Mitigating Exploitation: Indie Game Developers' Reconfigurations of Labor in Technology

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Much HCI research seeks to contribute to technological agendas that lead to more just and participative labor relations and practices, yet that research also raises concerns about forms of exploitation associated with them. In this paper, we explore how U.S. independent [indie] game developers' socio-technological practices inject forms of labor, capital, and production into the game development industry. Our findings highlight that indie game development 1) seeks to promote an alternative to business models of game development that depend on free and immaterial labor; 2) builds offline networks at different scales to develop collectives that can sustain their production; and 3) emphasizes how distributed collaboration, co-creation, and the use of free tools and middleware make game production more widely accessible. The research contributes to HCI research that seeks to explicate and mitigate emerging forms of exploitation enabled by new technologies and processes. Our critical review of indie developers' practices and strategies also extends the current conceptualization of labor and technology in CSCW.

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

Additional Key Words and Phrases: labor; technology; exploitation; indie game development

1 INTRODUCTION

Issues of labor relations and practices such as wages, employment, power structure in workplace, and division of labor not only have direct implications for the types of technical systems HCI/CSCW can provide but also show consequences of technologies in areas such as social relations, gender, and economic conditions [28, 56]. Therefore, research on technology and labor in our field has focused on central concerns such as more sustainable labor relations [21, 31], economic decisions that could benefit others [30], social equality and justice [16, 17, 21], value sensitive design [26, 41], and HCI for economically disadvantaged communities [11–14].

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In particular, a body of literature has explored how the emergence and prevalence of collaborative technologies and new bottom-up innovation mode transform traditional work practices and create new labor opportunities, including sharing economy such as ride and housing sharing [27, 39, 55, 63]; DIY making, open design, and open manufacturing [24, 25, 42, 43]; emotional and moral labor in online communities [18, 36, 50, 61, 62]; free labor in open source and online fandom projects [10, 60]; and crowdsourcing [32, 33]. While prior studies highlight emerging technologies in restructuring labor relations and economic order, they also reveal an important issue that need to be addressed – new forms of exploitation of labor (i.e., treating others unfairly for gaining advantages and benefits). Examples include the "digital sweatshop" in crowdsourcing [32, 33], the conflicting values between online users and corporates in moral labor [36], the challenges to protect worker rights in sharing economy (e.g., Uber and Lyft drivers' worldwide protests for better work conditions [2, 8], gender dynamics and labor [53], and privileged users (who are usually male, white, tech savvy, and highly educated) [6, 53] among others.

How can HCI researchers understand these restructuring technology-labor relationship? And how can the design of technology be more sensitive to the new forms of exploitation of labor so as to help mitigate rather than enable such inequalities? In this paper, we explore how U.S. independent [indie] game developers' socio-technological practices inject forms of labor, capital, and production into the game development industry. Specifically, we focus on indie game development because it offers alternative production and distribution structures in the gaming economy and fosters new forms of labor relations in technology (see also Background). We understand that people engage in indie game development for various purposes and not everyone is on an activist and non-profit agenda. Therefore, our analysis is scoped to the practice of those who are interested in reconfiguring labor in technology. Our analysis is also both empirical and critical: we distinguish our own views and interpretations from those of indie game developers throughout the paper. In doing so, we hope to understand their account on its own terms as an alternative to game development and using that account as an object of critical inquiry for further investigation.

This research contributes to HCI research that seeks to explicate and mitigate emerging forms of exploitation enabled by new technologies and processes. We unpack the complicated labor relations in an emerging workforce (i.e., indie game developers) and highlight a number of strategies to mitigate the potential exploitation in indie game developers' practices. We explore how these strategies may inform the design of future technologies that are specific to the principles of mitigating exploitation. Our critical review of indie developers' practices and strategies also extends the current conceptualization of labor and technology in CSCW.

2 BACKGROUND

2.1 Technology and Labor in HCI

Labor is an indispensable condition to every productive operation and can be either bodily or mental; material (i.e., creating a tangible product) or immaterial (i.e., producing the informational and cultural content of the commodity [40]); and productive (i.e., terminate in the creation of material wealth) or unproductive (i.e., does not terminate in the creation of material wealth) [51]. In 1996, Greenbaum advocated a labor-oriented economic frame in designing, organizing, and using information technologies [28, 29]. Following this call, a growing body of HCI, CSCW, and STS research has attended to the intersection of technology, design, and labor, such as Schmidt's study on the concept of "work" in CSCW [56], Harvey's advocacy for HCI and a fair, healthy, and universally democratic economy [30], and Dombrowski's work to "interrupt uneven social, economic, and information relations in the low-wage workplace" [16].

