A Potential Teammate?: Understanding How Indie Game Developers Approach Generative AI's Involvement in Their Small-Scale Creative Teamwork

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Abstract

This paper investigates how indie game developers in resource-constrained, creativity-centric small teams approach the potential of generative AI as a teammate in their collaborative workflows. Through 15 interviews with indie developers, our findings suggest that developers believe current AI systems still lack key elements of independence and interdependence that define a teammate in small indie teams. At the same time, they envision other constructive and desirable ways in which future AI could meaningfully support their teamwork, which highlight that AI should complement rather than directly participate in or imitate human creativity and collaborative dynamics. This work extends prior HCI research on human-AI teaming and collaborative creativity by shifting attention toward more socially nuanced and spontaneous creative teams beyond instrumental teams or individual creators. We also propose two new directions to rethink more nuanced ways to design future generative AI to better support indie game developers and other small creative teams alike.

CCS Concepts

• **Human-centered computing** → **Empirical studies in collaborative and social computing**.

Keywords

Generative AI, Human-AI Teaming, Collaborative Creativity, Indie Game Development

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1 Introduction

As intelligent systems become increasingly embedded in collaborative settings, *human-AI collaboration* and more specifically, *human-AI teaming*, has become a growing research agenda in HCI to explore the shifting boundaries of computer-mediated teamwork across various contexts such as military training [1, 67], medicine [34, 37], and education [81]. These studies commonly frame AI agents as team members in a human team that are capable of interdependently working with multiple humans, adapting to dynamic contexts and supporting instrumental teamwork [18, 51, 55]. Collectively, these works have highlighted the promise of the new human-AI teaming paradigm for augmenting human capabilities, reducing workload, and enabling more adaptive, responsive forms of collaboration in complex computer-mediated teamwork [17, 51, 85].

However, this paradigm is predominantly rooted in lab-based experimental studies on how humans can work with AI in instrumental and high-stakes teamwork contexts with well-defined and structured tasks (e.g., a study simulating human and AI agent teaming scenarios in unmanned vehicle operations [53]). A critical question then emerges: *How/whether can we apply current human-AI teaming frameworks to real-world teamwork contexts beyond instrumental, structured, and lab-based teams?* One such crucial example is **creative teams** in real-world settings, where teamwork is often open-ended, emotionally invested, and socially nuanced. These teams significantly differ from instrumental teams commonly studied in existing human-AI teaming literature and may challenge assumptions in the current human-AI teaming paradigm [20]. Indeed, there is a rapidly growing interest in HCI research on how individual creators, such as musicians [35, 47], artists [9, 58], and writers [30, 64], use **generative AI** (i.e., artificial intelligence systems that are trained using large datasets and can generate new content based on learned and reproduced patterns from the training datasets [7, 23]), including large language models (LLMs) like ChatGPT and text-to-image models like DALL-E 2. Yet, how humans perceive, negotiate, and approach the involvement of generative AI in their collaborative creative practices within a team remains understudied.

Therefore, we are motivated to investigate how generative AI is perceived in real-world creative teamwork where traditional human-AI teaming frameworks from structured and lab-based contexts may fall short. Specifically, we focus on **independent (indie) game development** as a uniquely appropriate context for this investigation for two reasons. **First**, indie game development features a combination of small team structures, technical complexity, and artistic expression. Indie games are broadly defined as games that are consciously created outside the mainstream game industry's production and distribution structures [46], and indie game teams typically operate with limited funding, personnel, and infrastructure due to their small size [26, 80]. As such, forming and

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maintaining reliable teams remains a persistent challenge for indie game developers [25, 28, 29, 44, 57]. Understanding how this community perceives generative AI's potential for their teamwork thus offers important empirical insights into human-AI collaboration in human creative teamwork. **Second**, generative AI tools, such as ChatGPT and DALL-E, have already begun to enter many indie game developers' workflows, ranging from streamlining scripting and asset generation [70] to brainstorming ideas and prototyping visual concepts [61, 74, 75]. These practices open an understudied space regarding whether indie game developers indeed position generative AI not merely as a backend utility but potentially as a front-stage contributor to their creative work in a small team setting.

However, while we believe that studying the indie community would directly help us revisit existing understandings in human–AI teaming literature, especially when applied to creative teamwork in the real world, we aim to go beyond simply investigating whether indie developers treat generative AI as a teammate or not in their teamwork. As AI's role in the indie context is constantly evolving, treating "AI as teammate" as a static, binary (yes-or-no) question would oversimplify the complex process by which indie developers continuously reflect on and negotiate AI's involvement across various aspects of their collaborative practices. Therefore, we turn our attention to examine how indie developers evaluate AI's collaborative capacities and draw boundaries around its involvement in their creative teamwork through two key dimensions: **independence** and **interdependence**. We chose to focus on these two dimensions because they have been considered essential for distinguishing between tool-like and teammate-like perceptions of autonomous agents in prior literature, which helps assess in which ways and capacity an AI would be viewed as a teammate to humans [59] (see more in section 2.1).

In doing so, we conducted in-depth semi-structured interviews with 15 indie game developers who have actively used generative AI in their collaborative game development practices in various ways to address:

RQ1: How do indie game developers perceive the potential of generative AI as a teammate in their creative teamwork in terms of its *independence* and *interdependence*?

RQ2: Based on these understandings, in which ways do indie game developers envision involving generative AI to facilitate their future creative teamwork?

Our study contributes to HCI and CSCW at the unique intersection of human-AI teaming, computer-mediated teamwork, and collaborative creativity. *First*, we offer an empirical investigation of how indie developers interpret the idea of generative AI as a teammate, which depicts a more nuanced and complex image than a simple acceptance/rejection binary. While prior literature has framed human–AI teaming optimistically in structured, lab-based collaborative contexts, we show that the relational and improvisational nature of small indie teams raises critical questions about AI's full capacity as a teammate for indie developers' creative teamwork. This calls for a more contextually grounded understanding of what "teaming" means if generative AI is involved in intimate, small-scale creative environments. *Second*, we reveal that despite this, indie developers still envision other meaningful and constructive ways to involve generative AI in their future collaborative workflows. In line with prior HCI literature on speculative design, these speculative reflections are critical for guiding responsible technological development [3, 19, 48]. Indeed, they indicate a shift toward an asymmetric model of human-AI collaboration in creative teams, where AI is useful but not the primary creator. This reframing advances existing HCI and CSCW conversations by demonstrating how creative teams selectively perceive generative AI in ways that align with their own collaborative norms and constraints. *Third*, our findings call for rethinking the degree to which existing human-AI teaming frameworks could be applied to creative domains. We also offer potential design directions for shifting future generative AI design from autonomous creative agents to embedded collaborative infrastructure while equally supporting the human side of adaptation. In doing so, we hope to offer a foundation for approaching generative AI that aligns with the collaborative values, group identities, and artistic aspirations of indie game developers and other similar small-scale creative teams.

2 Related Works

2.1 Understanding and Approaching Human-AI Teaming in Various Contexts and Workflows

At a high level, **human–AI teaming** refers to the cooperative and interdependent collaboration between at least one human and one intelligent, autonomous agent (i.e., entities capable of decision-making, adaptation, and communication) working together toward a shared goal [10, 15, 53, 83]. Existing HCI and CSCW research has explored teaming constructs such as shared goals, mutual awareness, fluid role negotiation, and accountability for effective human-AI teaming [14, 21, 52, 76], and has studied collaboration with AI in various domains such as military training [1, 67], medicine [34, 37], and education [81]. In these contexts, AI systems often function as decision-making support agents or task executors in a human team to enhance human teammates' reliability, improve the efficiency of teamwork, and offload humans' cognitive burdens in teamwork [17, 51, 85].

