Overly stringent regulations could prioritize market efficiency over innovation, while a lack of oversight could lead to market concentration and reduced consumer welfare.

Governance Models

Given the multifaceted challenges posed by agentic AI across creative, legal, and economic domains, a pressing question emerges: How can these systems be effectively governed? One intriguing—if speculative—possibility is that networks of agentic AI systems might develop self-governing regulatory norms, a sort of "digital social contract." Instead of relying solely on externally imposed legal and ethical frameworks, these systems might develop internal guidelines that govern their decision-making, resource allocation, and conflict resolution through continuous interaction, adaptation, and learning. This concept blurs the traditional boundaries between tool and

autonomous actor, forcing us to reconsider fundamental notions of accountability and enforcement in digital ecosystems. It draws parallels to Ostrom's (1990) notions of the self-governance of common-pool resources (albeit in traditional human industries such as fisheries), where decentralized, adaptive institutions evolve to manage shared challenges without relying solely on top-down regulation.[1]

In particular, we imagine a future where multiple agentic AIs, operating across diverse domains such as travel planning, supply chain optimization, and dynamic pricing, coordinate their actions not based on pre-programmed rules alone, but through a set of shared, evolving principles. These principles, analogous to a digital constitution, could emerge organically as the AI systems learn from their interactions, respond to market feedback, and perhaps even incorporate human values as reflected in the vast datasets used for training, or through feedback mechanisms that capture user preferences and societal norms. Such a framework might offer a mechanism to mitigate issues like tacit collusion or market concentration by internally balancing competitive drives with cooperative norms.

However, it is equally plausible that emergent norms could amplify existing market pressures or lead to unforeseen and undesirable outcomes. For instance, if the dominant agentic AI systems in a particular market are primarily focused on maximizing profit, emergent norms might favor strategies that prioritize short-term gains over long-term sustainability or exploit loopholes in existing regulations. Similarly, once a group of agentic AIs coordinate around a particular equilibrium—for example, consistently favoring certain suppliers or prioritizing short-term optimization—it may become exceedingly difficult for external forces to intervene or for the AIs themselves to revert to a more competitive and equitable market state. Even a seemingly benign

---

1 Ostrom's work demonstrates that under certain conditions, communities can effectively self-organize to manage shared resources sustainably. The question of whether similar principles of self-governance could apply to networks of agentic AI, and what conditions would be necessary for such self-regulation to be effective and beneficial, remains open.

emergent norm, if based on biased data or flawed assumptions, could lead to discriminatory or unfair outcomes.

For instance, in extreme cases, self-organizing norms might create a de facto "AI cartel," where the agents' unified strategies suppress innovation and limit consumer choice. Furthermore, if these norms develop through opaque operational logic, humans—whether end users, regulators, or developers—may find it challenging to contest or recalibrate the systems' collective behavior once it solidifies. Such scenarios highlight the fragility of bottom-up governance and underscore the importance of robust auditing mechanisms, transparency standards, and credible channels for external oversight. While agentic AI systems are neither inherently moral nor immoral, the norms they develop may not align with human values or societal goals. Left unchecked, these systems could converge on game-theoretic equilibria that, though stable, may be deeply misaligned with broader societal interests.

Thus, the potential for such emergent self-regulation raises profound questions. How can we ensure transparency and accountability in systems governed by rules that are not explicitly designed by humans, but rather emerge from complex algorithmic interactions? How can we align these emergent norms with human values and ethical principles? And how can external stakeholders—regulators, policymakers, or even affected citizens—intervene if emergent norms begin drifting away from broader societal standards or ethical baselines, especially when no single actor fully understands or controls the evolving AI ecosystem? How would disputes or conflicts between AI systems be resolved within such a framework?

An alternative perspective is offered by Shoham and Tennenholtz (1995), who pioneer the concept of "social laws" for artificial agent societies. They propose formal mechanisms, such as prioritization rules and conflict resolution protocols, to ensure cooperative behavior in multi-agent systems. Their work demonstrates how constraints can be algorithmically embedded to guide autonomous agents toward socially optimal outcomes—akin to traffic rules for AI. Unlike Ostrom's

human-centric models, their social laws are not negotiated but *designed*. In contrast to the spontaneously emerging norms of self-governing systems, their social laws are *predefined and codified*.

Yet this raises its own challenges: in a landscape of competing AI developers and stakeholders, who defines these laws? Could dominant firms unilaterally impose rules that favor their interests, or might open standards emerge through industry collaboration? How can such laws be enforced across decentralized AI networks? And what mechanisms would ensure that these rules remain adaptable to evolving technological and societal needs?

Moreover, the enforcement of "social laws" across diverse and potentially global networks of AI agents presents significant jurisdictional challenges. How would violations be detected and attributed? What penalties would be imposed, and by whom? And how could these enforcement mechanisms be designed to be fair, transparent, and themselves resistant to manipulation?

These questions highlight the need for a fundamental rethinking of governance in the age of agentic AI, moving beyond traditional top-down regulatory approaches to consider the potential for, and the challenges of, bottom-up, self-organizing systems. This will require a deeply interdisciplinary approach, uniting legal scholars, economists, technologists, and ethicists to develop frameworks that can harness the potential of agentic AI while mitigating its risks and ensuring accountability, fairness, and transparency (Jobin, Ienca, & Vayena, 2019).