Specifically, extensive research has explored new forms of labor relations and practices enabled by emerging technologies. Examples include: 1) *sharing economy* refers the practice of people sharing their possessions (e.g., houses and vehicles) and/or services (hosting and driving) that enable such practice through technical platforms [15, 38, 55]. Such practice often leads to emerging on-demand mobile workforce [27]; at the same time, it also introduces new employment opportunities for traditionally disadvantaged population [15]; 2) *entrepreneurial labor*: research on making and DIY shows Western neoliberal understandings of tech labor makes it challenging for non-Western sites of innovation to participate as producers and innovators in the global market [4, 5, 42]; 3) *emotional labor* in online communities refers to the amount of efforts to express socially desired emotions during online service such as contributing to Wikipedia [50] or moderating online communities [18, 61, 62]; 4) *moral labor* that is driven by users' moral sense and expected to improve commercial products or online experiences, such as players' collective efforts to fight against toxic behavior in gaming [36]; 5) *free labor* is defined as to conduct productive operation with no immediate financial incentives. As an important aspect of digital economy, it is most commonly seen in open source and online fandom projects [10, 23, 60]; 6) *crowdsourcing* is a form of labor supported by micro-task platforms such as Amazon's Mechanical Turk (AMT) where crowds of online users can select and complete small tasks for monetary or non-monetary (e.g., reputation) reward [32–35].

These studies point to a promising and somewhat optimistic future where technology and design may afford more sustainable, nuanced, and participative labor relations and practices. However, they also raise concerns about mitigating emerging forms of exploitation of labor enabled by such technologies. Labor may become coerced as workers' products, once produced, no longer belong to them but others such as the capitalist [47], as seen in Uber drivers' work conditions and Airbnb hosts' privacy and trustworthiness in sharing economy [27, 46], the fairly exclusive and masculine-dominated approach to technological innovation in makerspaces and Fab Labs [6, 53], the tension between online users' moral decisions and the dominate corporate power in moral labor [36], the challenges to be credited, acknowledged, and considered "legitimate" in emotional and free labor [18, 23, 50, 61, 62], and the issues of "digital sweater shop" and invisibility of workers in crowdsourcing [32, 33].

The present work contributes to this line of research by documenting and analyzing U.S. indie game developers' reconfigurations of technology-labor relations and their implications for HCI. Specifically, in this paper we define exploitation as *treating others unfairly for gaining advantages and benefits*.

2.2 Indie Game Development

Indie games have been broadly defined as games that are consciously created within alternative production and distribution structures outside of the mainstream game companies [44]. Yet, indie in the context of indie game development is not necessarily related to hobbyists, amateurs, or unprofessionalism but a complex multidimensional concept: it is about "a social movement, an art movement, a cultural scene, a fad, an ethics, a value orientation, a social identity, an assertion of authority, a cultural politics, an accident, a new form of capitalism" [57]. Drawn upon these understandings and grounded on our engagement in the indie game development community since early 2017, in this paper we define indie game developers as *people who do not affiliate with large game companies or publishers but make and publish games in alternative ways such as self-funding/publishing, small teams/studios, and free labor.* They are workers because they use their labor to produce content; they can be entrepreneurs if they find institutional and networked ways to turn practices of innovation into an organization [19].

We chose indie game development in the U.S. as our research context for two reasons. First, the gaming industry is a powerful revenue generator and dynamic job creator in the U.S.: it contributes

$261 billion to the U.S. economy; generates $40.8 billion in tax revenues to federal, state and local governments; and directly employs 727,000 people in the U.S. with $33.3 billion of wages, salaries, tips, benefits and other labor income [3]. Yet the gaming industry is also notorious for the highly intense and stressful labor relations and practices – long hours, looming deadlines, hardcore workers, big money payouts and tremendous losses [54] as well as sexism (e.g., Gamergate).

In contrast, indie games rise as relatively successful examples that offer alternatives to work in the gaming economy and produce games. Recent industry reports have highlighted the success of indie games in economic growth: indie gaming has become one of the fastest growing and most influential segments of the video game industry, which produces $80 billion dollars in annual revenue [1]; indie games have also dominated the mobile gaming market, accounting for 68% of all mobile game sessions [22]. Studying indie game development, therefore, adds nuance to the current HCI discourse on technology and labor by focusing on the ongoing struggles and restructuring of labor relations and practices in a technology-centric creative industry that has a prominent impact on the U.S. economy.

Second, the indie community often considers itself anti-establishment and anti-authoritarian [45]. Compared to the mainstream gaming industry, the indie community seems to demonstrate different labor setups, production models, and expectations for end products. Indie games are often relatively small projects in contrast to the so-called "AAA" games (AAA, or Triple-A, games refer to games with the highest development budgets and levels of promotion). They are also developed by small teams of developers. "Being indie" seems to represent a new business model of game entrepreneurship, which has the potential to reconfigure and revitalize the mainstream gaming industry [48]. O'Donnell also pointed out that indie games focus on a small number of clear design and aesthetic goals and can be developed at a much smaller scale in terms of workload and manpower [54]. Therefore, indie games are often praised as "moral, artistic high-ground" [45]. As the documentary *Us and the Game Industry* shows, at least a subset of the indie game development community self-identifies as a new form of "rebellious entertainment" and a new counter-culture that advocates a more inclusive and supportive work atmosphere in the gaming industry as well as a more ethical, fair, and participative form of game development and digital production in the gaming economy [59].