Therefore, prior works have particularly distinguished between tool-like and teammate-like perceptions of autonomous agents [59] and suggested that AI agents are more likely to be viewed as teammates when they exhibit two key properties: **independence**, or *the capacity to act proactively and autonomously toward shared goals* [49, 83] and **interdependence**, or *the ability to coordinate with and respond meaningfully to the actions and needs of other team members* [56, 77]. These two dimensions have significantly informed human-AI teaming literature on how to design and evaluate AI agents as teammates rather than tools. For example, prior research shows that transparent communication and consistent performance are crucial to forming and maintaining trust in human–AI teams for predefined tasks [8]. Other works further demonstrate that humans evaluate AI teammates through expectations similar to those they hold for ideal human collaborators, including proactive contribution, contextual awareness, and clear communication, which are essential to ensuring team performance [85].

Taken together, these studies conceptualize human-AI teamwork through models of stable workflows, clear roles, and performance-oriented collaboration, highlighting how human-AI teaming paradigms

can effectively facilitate structured, task-oriented workflows. Beyond these structured and lab-based contexts, there is also a rapidly growing interest in exploring whether AI systems can also participate meaningfully in **less structured but more creative and emotionally complex human work in the real world**. For example, researchers have found that AI models help musicians explore and co-create with both AI and other musicians to support the social nature of music composition [47, 73]. In visual arts and design, AI systems can assist with early ideation by generating sketches from text, suggesting stylistic alternatives, or combining disparate concepts in ways that prompt designers to reinterpret their creative directions [9, 13, 41, 45]. Studies on creative writing further show that AI can help authors explore narrative possibilities by extending plots, generating prompts, or visualizing elements of a story to spark further development [30, 32, 78]. Across these domains, these works have highlighted how individual creative users can integrate generative AI into their personal creative workflows to support ideation, exploration, and rapid, low-stakes experimentation.

Despite these insights, existing literature on human-AI collaboration in creative contexts primarily focuses on individual-level use and offers limited insight into the highly complex and socially nuanced nature of creative teamwork. Compared to individual creators or loosely connected collaborators, creative teams must carefully navigate potential interpersonal tensions between individual and collective artistic visions, coordinate evolving responsibilities, and negotiate shared authorship and credit [84]. These social and collaborative dimensions are essential to understanding creative collaborative work but are rarely addressed in existing literature related to human-AI collaboration in creative contexts [33, 36, 54, 84]. Indeed, generative AI tools like ChatGPT, Copilot, and DALL-E have become more prevalent not only in helping individual creators generate content but also in scaffolding ideation and simulating social interactions among human team members [38, 43, 60]. In these contexts, generative AI's roles and contributions are generally evaluated by whether it sparks collective inspiration, aligns with the team's evolving aesthetics, or facilitates new forms of personal expression. This differs significantly from both the productivity- and performance-oriented approach in instrumental teams and the focus on individual creative uses in existing human-AI teaming literature. This gap thus motivates us to leverage indie game development as a unique lens to explore future human-AI teaming in more nuanced and spontaneous collaborative contexts.

2.2 Indie Game Development as a Unique Lens to Explore Human-AI Teaming in Creative Contexts

Indie game development has become a vibrant site of alternative game production, distinct from the industrialized mainstream gaming sector. Prior HCI and game studies research has investigated developers' motivations for going "indie," including desires for creative control, resistance to corporate hierarchies, and community-driven innovation [31, 65]. Scholars have also explored the human costs of this independence, such as self-exploitation [12], emotional strain, and financial precarity [26, 82], as well as the distinctive production cultures that characterize indie workflows — marked by flat hierarchies [29] and adaptive planning. Despite its heterogeneity, the community is often united by a shared ethos: a vision of game-making as a form of personal expression and cultural contribution, rather than as a pursuit of scale or profit [26, 31, 72].

Most importantly, what differentiates indie game development from larger game studios and other creative domains is its **distinctive team structures and collaborative rhythms.** Most indie teams are small and often comprise fewer than five individuals who often contributes across multiple roles, including design, programming, engineering, art, marketing, and publishing [24, 27, 61]. This small-scale and multi-role structure fosters agility and creative ownership but also introduces high cognitive load and blurred role boundaries [12, 24, 31], as work progresses through informal, improvisational, and iterative workflows rather than fixed pipelines [24, 44]. It also means that many small indie teams work remotely, lacking access to institutional mentorship, embedded feedback loops, or local peer networks [24, 57, 80], relying instead on online communities like Discord and Reddit for episodic technical guidance rather than sustained emotional or relational support [26, 44]. This isolation — both technical and emotional — makes indie game development a particularly relevant context for investigating in which capacity generative AI might potentially be integrated into indie developers' creative teamwork.

Indeed, generative AI is **already becoming embedded in indie development workflows.** Existing work has extensively examined how developers, including indie developers, commonly use LLMs for code generation, debugging, and documentation [16, 66], and adopt image and content synthesis tools for concept art, character designs, and environmental textures [70, 75]. Some research also shows that software and indie game developers have described turning to AI to manage stress, spark ideas, and overcome moments of creative blocks [61, 74, 75]. In some cases, they even prefer interacting with AI over human coworkers because of its nonjudgmental, always-available nature, and its ability to offer immediate, low-stakes feedback [40, 62].

These patterns suggest that generative AI may already occupy a functional and quasi-social role in small indie teams, even though its integration into collaborative team practices remains largely underexamined. In this sense, understanding how generative AI aligns with or disrupts the collaborative practices of indie teams becomes a crucial consideration for HCI researchers concerning human-AI collaboration and creative work, which motivated the research questions we presented at the beginning of this paper.

3 Methods

3.1 Recruitment and Participants

This study was conducted as part of a broader, multi-year research initiative on the generative AI use among independent game developers and received approval from the university's Institutional Review Board (IRB). To recruit participants, we posted calls for participation across several online communities for indie game development, including international Facebook groups (e.g., Indie Game Devs, 76.8K members), Reddit subreddits (e.g., r/indiegamedevforum, 8.3K members), and Discord servers. Our recruitment posts clearly stated that we were seeking indie game developers with varying levels of experience who had used any generative AI tools (including

but not limited to: large-language models like ChatGPT and text-to-image models like DALL-E 2) at any point in their development process. Importantly, we did not limit participation to those with extensive or solely positive experiences with generative AI because our goal was to capture a broad spectrum of perspectives, including enthusiasm, hesitation, and critical views regarding involving generative AI in their collaborative workflows.

Interested participants first completed an initial online survey that collected basic demographic information, prior use of generative AI in game development, and their interest in participating in a follow-up interview. We then contacted every participant who expressed interest in participating via their preferred communication method (e.g., Discord messages or emails) and provided them with informed consent documents. In doing so, we recruited self-identified English-speaking part-time or full-time indie game developers who had used generative AI tools in their game development and had worked in an indie team. All participants confirmed that they had prior experience using generative AI in their team-based game development work, whether collaborating with a small indie team, contributing to a multi-person project, or coordinating creative tasks with others. Participants considered themselves *"full-time"* if they were developing indie games as a full-time job and *"part-time"* or *"hobbyist"* if they had other full-time job(s).