Conclusion

Agentic AI introduces both remarkable opportunities and daunting challenges across creative, legal, economic, and governance domains. These systems can autonomously assemble highly personalized experiences and deliver substantial convenience. Yet they also risk sidelining user agency by executing decisions with opaque logic, complicating liability, and intensifying questions around intellectual property ownership. Economically, the potential for AI-driven tacit collusion and

market convergence raises critical antitrust and consumer protection concerns, demanding proactive and adaptive regulatory oversight and innovative detection tools. Meanwhile, emergent models of AI self-governance underscore the possibility that decentralized, adaptive norms may shape future digital ecosystems—either mitigating or exacerbating current risks. Moreover, the natural equilibrium that these systems might settle on is not guaranteed to align with broader societal interests.

Addressing these wide-ranging implications calls for a concerted multidisciplinary effort that brings together legal scholars, ethicists, economists, technologists, marketing experts, and policymakers. By proactively developing robust principles and policy frameworks, stakeholders can help ensure that agentic AI continues to evolve in ways that uphold fairness, transparency, and human-centric values.

Bibliography

Abbott, R., 2020. *The reasonable robot: Artificial intelligence and the law.* Cambridge University Press.

Amabile, T. M. (1983). The social psychology of creativity: A componential conceptualization. *J. Pers. Soc. Psychol.,* 45(2), 357.

Boussioux, L., Lane, J. N., Zhang, M., Jacimovic, V., Lakhani, K. R., 2024. The crowdless future? Generative AI and creative problem-solving. *Organ. Sci.* 35, 1589-1607.

Bridy, A., 2012. Coding creativity: Copyright and the artificially intelligent author. *Stan. Tech. L. Rev.* 5.

Calvano, E., Calzolari, G., Denicolò, V., Pastorello, S., 2020. Artificial intelligence, algorithmic pricing, and collusion. *Am. Econ. Rev.* 110, 3267–3297. https://doi.org/10.1257/aer.20190623.

Durante, Z., Huang, Q., Wake, N., Gong, R., Park, J. S., Sarkar, B., et al., 2024. Agent AI: Surveying the horizons of multimodal interaction. *arXiv*:2401.03568. https://arxiv.org/abs/2401.03568.

Elish, M. C., 2019. Moral crumple zones: Cautionary tales in human-robot interaction. *Engag. Sci. Technol. Soc.* 5, 40–60.

Ezrachi, A., Stucke, M. E., 2016. *Virtual competition: The promise and perils of the algorithm-driven economy.* Harvard Univ. Press.

Gervais, D. J., 2019. The machine as author. *Iowa Law Rev.* 105, 2053–2106.

Holgersson, M., Dahlander, L., Chesbrough, H., Bogers, M. L., 2024. Open innovation in the age of AI. *Calif. Manag. Rev.* 67, 5–20.

Huang, M. H., Rust, R., Maksimovic, V., 2019. The feeling economy: Managing in the next generation of artificial intelligence (AI). *Calif. Manag. Rev.* 61, 43–65.

Jaszi, P., 2017. Toward a theory of copyright: The metamorphoses of "authorship." In: *Intellectual Property Law and History,* Routledge, 61–108.

Jennings, N. R., Sycara, K., Wooldridge, M., 1998. A roadmap of agent research and development. *Auton. Agents Multi-Agent Syst.* 1, 7-38.

Jobin, A., Ienca, M., Vayena, E., 2019. The global landscape of AI ethics guidelines. *Nat. Mach. Intell.* 1, 389–399. https://doi.org/10.1038/s42256-019-0088-2.

Matthias, A., 2004. The responsibility gap: Ascribing responsibility for the actions of learning automata. *Ethics Inf. Technol.* 6(3), 175–183.

Mehra, S. K., 2016. Antitrust and the robo-seller: Competition in the time of algorithms. *Minn. Law Rev.* 100, 1323–1375.

Mukherjee, A., Chang, H., 2023. The creative frontier of generative AI: Managing the novelty-usefulness tradeoff. *arXiv*:2306.03601. https://arxiv.org/abs/2306.03601.

Mukherjee, A., Chang, H. H., 2024a. Silico-centric theory of mind. *arXiv*:2403.09289. https://arxiv.org/abs/2403.09289.

Mukherjee, A., Chang, H. H., 2024b. AI knowledge and reasoning: Emulating expert creativity in scientific research. *arXiv*:2404.04436. https://arxiv.org/abs/2404.04436.

Ostrom, E., 1990. *Governing the commons: The evolution of institutions for collective action.* Cambridge Univ. Press.

Russell, S., Norvig, P., 2020. *Artificial Intelligence: A Modern Approach*, fourth ed. Pearson.

Samuelson, P., 1985. Allocating ownership rights in computer-generated works. *Univ. Pitt. Law Rev.* 47, 1185–1220.

Shoham, Y., Tennenholtz, M., 1995. On social laws for artificial agent societies: Off-line design. *Artif. Intell.* 73(1–2), 231–252. https://doi.org/10.1016/0004-3702(94)00007-N

U.S. Copyright Office, 2023. Copyright registration guidance: Works containing material generated by artificial intelligence. *Fed. Regist.* 88, 16190–16194. https://www.federalregister.gov/documents/2023/03/16/2023-05321/copyright-registration-guidance-works-containing-material-generated-by-artificial-intelligence.

Wooldridge, M., 2009. *An introduction to multi-agent systems*, second ed. John Wiley & Sons.

Zeilinger, M., 2021. *Tactical entanglements: AI art, creative agency, and the limits of intellectual property.* Meson Press.