These indie developers tend to consider the mainstream gaming industry "exploitative" in two ways: 1) exploiting the production: treating games as revenue-driven commodities but less as cultural products; and 2) exploiting the labor: making revenues by coerced work conditions and buying developers' or small studios' intellectual property [52]. Coming to the indie community, they do not see themselves exploited because they consider indie game development a counter-culture to the mainstream gaming industry where the actual exploitation exists.

In this sense, empirically studying how indie game developers' socio-technological practices offer alternatives of labor, capital, and production in the gaming economy may inform the design of future technologies that not only enable new labor relations and opportunities but also mitigate the risk of new forms of exploitation associated with them. A critical view of their practices and strategies would also shed light on the increasingly complex relationships between labor and technology in today's innovation economy.

3 METHODOLOGY

This study is part of a broader, multi-year research project on studying indie game development as public engagement in technological innovation. This project was approved by the IRB office at Clemson University and all members of the research team received appropriate training in the protection of human subjects in research.

Table 1. Demographic information of interviewees

ID	Gender	Age	Race	Years of Experience	Full/Part Time Indie
P1	Female	33	Caucasian	8	Part Time
P2	Female	27	Caucasian	5	Full Time
P3	Female	28	Caucasian	2	Full Time
P4	Female	33	African American	12	Part Time
P5	Male	27	Caucasian	5	Part Time
P6	Female	29	Asian	2	Full Time
P7	Male	25	Caucasian	17	Part Time
P8	Male	30	Caucasian	6	Full Time
P9	Male	51	Caucasian	14	Part Time
P10	Male	27	African American	5	Part Time
P11	Male	32	Caucasian	6	Full Time
P12	Female	35	Caucasian	6	Part Time

Three types of data were collected for this study. First, due to indie game developers' high level of online participation, we collected developers' self-reports of their personal experiences of engaging in the indie game community that were posted to active public English language forums for indie game development. These online forums include QA sites such as Quora, Unity forum, indie gamer forum, Reddit (game dev), and Reddit (Indie Dev). We used a series of keywords such as "indie games," "indie game development," and "indie game developer" to search threads and posts on these forums and filtered out those not directly related (e.g., threads about solving a specific technical or design issue in indie game development). In total, 2,056 posts and comments with a time span from 2010 to 2018 were collected.

Second, after consulting an informant who was the organizer of a local International Game Developers Association (IGDA) chapter in USA, we requested to join Facebook Groups for indie game developers using keywords such as "indie game development" and "indie game developer." We then posted a recruitment message on those groups who accepted our requests to join and post (N = 6) in order to recruit voluntary interviewees. We also directly contacted indie game developers in USA who we already knew to ask their willingness to participate using a snowball sampling. All developers who responded to our requests and agreed to participate were interviewed. As a result, 12 semi-structured in-depth interviews were conducted in order to investigate indie game developers' attitudes and experiences of engaging in indie game development. Interviews were conducted via text/audio Skype chat based on participants' preferences from December 2017 to February 2018. In each interview, 15 predefined open-ended questions were asked and the average length of interviews was 80 min. All 12 participants were located in the USA. Six self-identified as female and six as male. Nine self-identified as Caucasian, two as African American and one as Asian. The average age of the participants was 31 years old (min. = 25, max. = 51) and average years of experience in indie game development was 8.5 years (min. = 2 years, max. = 17 years). Five of them (42%) developed indie games full time as freelancers or working in small studios (two to three people) while seven (58%) as part time. Table 1 summarizes participants' demographic information.

Lastly, the first author was an active member of two local indie game development meetup groups in a mid-sized city in USA. She attended several events and workshops in 2017 hosted by the meetup groups as well as the 2018 Global Game Jam in the same city and conducted participatory observations [58] of developers' work relations and conditions. These observations were approved

by IRB. The first author informed the indie developers of this research and did not pose any interventions when she participated in these events. In this study, these observations were mainly used to understand the context of indie game development, so as to better interpret developers' self-reports and interviews.

Inspired by phenomenology [20], we conducted an empirical, in-depth qualitative analysis of the collected data to explore how indie game development is shaping the traditional gaming economy by bringing in new forms of labor, production, and values. In our analysis, we sought indie developers' first-person, subjective, narrative accounts and coded them thematically. We also did not specifically separate interviews and online posts in order to offer a more comprehensive picture of indie developers' practices.

Based on McDonald et al.' [49] guidelines for qualitative analysis in CSCW and HCI practice, our analytical procedures focused on eventually yielding concepts and themes (recurrent topics or meanings that represent a phenomena) rather than agreement – because even if coders agreed on codes, they may interpret the meaning of those codes differently [49]. Therefore, we did not seek inter-rater reliability in our analysis but endeavored to identify recurring themes of interest, detect relationships among them, and organize them into clusters of more complex and broader themes.