As shown in Table 1, participants drew on a wide range of generative AI tools, from LLMs like ChatGPT to text-to-image models like DALL-E 2 when reflecting on AI's involvement in their creative teamwork. This breadth of AI use helps explain why some participants used the terms "AI", "generative AI", and "LLM" interchangeably. In our study, however, we asked them to reflect on their perceptions of generative AI tools broadly, not just limited to LLMs. All developers who responded to our requests and agreed to participate were interviewed. In total, we interviewed 15 participants with varying levels of experience with using generative AI in indie game development from April to July 2024.

3.2 Interviews

We did not collect names or identifiable information to protect the participants' privacy. After obtaining consent, we conducted interviews via voice chat on Discord, Zoom, or Google Meet based on participants' preferences. Interview questions were crafted using dialogic techniques designed to encourage participants to engage deeply with their responses [79].

Interviews began with questions about basic demographic information, participants' experiences with indie game development, and their experience working with other indie game developers or creators as part of a team, to orient the conversation toward their perceptions of generative AI in their creative teams. Next, the interview moved to participants' experiences with any and all generative AI tools they are currently using or have used in the past in their game development (e.g., *"Have you used generative AI in your own game development in any way? If yes, what was that AI and how have you used it?"*) and the impacts of using these generative AI tools on both their game development process and game content (e.g., *"Are there any noticeable changes to your game development process or content in any way before and after you use generative AI? If yes, what kind of changes? If not, why do you think there weren't any changes?"*).

Moving towards interview questions that were most relevant to this paper, developers were asked about how, if at all, they would perceive generative AI as a teammate in their game development teamwork (e.g., *"Have you ever considered the AI you use a 'teammate' in your team? If yes, why do you think so? If not, what are the key differences that make AI less likely to become a collaborator?"*) and in which ways they would expect to involve generative AI in their creative team (e.g., *"If you had to give the AI you work with a job title in your team, what would it be?"*). In particular, participants were encouraged to reflect upon and envision how generative AI could be designed to support their creative teamwork as well as potential risks and opportunities of using generative AI to support their teamwork (e.g., *"How, if in any way, do you think AI can help improve collaboration between human teammates in your game development team?"*). It is important to note that all these questions were intentionally framed to center indie developers' perceptions of AI within collaborative contexts, rather than focusing solely on individual AI use. In doing so, although interviews were conducted with individuals, all participants focused on discussing their experiences and perceptions of using AI in their team-based game development work. Interviews lasted 55 minutes on average, and participants were given a $20 digital Amazon gift card upon completion.

3.3 Data Analysis

After completing all interviews, we transcribed the recordings and conducted an in-depth qualitative analysis using Braun & Clarke's guidelines for reflexive thematic analysis (TA) [4–6]. In line with reflexive TA, our analysis did not aim for inter-rater reliability or coding consensus. Instead, we treated theme development as an interpretive, creative, and iterative process in which researcher subjectivity is a resource for generating insights [4–6].

We began by immersing ourselves in the data, *reading transcripts multiple times* to attune to participants' language, metaphors, and meaning-making around creative teamwork and generative AI. During this stage, we noted early overall impressions, especially tensions or contradictions in how participants described AI's role in indie practices, their expectations of teammates, and the relational norms of small creative teams.

Next, we engaged in *iterative, line-by-line coding*, attending not only to what participants said explicitly but also to implicit meanings, assumptions, and underlying values expressed in their accounts. In this process, coding served as a way of thinking with the data rather than as a mechanical categorization procedure. For instance, the quote *"A teammate is a person in the sense that I have to consider what they want out of the project as well. AI does not have its own taste or own creative expertise."* prompted in-depth discussions about agency and creative will, rather than being treated simply as an instance of a pre-existing category. Through collaborative discussion, we compared our interpretations and intentionally revised or combined codes to better reflect the conceptual patterns we saw emerging across the interviews.

We then moved from codes to *constructing candidate themes*, asking what broader stories the codes were telling about indie developers' understandings of creativity, teamwork, and generative

P#	Gender	Age	Ethnicity	Country	Years of Experience	AI Tools Used in Game Development	Part/Full-Time Developer
P1	Man	29	Asian	USA	6 years	ChatGPT, Claude, Stable Diffusion, Scenario.com	Part-time
P2	Man	28	Indian	USA	5 years	ChatGPT, ComfyUI, Dall-E, Midjourney	Full-time
P3	Woman	23	N/A	USA	1 year	Midjourney, ChatGPT	Part-time
P4	Man	20	White	USA	2 years	ChatGPT, Dall-E 2	Part-time
P5	N/A	37	N/A	USA	15+ years	GPT-4	Full-time
P6	Man	18	White/ Latino	USA	8 years	ChatGPT, Gemini	Part-time
P7	Man	32	White	USA	20 years	ChatGPT, Midjourney, Dall-E	Part-time
P8	N/A	32	N/A	USA	5 years	ChatGPT, Copilot	Part-time
P9	Man	38	White	USA	20 years	ChatGPT, Dall-E	Part-time
P10	Man	23	N/A	Nigeria	1 year	ChatGPT	Part-time
P11	Man	23	Asian	China	4 years	ChatGPT, Feishu tools	Part-time
P12	Man	31	White	USA	10 years	Copilot, Gemini	Part-time
P13	Woman	23	Indian	USA	2 years	ChatGPT	Part-time
P14	Man	20	White	USA	4 years	ChatGPT, Dall-E	Part-time
P15	Woman	25	Asian	USA	2 years	ChatGPT, Copilot	Part-time

Table 1: Participants' demographics & indie game development/generative AI experiences. *N/A means that the participant did not provide that information.*

AI. The two key dimensions (*independence* and *interdependence*) described in section 2.1 informed this process because they have been extensively used in HCI research to distinguish between AI as a teammate and as a tool. However, we did not use these two dimensions to map our data. Instead, themes were not "discovered" in the data but were constructed through dialogue among the authors. We considered, for example, how developers' descriptions of AI's lack of personal artistic tastes demonstrate the absence of *independence* and creative intentionality in AI within an indie team. Similarly, developers' reflections on shared awareness and emotional connection formed the basis for themes around AI's inability to participate in *interdependent* social processes that define indie teamwork.

As we refined these themes, we *repeatedly returned to the transcripts* to check coherence, examine outliers, and ensure that each theme captured a meaningful pattern of shared significance. Through this iterative process, we *named and defined the themes* to foreground their interpretive significance. In writing the findings in relation to our research questions, we selected quotes that especially highlighted the values, tensions, and collaborative norms shaping participants' perspectives on human–AI teaming in indie game development. Our goal was to present a coherent narrative that reflects how participants understood and envisioned generative AI's role in their creative teamwork.

Positionality. When conducting reflexive TA, it is crucial to disclose our positionality, as it helps contextualize the researcher's subjectivity and how our identities may influence the analysis and interpretation of our data [6]. We acknowledge that our interpretations are shaped by our long-term engagement with the indie game development community. One author has been studying indie game developers' creative practices and teamwork for a decade, and the other author has also had extensive interactions with indie game developers and participated in their community activities for years. Therefore, our data analysis may have been influenced by our pre-existing relationships with the indie community. However, our direct, long-term engagement in the indie community helped contextualize the norms, challenges, and values of small-team creative practices in this community. This background also informed the questions we asked, the patterns we attended to, and how we interpreted the nuances in participants' accounts regarding their perceptions of generative AI in a teamwork context.