Specifically, all four authors closely read through the collected data (both interviews and online posts) to acquire a sense of the whole picture with regards to developers' perception and interpretations of their socio-technological practices and technology-labor relations in indie game development. Then the first author identified initial thematic topics and common features related to labor, capital, and production and all four authors collectively examined and refined them in an iterative process. After that, all four authors collaborated to discuss, combine, and refine themes and features to generate a rich description synthesizing the restructuring labor relations and practices as shown in indie game development. Six months later, the first author revisited the identified themes and sub-themes and did not find much inconsistency. All authors also collaborated to discuss and refine these themes and sub-themes. Lastly, the first author shared preliminary findings with participants and other indie developers by posting on Facebook groups to conduct member checking [37] and received positive feedback.

4 FINDINGS

In this section we report how U.S. indie game developers' socio-technological practices inject forms of labor, capital, and production into the game development industry.

4.1 Restructuring Labor in Game Development

As a niche technical practice, game development requires sophisticated technical skills including programming, computer graphics, and 3D modeling (i.e., hardcore workers) but also offers one of the highest pay in the technology industry in general (i.e., big money payouts) [54]. Yet our participants pointed out that indie game development promoted an alternative to approach labor in game development by depending on 1) free labor; and 2) immaterial labor.

4.1.1 The Focus on Free Labor: Where It Is and How to Use It. In technological innovation and knowledge production, free labor sometimes risks exploitation (e.g., being unpaid and the failure to claim one's contribution to one's own work). However, in our study, indie developers seldom considered their free labor as "exploited" but described it as part of the key indie culture – free labor made indie game development inherently different and independent from traditional game development and gaming economy. For example, P1 and P3 described the popularity and willingness to offer free help and collaboration in the indie game development community:

> *"Sometimes it's just a matter of asking on Twitter 'hey, I'm running into this problem with Unity, has anyone encountered this?' Stuff like that."* (P1, female, age 33, white)

> *"There are a lot of public Facebook groups and offline events in bars and offices that invite everybody. Usually you just need to post or yell at the beginning of those events: 'who needs an artist? who needs a Unity programmer? who needs a musician/sound tech?' Just volunteer and then you will be connected with all kinds of people – some may be in your neighborhood and some may be in Europe."* (P3, female, age 28, white)

In particular, all participants highlighted social media as part of the infrastructure through which they found each other, facilitated exchange of free labor (in forms of voluntary help and mentor), and received/offered feedback for each other's game projects with no incentives or payment. Various social media platforms were used within the indie community due to specific needs, including Facebook, Twitter, Discord, Twitch, online forums, and self-made tools. They considered Facebook and Twitter the most popular platforms because they were useful to establish general interactions with other indie developers, announce projects, and seek quick feedback. P7 (male, age 25, white) and a post on Reddit said,

> *"Most of my social media interaction with indie game development is on Twitter. People will show images of projects they're working on, or ask for help and suggestions, or share opinions and industry news, and I'll favorite or reply to tweets now and then."* (P7)

> *"I think getting (and staying) in touch with people in the indie field will be incredibly difficult without any form of social media. And most of what I see going on is Facebook and twitter."* (A post on Reddit)

They also described more specific needs to develop and sustain special interest groups, to prototype and playtest games, and to collectively solve technical, design, and business issues regarding game development (all for free). Discord, Twitch, and game engine specific online forums were often considered useful for achieving these goals. For example, P5 (male, age 27, white) noted,

> *"We have a community chat (Discord) that has the three big indie communities in the Midwest. We decided to use Discord because Discord is a one account log in. Since there is also a chat feature, this allows members to talk through a design or technical problem brainstorm etc."*

P6 (female, age 26, Asian) and a post on Reddit especially highlighted streaming platforms such as Twich:

> *"Our team streams us working on games. We will talk about why we are doing things a certain way and chat with viewers to collect their feedback. Sometimes the chat will chime in with bug fixes or they are invested in the creation in some way."* (P6)

> *"A huge number of indie developers use twitch. They use it for promotion, they use it to socialize and share what they're working on. All with different experiences and perspectives they can share."* (A post on Reddit)

P4 even highlighted the importance of more indie-exclusive platforms:

> *"We have a local site that operates kind of like craigslist but is more targeted and easy to navigate for indie-related things. It's a cool platform created by a group of indies in town. You can make 'asks' and 'offers' on the site to get help or help others. Pretty simple, pretty informal and warm feeling."* (P4, female, age 33, African American)

Through all the diverse technologies and platforms, indie game developers built an infrastructure to network, socialize, collaborate, and help each other. Most of their labor involving in conduct such practices are free (unpaid) but not exploited. For them, the return is not only the invisible

mutual help, the pleasure to connect with people who shared similar interests (therefore the not imposed, independent work [60] but also the emergence of a distinctive indie culture (compared to the mainstream game industry) that defines them identity.