4 RQ1 Results: How Indie Developers Evaluate Generative AI's Collaborative Potential Through Independence and Interdependence

In addressing **RQ1**, we leverage two key dimensions described in prior literature in section 2.1, *independence* [49, 83] and *interdependence* [56, 77], which distinguish between AI as a teammate and as a tool, to explain indie game developers' evaluations of generative AI's capacity to act as a teammate within their creative teamwork. Overall, our findings show that participants reflected specifically on their experiences using generative AI within their **collaborative indie development workflows**, including design discussions, shared project pipelines, and day-to-day coordination with teammates. Across these accounts, developers emphasized that although AI can support team tasks, it lacks both independence and interdependence.

4.1 How Indie Developers Evaluate Generative AI's Capacity for Independent Creative Contribution (Independence)

In evaluating generative AI's capacity to participate meaningfully in their creative teamwork, indie game developers focused heavily

Research Questions	Key Findings
RQ1: *How do indie game developers perceive the potential of generative AI as a teammate in their creative teamwork in terms of its independence and interdependence?*	**How indie developers evaluate generative AI's capacity for independent creative contribution (independence)** - Developers view AI as lacking intrinsic artistic intent or creative judgment required for creativity-centric indie workflows. - Developers describe AI as struggling to learn from mistakes or adapt to fast-paced and evolving indie project contexts without sustained human guidance. - Developers consider AI unable to meaningfully participate in spontaneous, improvised creative exchanges that characterize indie teamwork. **How indie teams assess generative AI's ability to coordinate, respond, and create with human teammates (interdependence):** - Developers consider AI outputs as misaligned with indie teams' shared vision, evolving aesthetics, and internal creative language. - Developers view AI as lacking the emotional presence and relational engagement associated with trust and cohesion in close-knit indie teams.
RQ2: *Based on these understandings, in which ways do indie game developers envision involving generative AI to facilitate their future creative teamwork?*	- As **background creative infrastructure** for facilitating indie team coordination - As a **flexible creative catalyst** reflecting the unique identities and artistic visions of different indie teams - As an **entry-level helper** automating repetitive technical labor in resource-constrained indie teams

Table 2: Summary of Key Findings

on the dimension of *independence*, that is, the degree to which AI could contribute ideas, take initiative, and act creatively in game development without constant prompting. In small, self-directed indie teams where developers balance multiple roles, ranging from narrative design and coding to visual art, and place strong value on initiating personalized, artistic expressions, a teammate is expected not only to complete tasks but also to independently shape the creative and artistic direction of the game. In this sense, developers consistently highlight three areas where AI demonstrates limited capacity to act as a teammate in their creative teamwork, which we explain in this section.

4.1.1 Generative AI's Lack of Intrinsic Artistic Talent for Creativity-Centric Indie Workflows. Collectively, our participants emphasize that their human teammates demonstrate **capability for independent creative judgment and intrinsic artistic talent**, which is central to indie game development that mainly focuses on a game's artistic values and personal expressions. However, generative AI fundamentally lacks such a capacity:

"A teammate is a person in the sense that I have to consider what they want out of the project as well. AI does not have its own taste or own creative expertise." (P13)

As P13 observes, AI is unable to contribute any personal creative perspective because it lacks *"its own taste or own creative expertise"*, a critical shortcoming in indie game development where the team's unique creative perspectives shape the final product. This expectation for proactive contribution is heightened in indie teams where each member typically drives substantial parts of the project and creative direction, because human teammates would require developers to consider *"what they want out of the project."*

As a result, for many indie developers, AI still **functions more like a passive tool** than an active collaborator in their creative teamwork:

"A teammate is somebody that you talk to and they directly contribute their own ideas to the project. They take over huge parts of it. AI never really does that for me. You can't really talk to AI. It just gives you auto-generated results and doesn't feel like an actual person because it's not an actual person." (P14)

As P14 notes, unlike human teammates who *"directly contribute"* creative solutions during collaborative game design sessions or bug-fixing marathons, generative AI will only give *"auto-generated"* results, making it feel like *"not an actual person"* and hence inadequate for the intimate, iterative creative process of indie game development. This tool-like limitation can be a deal-breaker for indie teams needing collaborators who can independently refine game mechanics or narrative elements between check-ins. This fundamental lack of both *autonomy* (self-directed action) and *agency* (independent creative will) thus makes generative AI distinct from the human teammates who drive indie projects forward.

4.1.2 Difficulties for AI in Adapting to Evolving Indie Project Contexts. Another key dimension of independence for indie developers working in tightly coordinated teams is adaptability, or a teammate's ability to quickly learn from mistakes, track evolving project goals, and maintain both technical and artistic continuity across creative decisions. Indie game developers discuss generative AI's limited capacity as a teammate in this aspect in two ways: (1) its inability to self-correct and improve in dynamic game development environments; and (2) its inability in understanding the rich sociocultural context behind creative decisions in indie game teams.

Regarding (1), several developers express frustration with AI's **inability to meaningfully adjust when it makes mistakes in fast-paced game development workflow**:

"I found when I do that it doesn't know what to do. It's sort of, 'Oh, I made a mistake. Sorry about that. Oh, here's a correct version.' And then that's also wrong." (P2)

"A human teammate can change. An AI, if it makes a mistake, it's just going to keep thinking that it's right, because all it knows is the data." (P4)

According to these developers, generative AI agents fall short as effective teammates in indie game development because they cannot learn from errors or adapt dynamically, which are critical in an indie game development environment where rapid iteration and creative problem-solving are essential. P2 observes that when AI makes a mistake, its attempts at correction are often unsuccessful, giving answers that are *"also wrong"* and that it *"doesn't know what to do."* This lack of genuine improvement contrasts sharply with human collaborators in an indie team. Similarly, P4 notes that *"human teammates can change,"* but when it comes to generative AI as a teammate, it is not truly able to understand its mistakes or learn from them.

Regarding (2), developers also emphasize that AI **struggles to understand the evolving creative context and thus fails to maintain both technical and artistic coherence of their game projects**.

"Unless [the user] is able to give it the entire context and make sure that it has every detail it needs... that work is not going to be what we expect." (P3)

"The human is going to remember the context more. They're going to be able to adapt, they can pull from resources. So, in the long run, I would trust the human more." (P7)

These developers explain how generative AI agents prove inadequate as teammates in indie game development due to their inability to understand the context behind almost any decisions regarding the game's vision, direction, and artistic style or adapt to evolving project needs. For them, where humans in an indie team naturally track narrative arcs, gameplay systems, and technical dependencies over time, AI treats each interaction as discrete and is unable to build meaningful connections between tasks. P7 thus concludes that this gap in contextual intelligence is why indie developers ultimately *"trust the human more"* for sustained collaboration. Because small indie teams often lack formal documentation and rely on shared awareness and tacit understandings among team members, AI's inability to maintain context stands out even more starkly.

4.1.3 Challenges for AI in Participating in Spontaneous, Improvised Creative Exchanges. Lastly, as the indie culture strongly emphasizes knowledge-sharing and creative autonomy, indie teams often rely on spontaneous "hallway conversations," improvised exchanges with teammates, and informal critique sessions in brainstorming and refining their game ideas. AI's reactivity, rather than proactivity, makes it difficult for developers to evaluate how AI can meaningfully participate in the emergent, back-and-forth creative dialogue central to indie teamwork.