4.1.2   The Rise of Immaterial Labor: Engaging Tech Newcomers and the Underrepresented. Immaterial labor, which produces the informational and cultural content of the commodity [40], has always been fundamental to game development. In many ways, producing digital games not only transforms the traditional labor processes in the Industrial Age (e.g., developing software on computer rather than manufacturing tangible products) but also generates cultural products whose meanings are placed on them through their context and use as well as being "negotiated or resisted in order to benefit specific groups of communities" [9]. Though the mainstream gaming industry plays a critical role in the U.S. economy, a growing concern is that it has increasingly focused more on developing digital games as revenue-driven commodities but less as cultural products, which neglects the importance of immaterial labor. For example, one of the largest game companies in the U.S., Electronic Arts, has constantly been criticized for its controversial strategies to generate revenue, such as deliberately holding back game content with the sole intent of charging a fee for it and acquiring small studios for their intellectual property rather than developing novel and high quality games [52].

Our participants, therefore, explained that one central goal of indie game development was to foster a counter-culture that reinforced games as cultural products. As P2 (female, age 27, white) described, *"most people think of AAA studios when they think games, which is a shame. Because games are so much more than that. I hate games as a business but love games as an art form."* To do so, indie developers endeavor to support and promote immaterial labor in two ways: engaging tech new comers and the underrepresented.

Engaging Tech Newcomers: Risk-Taking and Tolerance

Game development and the gaming industry in general have traditionally been considered not very friendly to newcomers due to the high demand for technical skills and steep learning curve. In this sense, the labor power lies on highly skilled workers and their existing capacities. However, in this study, participants revealed that indie game development especially focused on engaging tech newcomers and their potential. They mentioned that many indie game developers had no prior experience about programming and game development but decided to engage in indie game development due to their passion about creativity, innovation, and gaming as well as their desire to express personal feelings and experiences by using games as an interactive media. Through learning with others to develop games, they not only realized their potential (e.g., new technical skills) but also contributed immaterial labor to create new cultural products.

For example, P8 (male, age 30, white) described how much he appreciated this newcomer-friendliness culture, which allowed him to participate in game development and helped him gain new skills:

> *"I knew nothing about programming or how to make a game before I decided to do indie. To be honest I was surprised by how tolerant, positive, and open-minded this community was. I was not afraid to ask dumb questions on the forums and I got the answers fairly fast. I was welcomed to join a few projects when I was still learning. I really appreciate those opportunities because I know how much risk they took to count me in! I feel making indie games has got my potentials out – never thought I could be a programmer before!"*

Our participants especially appreciated how their immaterial labor was acknowledged, valued, and incorporated throughout the whole process of game development. P3 (female, age 28, white) explained that while she had not been successful in her life, her input was still taken into consideration when planning the design direction of an indie game, which greatly rebuilt her confidence:

> "My self-esteem was rock-bottom. I'm nearly 30 and still living with my parents, a failure in every sense. I found the X group on Facebook [a local Facebook group for indie game developers] by luck about one year ago. After that I have been doing everything from playtesting to artwork for different game projects. It's just nice to have people value my work and opinions so much because they did changed the game features based on my feedback! I know sometimes I screwed up, so I'm very grateful that they trusted me, helped me learn, and took me seriously."

Of course, promoting immaterial labor by inviting newcomers to game projects did not always work out. An online post on the Indie Gamer forum discussed two types of risks. First was that people added tech newcomers to their projects because they wanted to have free labor for tedious tasks but not to help newcomers learn. Second was that after joining the project, the newcomers just disappeared with no follow-up action, which hindered the whole project. This post received more than 100 comments and triggered a heated discussion about how to better engage people with no prior experience of game development in this community. Many replies were well aware of these risks but still advocated the newcomer-friendliness culture. They argued that it was why indie game development can become a viable alternative to the revenue-driven gaming industry by returning to the importance of immaterial labor, and how this community could remain vigorous and make new breakthroughs.

Our interviewees also echoed this viewpoint, for example,

> "I have been extremely grateful in that I've had a long series of mentors who have really encouraged me, and it's been encouraging to see how my games have impacted people, and that's inspiring. I feel like indie developers are extremely encouraging of other indie developers. Like it's very welcoming to people who want to learn." (P1, female, age 33, white)

In summary, our participants regarded engaging tech newcomers in every stage of game development as one of the core labor practices in this community. According to them, this practice distinguishes indie game development from the mainstream gaming industry by restructuring the labor relations and opportunities: encouraging everyone who is passionate about gaming to contribute and learn by doing, regardless of prior experience, skills, and knowledge.

Engaging the Underrepresented in Game Design/Development

In our study, indie developers' focus on engaging the underrepresented in game design/development exhibited how immaterial labor was unfolded and pursued: The gaming industry has a notorious history for being traditionally male and Caucasian dominated. Scandals of sexism and misogyny often emerge (e.g., the Gamergate controversy). Yet through their immaterial labor, non-stereotypical game developers (e.g., women and non-Caucasian) show their voices in expressing cultural and artistic standards, social values, and opinions, which transform them to active agents with growing agency to participate, innovate, experience, and influence in their own subjective ways. This became evidence of how indies fought against exploitation in the gaming economy.

For example, almost all female indie game developers in our study described their participation in indie game development to be positive because they felt safe, supportive, and respected. For example, P1 (female, age 33, white) explained:

> *"I feel lucky because of how positive and supportive the indie community is. We all hear a lot of bad stories from ladies at studios that had sexist culture, and I never encountered that."*

P3 (female, age 28, white) related how the indie community reacted to the Gamergate incident: on the one hand, the community became even more protective of female developers; on the other hand, it respected women's agency so people were not overprotective:

> *"I think after the gamergate fiasco, the indie scene is feeling protective of female developers in general, but afraid of seeming protective b/c that's socially interpreted as a sexual advance, so they're caught in the quandary of not knowing whether to punch that as*hole or let the woman punch him."*

The only female interviewee in our sample who had a somewhat negative experience was mainly concerned about the financial pressure and made it clear that she *"loves making indie games,"* and she *"wouldn't want to work on anything else"* (P2, female, age 27, white).

The non-Caucasian interviewees shared similar experiences. P4 (female, age 33, African American) revealed,

> *"I've been the only black person in any of the companies I've worked for. I feel more comfortable in the indie community. I feel like on the whole, the indie game movement wants to see more diversity. We're trying to push the entire game industry in that direction. we want more people of color not only portrayed in the games we play, but also on the teams that make them."*

Another story detailed how a stay-at-home mom became an indie game developer in part because of the collective support from the community. Her online post on the Indie Gamer forum triggered more than 60 replies. Many commenters shared their experiences of balancing family life and game development practices, time management strategies, learning materials, and tips for starting her first game project. As a result, this poster successfully completed her first game and shared it with the online users who helped her through this process. In this example, the game maker who was encouraged to enter indie game development is female, who is underrepresented in the game development industry; she is also a mother, balancing caring for her kids and pursuing a career in game design/development. Nevertheless, with the collective support from numerous anonymous game developers, along with her passion and commitment for game design/development, she broke the double social stigma.

When asked about why and how the indie community made previously underrepresented stakeholders more confident to participate in the traditionally male-dominant labor practices (i.e., game development), P3 (female, age 28, white) explained that this is because indie game development is a subculture itself: *"indies tend to have an underdog attitude, so they like to band with other underdogs like women and anybody who isn't white and non-mainstream artists of every stripe and misunderstood geniuses and the disabled."* Others also highlighted indie developers' collective efforts to overcome existing social stigma. Many participants recognized that underrepresented women and minorities in game development was not merely a concern within the gaming community but part of a broader social issue. They advocated collective efforts to overcome this social stigma. For them, such endeavors are built on every member's awareness of the status quo and motivation for change.

In particular, participants highlighted a high-level strategy to overcome the social stigma and engage the underrepresented labor in game development: showcasing what indie game development would empower people to do, and introducing these visions to the younger generation, as seen in the following two quotes:

> *"I think the best thing indies do is to provide everyone with an opportunity to make a change themselves. Want more games with female characters? You can make them! Want to make a game about the difficulties of sexism in the work environment? Just make it! The more games that have diverse teams or are about diverse subjects, the more it will become more mainstream. It also gives a chance for anyone from any-where to learn the skills that are required for game development, which I think will naturally create more diverse environments in those bigger companies."* (P8, male, age 30, white)

> *"Our team often volunteers to give game dev workshops at middle and high schools. We are encouraging the younger population to do game dev as a hobby with basically anything to make the practice of game dev seem less intimidating and more accessible. I think as the indie market grows we will see games that appeal to a wider audience (as we are already seeing) and that may inspire a more varied group of people to get pas-sionate about producing content. We are working on pushing these kinda of initiatives in areas that have less income and less privilege toward a clear cut path to success as well."* (P6, female, age 29, Asian)

P8 outlined several concrete recommendations for more participative outcomes in game development, and P6 summarized current initiatives to fuse game development and education, especially for low-income students to cultivate the next generation of game developers. They were both confident that these practices would provide pragmatic tools to bring about alternative and more desirable futures for the gaming culture.

Another strategy to encourage the underrepresented labor that participants identified was to develop personal experience-based games. While they admitted that games developed by AAA studios and mainstream game companies can also focus on experiences and social values, they believed that the indie community has more freedom to develop games based on individual life experiences and ideologies. To support this claim, participants cited the successful indie game *That Dragon, Cancer* as an example, which is based on the leading game designers' (who are a couple) experience of raising their son who was diagnosed with terminal cancer at twelve months old.