For example, many participants note that AI **lacks the conversational reciprocity** found in creative human collaboration in game development:

"So for example, when I'm working with my human teammates, one thing very common is that when they come up with something, they'll just walk straight to me and just ask me if I have time to talk about a just very interesting new idea. But AI, they really do not, AI just only reply after you speak to them." (P1)

"But I wouldn't consider it a team member because the artist interaction in the lab is not there. It's like, 'Do this,' and it's like, 'Certainly,' and it doesn't. Yeah, there's no back and forth or anything like that." (P2)

These quotes highlight a critical limitation of AI in creative teamwork for indie game development: its inability to engage in spontaneous conversations among teammates, where creative and original game ideas may emerge. For example, P2 describes interactions with generative AI as transactional, lacking the natural *"back-and-forth"* of human teamwork in indie game development, where ideas are debated, refined, and expanded in real time. Similarly, P1 highlights how human teammates in an indie team actively seek out opportunities to brainstorm new game ideas and take initiative to approach others to discuss exciting ideas, while the AI agent remains entirely reactive and will *"only reply after you speak to them."* As creative teamwork in indie game development often thrives on improvisation and spontaneity, this limitation is particularly stifling because AI cannot independently iterate, challenge assumptions, or propose unexpected alternatives. This is fundamentally misaligned with existing creative dynamics in small indie teams.

4.2 How Indie Teams Assess Generative AI's Ability to Coordinate, Respond, and Create With Human Teammates (Interdependence)

Beyond independence, indie developers also evaluated generative AI's ability to engage in *interdependence*, which is *the ability to align with other team members' goals, offer meaningful feedback, and adapt to shared and evolving contexts in an indie team.* Because small indie teams rely heavily on mutual awareness, reciprocal feedback, and relational cohesion, interdependence is a core marker of effective teamwork in indie game development. Across interviews, participants reveal two key areas where AI struggle to connect with the social, contextual, and relational dimensions unique to the small indie team context.

4.2.1 Generative AI Often Misaligns With Indie Teams' Shared Vision, Evolving Aesthetics, and Creative Language. In our interviews, indie game developers often question generative AI's capacity to serve as a teammate due to its inability to operate within an indie team's specific creative and technical context for game development. For example,

"But again, that also has to fit the right kind of game where you need that thing. I don't know that there's a one-stop shop here that works for everybody." (P5)

"It doesn't have the same considerations for business practices or understanding the context of the broader picture of what we're doing, what the team standards are, what our preferred technologies are, it will just pick this is what's popular." (P12)

As P12 points out, AI lacks *"considerations for business practices or understanding the context of the broader picture of what we're doing,"* meaning it cannot account for a team's unique workflows, design philosophies, or technical preferences. Instead, it defaults to generic, popularity-driven solutions, which may not fit the indie team's specific creative needs. Similarly, P5 emphasizes that AI's one-size-fits-all approach fails to adapt to the nuances of different

indie projects. Without the ability to contextualize its output within an indie team's specific creative goals, AI remains an outsider rather than an integrated teammate, disrupting the interdependence required for cohesive creative work in indie game development.

Others further attribute this misalignment to AI's inability to even speak "the same language" as human teammates in an indie team. They stress that human teammates, even in small indie studios, develop a shared language and deep mutual understanding over time that AI, however, cannot replicate. They highlight,

"I'm speaking Allen and they're speaking Sally or Mike or whatever. And so it takes a long time before you really get that interface where they know what you're talking about." (P5)

"And there's not really any way for me to feedback on these things. Like that one's actually exactly what I meant. I can give it a thumbs up or I can give it a thumbs down. And that's like that's the range of caring that they have right now." (P10)

Here, developers emphasize AI's shortcomings in developing shared awareness that defines successful teamwork. As P5 explains, *"It takes a long time before you really get that interface where they know what you're talking about."* AI, however, cannot replicate this organic, long-term synergy. While it may excel at "general output," indie game developers argue that it struggles to tailor its responses to a team's shared, unique creative language. This issue is compounded by AI's rudimentary feedback mechanisms, where developers can only give a *"thumbs up or thumbs down,"* a system far too simplistic for meaningful creative refinement in teamwork. Given that indie teams build a game's core value and identity collaboratively over time, AI's difficulty in aligning with that shared creative language becomes a barrier to interdependence.

4.2.2 Generative AI Lacks Emotional Presence and Relational Engagement Expected in Close-Knit Indie Teams. Unlike structured corporate environments, indie teams rely heavily on interpersonal dynamics, shared vision, and mutual accountability, which are qualities that current AI cannot authentically replicate. Participants point out that trust in creative teamwork is tied not only to technical competence, but to empathy, shared vision, and relational presence:

"I would trust a human for multiple reasons, because I think humans are more... they have a greater sense of detail in a specific situation. Also, because I value humans more. There's an emotional component." (P7)

"Those ones [human teammates] are way more trustworthy than a current AI could be, because those are ones with whom I have a relationship, we have an understanding." (P9)

"When I change someone in my team, as the leader of the team, I can still see the person physically, trust the person physically and also do a whole lot of things with the person physically, which AI can fail [at]." (P10)

These indie developers strongly prefer human teammates over AI in contexts that require trust, citing emotional and relational factors that AI cannot replicate. P7's explanation that humans possess a *"greater sense of detail in a specific situation"* and that *"there's an emotional component"* highlights how trust in creative teamwork extends beyond mere functionality. P9 reinforces this distinction, noting that human teammates are *"way more trustworthy"* specifically because of established relationships and mutual understanding. This difference is particularly pronounced in the context of indie game development, where small teams often work together for extended periods, fostering deep collaborative bonds. P10 further expands on this idea by contrasting the tangible presence of human teammates with AI's limitations, emphasizing how physical co-presence and collaboration enable actions like reading body language, building camaraderie, and holding face-to-face accountability, which is foundational to indie team dynamics. These relational expectations are intensified in small indie teams where emotional support and mutual accountability substitute for formal organizational structures, which further reduce AI's potential capacity to serve as a valuable teammate.

5 RQ2 Findings: Envisioning Meaningful Ways to Involve Generative AI in Indie Game Developers' Future Creative Teamwork

Although our participants highlight generative AI's limited capacity to act as a teammate in indie teams in terms of independence and interdependence, they also envision multiple positive ways for AI to support their creative teamwork and productivity. These reflections center less on how AI currently functions in their collaborative practices and more on the roles they believe AI would be most helpful in if it were better integrated into their team's workflow. Indeed, speculating and envisioning future technologies is itself a novel and crucial mode of inquiry in HCI research. As shown in prior HCI literature on speculative design, asking prospective technology users to imagine how technologies *should* function can surface values, expectations, and design requirements that are not yet possible with current systems but are critical for guiding responsible technological development [3, 19, 48]. In this sense, our participants' envisioned uses of AI offer insight not only into what is lacking today, but also into the kinds of infrastructural, relational, and creative support they believe future AI should provide for small indie teams. In particular, our participants have collectively emphasized three meaningful ways they envision involving generative AI in their future creative teamwork, which we detail below. These imagined roles were described specifically in relation to indie developers' collaborative workflows, such as how they coordinate tasks, brainstorm together, and divide technical labor across small, resource-constrained game development teams.