Additionally, P11 (male, age 32, white) and P2 (female, age 27, white) described indie games as both the methods to engage the underrepresented and the products of engaging the underrepresented:

> *"Indie games play a big role to encourage diversity, because it's much easier for a developer to make a very personal experience based on their own lives than at a big studio. And I've met plenty of women and LGBTQ people who are doing just that, with games that edgy and risky and big studios just won't take that chance. Games are also a unique medium, in that they make the player an active participant and that can be really eye-opening when you are forced into a role that is very foreign to your own worldview. Like playing as a different race or gender, and seeing their struggles on a personal level."* (P11)

> *"You get games that are made by people in Africa with stories and aesthetics you've never seen. You get games like Cibelle. things that are so personal to the developer. That's why I love indie games. games become a way for them to express themselves and for others to experience their stories. This makes us better understand each other and our differences. This is what makes us more open and inclusive."* (P2)

For them, experience-based indie games are a creative and inclusive art form that effectively conveys different cultures, values, opinions, and ideologies. As a result, games become free expressions of sympathy. Creating and playing such games may make people more understandable, tolerable, and open to diversity, which fuels the diverse labor force in indie game development in return.

4.2 The Challenge of Lacking Capital: Promoting Collective Visibility as Social Capital

Our data also show that indie developers are still subject to the power and economic structure of the mainstream gaming industry in various ways. Many indie developers, even the prominent ones, still suffer from the tensions between their desire for advocating core indie values (e.g., independence from the mainstream gaming industry) and the longing for economic success.

The main reason is that indie developers often struggle with earning and sustaining the necessary capital to afford and sustain their labor during the production process. In the mainstream gaming economy, capital emerges in wealth from the previous products (i.e., selling a popular game) and is used to maintain a stable labor force for the next production (i.e., developing a new game). However, in indie game development, acquiring capital becomes a severe challenge: first, they often do not have saved wealth as existing capital to sustain their current labor process; second, they also make little wealth from their ongoing labor process to generate new capital. P3 (female, age 28, white) and P9 (male, age 51, white) explained this double challenge,

> *"The main issue with indie game development is the time that elapses between work start and profit. You have to be willing to accept delays and zero pay, possibly forever. For me and many others, you either work 16 hour days at two jobs, or you live with your parents because they are awesome."* (P3)

> *"If you can't keep the lights on and the Internet bill paid, you can't develop. You either have to support yourself through a second job, through someone who can support you (a loved one, partner, or sponsor)."* (P9)

These quotes clearly show that our participants were well aware of the socioeconomic barriers to enter and stay in indie game development. It does require tremendous time and economic investment to develop indie games; but many indie developers do not have sufficient capital to support their labor and production.

How do they address this challenge? Pursuing traditional capital that has dominated the mainstream gaming economy (e.g., publishers) is not an option: *"an indie game isn't funded by publishers. We get to make a game without worrying about what 'the big guys' will say. Its why we can open to different concepts and technologies and then make new and wonderful things"* (P2, female, age 27, white). Therefore, an alternative strategy to seek capital is to build offline networks at various scales (e.g., local, national, or global) for collective visibility as social capital – "the sum of the resources, actual or virtual, that accrue to an individual or a group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition" [7].

In our study, indie game developers strived for organizing and attending various casual and formal offline local, national, and global events to build a networked community for sharing, knowing, learning, and important outreaching. For them, the expectation was that these events would accumulate resources and make indie game development more visible and recognized to the broader gaming community and to the general public. This effort would generate and increase the social capital of both individual developers and indie game development as a whole, which could promote and sustain indie developers' labor and production. One post on Reddit noted,

> *"Yes we work from home and remotely a lot. But I think those face to face activities make this community more approachable and visible. there's something about a face that keeps you accountable to your work."*

Specifically, offline Meetup group meetings and other local networking activities became popular ways to form special interest groups or small local development teams. Some participants described how identifying a local group made them feel "not alone":

"I attend Indie City Meetups. They normally have an hour long talk about various topics, and then a 5 min per person open mic session where you can show off your current projects. I also attend the indie lunch. It is a big one for just meeting and talking so we know we are not alone; there are some other people like us out there." (P8, male, age 30, white)

Participants also mentioned how they learnt new skills and technologies and even advanced their career at those local events, such as:

"These local meetups are great for networking. You can discuss your concerns and issues with other people who might have similar experiences and solutions for you. It is really a supportive environment. I even accepted a job with a start up company – whose founder I met at one of the meetups!!!" (P7, male, age 25, white)

For them, local gatherings became multifunctional and multidimensional social spaces for growing social capital – developers reinforced existing connections and developed new networks, built credibility, publicized their games and received feedback face-to-face, practiced and improved game development skills, and collectively learned from each other and innovated together.

Indie developers' endeavors to make their practices and products visible were not limited within their small local circles. Though many of them had limited financial stability, they enthusiastically participated in national or international events such as the Game Developer's Conference (GDC) and the Global Game Jam (GGJ). One online post on Reddit noted,

"Ludum Dare and Global Game Jam are big international events. They both have thousands of participants. These are basically really short periods of time where people get together and work on a game for 48 hours straight. Great events to make games in a very open and collaborative way. You have more publicity too since a lot of people outside of the game world start to know these events."

Our participants highly praised these events, considering them opportunities to interact, share game ideas, and collaborate together in person with people all over the country/world. They suggested that those events not only built their confidence and motivated them to stay in this field and continue to produce, but also introduced the indie community to the general public who were not in the gaming area, which might possibly bring more emotional, financial, and technical support to indie game development (i.e., increased capital).