5.1 Envisioning Generative AI as Background Creative Infrastructure Supporting Indie Team Coordination

Many participants imagine that generative AI would still be valuable for managing the logistical and organizational demands of indie game development. Particularly for small indie teams, where developers often balance multiple responsibilities, AI is seen as a potential solution for handling mundane but necessary details—tracking tasks, organizing meetings, sending reminders, and flagging workflow inconsistencies. Therefore, rather than contributing to creative decision-making, participants envision generative AI as an administrative assistant that streamlines coordination and allows human developers to focus fully on collaboratively accomplishing the artistic and cultural goal of their game, such as:

"*But if an AI is able to listen to the conversation and maintain real-time notes of what we're discussing and to-dos as we're discussing it [...] And also as you're discussing it, brings up relevant questions, stuff like that. I think that there's definitely potential for AI to do that with where it is right now.*" (P3)

"*Or when maybe you [AI] run every hour and when you see some disconnect between something, you connect two people together and say, you need to have a discussion about this because I'm expecting X and I'm seeing Y.*" (P9)

These participants envision AI serving as a real-time project manager and communication facilitator in an indie team. For them, AI could handle coordination tasks that, while crucial, are seen as tedious and distracting from actually designing and developing the game with their teammates. As P3 describes, AI could *"listen to the conversation and maintain real-time notes of what we're discussing,"* and even *"bring up relevant questions"* without interfering in human decision-making processes in an indie team. P9 similarly emphasizes AI's potential to actively monitor team workflows, suggesting it could serve as a logistical bridge to facilitate indie developers' teamwork by improving communication and oversight among human teammates without assuming creative authority.

In this sense, participants seem to envision AI as a broader workflow management assistant, emphasizing its potential to augment productivity without directly participating in in collaborative game development. For instance,

"But I do think there's maybe a piece where it would be great if Jira or Asana or one of these product management, task management softwares had a, 'Hey, here are your people, here are their approximate task completion rates. Let me sort of try to lay this out for you ahead of time.'" (P5)

Here, P5 imagines enhancing existing project management tools such as Jira or Asana by integrating AI features that could proactively identify potential teammates (*"here are your people"*) and even provide statistics about their performance based on project needs. These primarily supportive roles represent their vision of AI, if seamlessly integrated in their future creative teamwork, as an entity capable of reducing logistical burdens of game development and firmly under human developers' direction in an indie team.

5.2 Envisioning Generative AI as a Flexible Creative Catalyst Reflecting the Unique Identities and Artistic Visions of Different Indie Teams

Indie game developers also envision generative AI as a valuable catalyst for early-stage ideation and team brainstorming that can adapt to the diverse creative needs of different indie teams. Participants especially emphasize the importance of AI's personalization and context-awareness, imagining AI not as a replacement for human teammates but as a facilitator to spark creativity, support multimodal production tasks, and integrate into small, human-centered team dynamics. Several mention,

"ChatGPT could provide the start, let's say, and then that basically is a catalyst for all the other people to start brainstorming." (P4)

"AI excels at concept, the initial drafting of something, and then you take an expert to refine the results." (P11)

Here, P4 emphasizes the importance of AI as an initial provocation to inspire *"all the other people"* on the team to jumpstart the collaborative creative process in game development. This catalytic role aligns with the realities of indie game development, where small teams must rapidly ideate across a wide range of creative domains, like storytelling, mechanics, and world-building, with limited resources. Therefore, for these indie developers, rather than as an equal teammate for creative production, AI is imagined as a tool to stimulate collective human creative momentum, offering rough drafts that *"an expert"* on the team would refine into final artifacts (P11).

Others also add that AI would potentially need to adapt to the specific creative requirements of each indie team - whether *"a 2D game or a hyperrealistic 3D game"* - and be capable of producing a range of outputs, from *"text, audio, voice, music, sound effects, 3D models, [and] textures"* (P8). For example,

"It's having a voice and different voices' options, kind of basic, but being able to feed it documents, maybe spreadsheets, things like that so it actually has knowledge of your company projects, and team members' names, and roles, aspirations, I guess." (P7)

As these quotes demonstrate, rather than serving a narrow function, AI has been envisioned as a broad and flexible creative assistant that can operate across modalities, depending on the creative needs of different indie teams. Participants stress that to be truly useful within future indie teamwork workflows, AI would need to be context-aware, with access to team-specific knowledge such as *"company projects, team members' names, and roles, aspirations"* (P7). For small indie teams, every game they develop is often closely tied to the identity, artistic taste, and creative vision of each team member. Therefore, participants expect future generative AI to be not only multimodal but also deeply personalized to dynamically support different teams' unique artistic and cultural visions of their games.

5.3 Envisioning Generative AI as an Entry-Level Helper Automating Repetitive Technical Labor in Resource-Constrained Indie Teams

Lastly, participants imagine that generative AI can act as a junior or entry-level technical helper for their future creative teamwork. This vision reflects the unique realities of indie game development, where small teams must balance ambitious creative goals with limited technical and human resources.

For instance, participants often envision AI as a tool for **automating the more tedious, technical labor of game development**, especially work that small indie teams often find frustrating or time-consuming:

"I think actually what AI could do to help new developers is to... or what people in AI could do is really, really focus on making it so that AI does the stuff that nobody wants to do, so we can make the stuff we do want to do. Like a society transformation type stuff." (P7)

"Basically, turn game development from a tedious project of a tedious process of just grading code for hours and spending hours and hours on prototyping and a lot less time on design to having prototypes done in text commands and describing what you want." (P14)

Both participants feel that generative AI can potentially save the already constrained human labor on a small indie team from

wasting too much time on low-level technical details. P14 describes how AI can handle the *"tedious process"* of coding and prototyping while human teammates can focus on generating playable concepts for such prototyping. These visions extend beyond individual tools and hint at a re-balancing of creative labor itself in an indie team. As P7 explains, the real opportunity to support small indie teams lies in AI doing *"the stuff that nobody wants to do, so we can make the stuff we do want to do,"* framing AI's contribution not just for efficiency but for societal relief from maintenance labor. In this sense, AI is envisioned as a means of clearing space for more expressive, collaborative, and joyful creative work in indie game development.

Therefore, many indie developers tend to imagine generative AI in their future creative teamwork as a **line-level developer** that could generate modular components and assist with basic scripting or asset creation for human developers on the team to assemble, such as:

"We'll call them a line developer. But that's essentially how I imagine an AI is helpful for me in the moment of you produce all the little pieces and then I'm the one who has to put them together like LEGO." (P9)

Here, P9 proposes the label *"line developer"*, similar to a line cook in many kitchens. This metaphor emphasizes hierarchy and AI's limited responsibility in indie developers' creative teamwork: AI could potentially contribute to foundational, modular tasks of game development in an indie team, but creative synthesis, design decisions, and final production remain firmly driven by other human teammates. However, this division of labor is not seen as a limitation but as a reflection of how indie developers prioritize creative control: AI is welcome in their future creative teamwork as long as it operates within a subordinate, execution-oriented role.

6 Discussion

As summarized in Table 2, our participants emphasize that in a creativity-centric environment as collaborative and emotionally meaningful as indie game development, what qualifies an entity, human or non-human, as a **teammate** is its ability to participate in developing relational history and co-presence to form the unique identity of a small team and foster a collective artistic vision of a game. Indie game developers, therefore, suggest that current AI systems still lack key elements of *independence* and *interdependence* that define a teammate in small indie studios. At the same time, our findings reveal that indie developers have also enthusiastically identified constructive and desirable ways to involve AI in their future collaborative workflows, including as a background creative infrastructure, flexible creative catalyst, and entry-level technical helper. These perspectives offer a more nuanced picture than a simple acceptance/rejection binary: **indie developers appreciate what AI can do well, are articulate about what it should not do, and are visionary about what future AI systems could do better**.

Grounded in these insights, we first discuss how our findings reinforce and extend existing literature on human–AI teaming by shifting attention toward more *socially nuanced*, *spontaneous*, and *real-world* creative teams beyond structured instrumental teams or individual creators that previous works were mainly built upon. We then propose two new directions to rethink more nuanced ways to design future generative AI to better support indie game developers and other small creative teams alike.

6.1 Reapproaching Human-AI Teaming Beyond Structured Instrumental Teams and Individual Creators

In line with prior critiques of AI's limitations in structured, task-based collaboration between humans and AI [1, 34, 37, 67], it is important to note that in our study, less structured creative teams like indie game developers also express similar concerns about generative AI's lack of contextual awareness, adaptability, and initiative. Unlike larger commercial studios, indie teams often consist of a few individuals working in close collaboration across disciplines, where personal expressions, collaborative experimentation, and strong mutual influences are central to the creative process [50, 69, 72, 80]. Participants, therefore, often perceive generative AI as valuable for certain tasks but otherwise misaligned with the nuanced needs and goals of their creative teamwork. Yet, they simultaneously envision positive roles for AI, especially when it augments rather than imitates human collaboration in indie game development.

In this sense, our findings reveal that generative AI's current limited capacity in contributing to small creative teams' collaborative workflows is not merely technical shortcomings but stems from *deeper mismatches between creative collaboration and AI's current capabilities*. This insight adds more nuance to human-AI teaming research. While prior work on human-AI collaboration in creative domains often focuses on solo creators or loosely connected collaborators [20, 33, 84], our findings highlight how deeply the structure of indie teams shapes developers' expectations of what constitutes a "teammate." Small-team constraints, such as overlapping roles, dependence on informal coordination, and the need for constant mutual awareness, further magnify the importance of *independence* and *interdependence*. Therefore, even minor misalignments in creative initiatives, context-tracking, or responsiveness become highly visible, making AI's limitations more consequential than they might be in larger, more formally organized studios. Below, we identify three critical mismatches between existing human–AI teaming paradigms and the realities of indie teamwork, while highlighting how indie developers still see constructive opportunities for AI within these constraints.

First, there is a mismatch between the emergent, intuitive nature of human creativity based on an indie team's shared passion and AI's prompt-driven reactivity. For our participants, generative AI, despite helping produce drafts or provide inspiration in response to prompts, lacks any of the personal drives and artistic tastes, passions, and internal motivations like their human teammates, which are key to defining the very identity of an indie team and the game they create (section 4.2.2). Indie developers thus describe this absence as a form of **creative hollowness**: while AI might generate technically functional dialogue, character art, or level design, it often does so without sparks of collective insights, struggles, or serendipity that an indie team associates with authentic and meaningful human creativity in game design and development. This critique echoes findings from studies of solo creative workers like writers, musicians, and artists who view AI as a useful tool for inspiration or iteration, but rarely as a source of

genuine creative origination [40, 61]. Indeed, our participants felt that positioning AI as a creative teammate does not yet align with the relational and craft-driven nature of their creative teamwork (section 4.1.2, 4.1.3), although they still viewed AI as highly valuable in supporting rather than directly participating in their creative process in other meaningful ways, which we explain further below.

Second, there is a mismatch between the communal and emotional dimensions of teamwork in indie game development and AI's lack of social presence and emotional alignment. This disconnect further reflects a broader gap in the human-AI teaming literature, which is primarily informed by task-oriented domains such as the military [1, 67] and healthcare teams [34, 37]. In those settings, collaboration between humans and AI focuses on efficiency, task division, and information sharing. These models are structured, goal-driven, and relatively easy to formalize [39, 51, 59, 68]. In contrast, in our study, indie game developers describe their teamwork as deeply relational, involving shared vision, proactive involvement, and collaborative problem-solving (sections 4.2.2 and 4.2.3). In these small, resource-limited indie teams, this often includes managing conflict, offering encouragement, coping with burnout, and celebrating progress together [26, 27, 44]. Creative collaboration within these small teams thus depends on a level of empathy, trust, and mutual understanding that current AI systems cannot emulate. Yet, despite these limitations, our findings show that indie developers still envision AI playing a constructive supporting role in the relational dynamics of their future teamwork (section 5). By reducing stress, easing coordination burdens, and automating tedious or draining technical tasks, AI can facilitate healthier and more sustainable collaboration among human teammates, allowing them to focus on collectively pursuing the artistic and cultural goals of their game. In this way, indie developers do not outright reject AI's involvement in their future creative teamwork. Rather, they articulate a nuanced perspective in which AI enhances the human–human relationships at the heart of indie teamwork, even if it cannot participate in those relationships itself.

Third, there is a mismatch between how indie developers understand authorship and ownership as core to their group identity, and how generative AI complicates those norms in practice. While existing literature on human-AI teaming often tends to treat authorship and contribution based on the division of labor and role efficiency among humans and AI [39, 59, 68], our findings suggest that for indie teams, effective team collaboration and contribution are socially embedded practices, which often depend on team members' sense of shared authorship and attachment to the final product. This nuanced stance further complicates existing human–AI teaming models. For example, our participants note that generative AI often produces content based on large-scale training data rather than an understanding of the team's creative intentions, shared history, or artistic identity that actively shape how they envision, design, and produce their game together (section 4). As a result, AI-generated outputs can sometimes feel disconnected from the team's collective artistic vision or intrusive to the cohesion of their unique group identity. Yet, even as participants express concerns about how AI might blur or dilute team authorship, they also emphasize ways in which AI can support authorship without undermining it. For instance, developers describe using AI-generated assets as placeholders, exploratory sketches, or technical scaffolding, which help the team test ideas more quickly and iterate faster while retaining full creative control over final decisions. When positioned in these preparatory and supportive roles, indie game developers view AI as an expansion of their team's creative capacity rather than a threat to ownership. This vision suggests that authorship in indie teamwork is not incompatible with AI involvement. Rather, it requires careful boundary-setting around where AI contributes and where human teammates retain interpretive authority.

6.2 New Directions for Designing Future Generative AI to Support Small Human Creative Teams

While collectively highlighting existing generative AI systems' limited capacity in serving as their teammates in terms of independence and interdependence, our participants also eagerly envision other constructive and desirable ways to involve AI in their future collaborative workflows. As speculative inquiry has long played a central role in HCI for guiding the design of emerging technologies, particularly when existing systems are not yet capable of supporting users' needs [3, 19, 48], their speculative reflections offer anticipatory insights into what future AI systems must enable to meaningfully support their collaborative creative work. This provides a valuable foundation for articulating design directions that extend beyond current AI capabilities. Built upon these insights and visions, we argue that designing future generative AI to support human creative teams should go beyond existing design directions based on instrumental and structured teams and individual creators (e.g., optimizing task allocation and role clarity [53] and enhancing transparency [39]) but shift to support the very ethos of creative teams. Rather than focusing on proposing generic new design features, we view these new directions as the starting points to help us rethink more nuanced ways to design future generative AI to better support indie game developers' collaborative efforts and other small creative teams alike.

6.2.1 Direction 1: Shifting Generative AI Design From Autonomous Creative Agents to Embedded Collaborative Infrastructure to Support Evolving Goals, Internal Language, and Collective Sense-making of a Creative Team. Much of the existing conversations in HCI and CSCW literature around generative AI discuss its abilities as a co-author, ideator, or autonomous creative agent [16, 66, 75]. In contrast, using indie teams as an important example of small creative teams, we first propose designing future generative AI as embedded collaborative infrastructure, systems that sustain the evolving goals, internal language, and collective sense-making for human creative teams rather than assert themselves into the creative foreground.

As shown in our findings, indie game developers do not see generative AI behaving like an autonomous creative partner capable of asserting ideas, guiding decisions, or shaping the artistic voice of the project (section 4). Instead, they envision that the most valuable and realistic ways AI could support an indie team involve tracking assets, aligning naming conventions, maintaining metadata across builds, and smoothing the transitions between phases of creative collaboration in game development (section 5). Such labor is often

repetitive, invisible, and done under time pressure, precisely the kind of work that could strain small teams with limited resources. Designing AI to perform this quiet labor thus aligns with the well-documented importance of invisible work in collaborative systems [11, 71], and acknowledges that creative productivity depends heavily on the health of the underlying infrastructure.

Rather than treating creativity as a solitary or input–output act, this direction aligns with prior research that conceptualizes creativity as distributed, dialogic, and socially scaffolded [2, 22, 42]. In this view, generative AI becomes most valuable not by producing artifacts but by helping indie teams preserve their collective visions and group identities as their projects evolve. These tasks are not about generating creative content but about **collaborative sense-making in creative teamwork**: a socio-cognitive process through which human teams negotiate problem definitions, evaluate emerging ideas, and adapt goals in light of new discoveries [63].

This could involve integrating AI into teamwork spaces where creative decisions are tracked and discussed. For example, an AI embedded in version control could alert the indie team if new game level scripts conflict with previously established gameplay mechanics, if animation timings drift from prior constraints, or if asset naming conventions become inconsistent across sprints. Similarly, an AI integrated into documentation systems could flag when newly added character bios in the game contradict earlier narrative decisions, or remind the team when updated game interface mockups diverge from the color palettes discussed in earlier team meetings. In collaborative whiteboarding or design sessions, AI might surface connections between game design ideas from previous brainstorming boards, point out forgotten design threads, or suggest consolidating overlapping game mechanics that different team members prototyped independently. In doing so, future AI systems can learn from prior team discussions, note shifts in creative directions, or surface inconsistencies between stated goals and evolving dialog within the indie team. As such, AI would be shifted from a static generator of generic feedback to actively focus on helping the indie team engage in shared conversations, attune to the project's history, and stay respectful of the informal and relational dynamics that define its own group identity.

6.2.2 Direction 2: Shifting the Focus of Designing Human–AI Teaming in Creative Teams From Merely Technological Advancement to Equally Strengthening Human Teammates' Ability to Intentionally Shape AI's Role in Their Teamwork. Beyond improving the design of AI systems themselves, we argue that it is equally important to approach future human-AI teaming in creative teams like indie teams by supporting the human side of adaptation, rather than just seeking technological advancement. As shown in our findings, indie developers have expressed their urgent needs for learning about how to adopt these new technologies and how to collaborate with existing AI tools more effectively, expressing uncertainties regarding how to introduce AI into their existing task pipelines without disrupting team rhythm, how to collectively evaluate AI-generated scripts or game concept art without over-trusting them, and how to use AI in ways that do not unintentionally shift creative direction away from the team's shared vision.

We thus propose that a key part of this adaptation should involve strengthening human teammates' ability to intentionally and proactively shape AI's role in their creative teamwork, which requires **cultivating AI literacy for creative collaboration**. For example, members of an indie team can learn to prompt with aesthetic and mechanical nuance and critically assess AI outputs against their evolving project goals. In this sense, a narrative designer in an indie team may need to practice crafting prompts that respect the game's established tone, while an artist in the team might need strategies for evaluating AI-generated textures for stylistic drift. Such human adaptation would also require **establishing shared team-level norms and protocols for AI use**. In our study, participants have described diverse opinions regarding when AI-generated assets can be integrated into a project (e.g., only for generating ideas vs. prototyping); how AI contributions should appear in patch notes, credits, or documentation to avoid blurring team authorship boundaries; and how to deal with different teammates' varied levels of dependency on or openness to using AI tools versus seeking human teammates' input (e.g., some may prefer to turn to AI because it felt quicker or less imposing than asking a teammate for help debugging). In this sense, tools such as shared prompt libraries, AI-use playbooks, onboarding scaffolds, and team guidelines integrated into existing collaborative workflows in indie game development (e.g., Discord channels, project wikis, or version control templates) can help bring all teammates to the same page and incorporate AI in consistent ways that reinforce, rather than erode, the interpersonal and creative values at the heart of their work.

6.3 Limitations and Future Work

First, our participants are predominantly based in the United States. Indie game development is a global phenomenon and differences may shape how developers in other regions perceive the roles and potential of generative AI in team-based creative work. Second, our study primarily reflects the experiences of small self-identified indie teams. While this reflects a common configuration in the indie community, there also exist larger indie studios with more formalized team structures and distributed workflows. It is possible that perceptions of generative AI as a teammate may shift in larger teams. Future work should aim to recruit a more globally diverse and structurally varied sample of indie developers to better capture the range of ways in which generative AI is perceived in their creative teamwork. In addition, while this study focused on indie game development, many of the themes we identified are relevant across other creative domains. Extending this line of inquiry to other creative teams, such as digital artists, animators, or musicians, can offer a broader understanding of how generative AI is shaping collaborative creative practices across industries. Finally, although our participants have offered rich insights into generative AI's potential capacity as a teammate in their creative teamwork, we were not able to recruit multiple members from the same indie team given that many indie teams are extremely small and informally organized. This limits our ability to analyze human teammates' diverse or similar perspectives on AI's involvement in their teamwork. Future work can extend this study by recruiting multiple members from the same indie teams to better compare and

triangulate how human teammates jointly interpret and approach generative AI in their collaborative game development processes.

7 Conclusion

As generative AI tools become more deeply embedded in creative workflows, understanding their role within human creative teams is an increasingly urgent concern for HCI and CSCW. Through studying indie game developers, a creativity-centric community featuring small teams, limited resources, and artistic aspirations, our findings reveal that despite the growing interest in human–AI teaming, indie developers demonstrate significant concerns about existing generative AI systems' potential capacity as teammates in their creative teamwork. However, such concerns do not stem from an absolute resistance to AI itself, but from AI's lack of *independence* and *interdependence* that characterize meaningful participation in creative teamwork. Indeed, indie developers still value generative AI's involvement in their future collaborative workflows in other positive and desirable ways. Their visions indicate both a shift in generative AI design from autonomous creative agents to embedded collaborative infrastructure and the importance of equally supporting the human side of adaptation. Using indie teams as an important example, these insights invite a rethinking of how we design intelligent systems intended to support small creative teams, which may not be a *"teammate"* in its full capacity but should prioritize respect for human authorship, collaborative sense-making, and alignment with the evolving goals and collective vision of creative teams. We hope that this work informs the development of future AI systems that support, not replace, the core values, dynamics, and focus on craftsmanship of human-centered creative teamwork.

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