4.3 An Alternative to Game Production

As a result of injecting new forms of labor and capital to the gaming industry, indie game developers offer an alternative to game production by focusing on collaboration and co-creation as well as the use of free tools and middleware.

4.3.1 Collaboration and Co-Creation for Production. Our participants considered distributed collaboration and co-creation a key in their production. This understanding is both a result of indie game development's dependence on free/immaterial labor (e.g., inexperienced and/or nontraditional game developers) and an outcome of the collective need for social capital – to pool information, resources, and talents regardless of geographic distance.

For example, a popular thread on the Indie Gamer forum discussed how to form remote indie teams to produce games. It received more than 50 comments. Many comments shared their successful experiences. One wrote,

"I wrote the physics engine for a game, started in 2000 and our collaboration continued for 14 years. We did everything by email the first three years, I didn't even meet anyone until 2002 which was a one or two day thing, then didn't see anyone again until a year later. I didn't meet the other developer until 2003 probably, and didn't meet the artist until close

to a year later. The first version was done by me in the US, a guy in Germany, an artist in the UK, and the funder paying for it all in Holland. The web team was in Slovakia. Our team is international, open-minded, and efficient, otherwise we wouldn't stick together for this long."

Another one described,

"We stayed together for over three years as partners. Because we were all getting something out of it. We made it clear that it was all about building up everyone's skills and portfolio for possible work. That worked wonderfully. Keep in contact, build friendship, have fun, learn, teach each other things you pick up."

In these quotes, indie developers described distributed collaboration not only as an effective way to produce but also the reason why production in indie game development was fun, engaging, and participatory: collaboration expanded their own social circles, built friendships with online strangers who also loved games, and made them learn from different minds and perspectives. *"It's an interesting phenomenon of the modern age, that we can have functional discussions and projects without ever having met your team. It was interesting to learn not only about game development, but also international culture in general,"* P7 (male, age 25, white) summarized.

4.3.2 Free Tools and Middleware Mediate and Support Production. Indie developers' game production is also largely supported and mediated by free tools and middleware. Many developers believed that this was why indie game development transformed the traditional game production: game development could be increasingly accessible to everyday technology users. Their argument is based on two reasons: the goal to lower the technological barriers so everyone who wants to make games can do so, and the understanding of digital games as cultural objects. For example, P12 (female, 35, white) explained how free tools made her engage in game development at a young age: *"I'm a very creative person. Unlike many girls, I enjoyed games when I was young and wanted to make my own games. When I was a kid, I found a website that offered free training and tools to make games. It was very inspiring for my early training and involvement."* Participants also reported that these tools freed them from consistently debugging tedious technical issues and enabled them to focus on a bigger image of their game - to create novel gameplay dynamics and engaging gaming experiences. P7 (male, age 27, white) observed, *"when you can spend more time iterating on concepts rather than getting a screen to render a pixel, you can focus more on pushing the envelope, especially when you have limited resources."*

In addition, developers highlighted how a wide range of free tools and middleware has opened up game development, a previously heavily programming-focused niche area, to engage everyday technology users who has no or limited technical skills with game production. P4 (female, age 33, African American) mentioned,

"New tools and engines have lowered the barrier for people to become creative and make games themselves. Practically anybody can become a game developer and they don't need a Masters in CS to do it."

And P10 (male, age 27, African American) added,

"I think advancements of accessible game engines and modding tools are allowing everyone who is interested in games to innovate. Unreal, Unity and all the mods allow any individual to become an indie dev. I learned what I know about Unity and Unreal from YouTube! Seriously, now you can download all the major game engines for free and learn them for free!"

According to them, many people might be interested in engaging in the production process in game development but were scared away by how sophisticated gaming technologies are and

the steep learning curve. Participants criticized such a high demand for resources and skills made game development a "closed" production process and highlighted how free tools and middleware allowed people to concentrate on their creative ideas and experiment new concepts without being hindered by technological barriers. They further described such a middleware-mediated innovation as a "learning and adapting" process: choosing the most appropriate tools, seeking all available resources to learn about them (e.g., Youtube videos, online forums and tutorials, and interaction with more experienced developers), and actively adapting these tools and resources based on a developer's, or a small studio's, unique creative needs.

Though many developers applauded how free tools and middleware available optimized their creativity and ability to produce and innovate, some others expressed their concerns about the mainstream gaming industry's power on influencing and controlling the production process in indie game development: *"The one thing I do think AAA is way better at is the use of cut-ting edge technology. Only once that tech has been documented the indies can start playing with it"* (P8, male, age 30, white). Still, most developers did not consider this situation a substantial threat to the indie community's freedom and production capability. P8's additional comment shows, *"even we can only play with those tools after those big guys release them, we can use them in way that those big guys may never think of."* They were confident that it would be challenging for any third party to control or undermine the indie community since production in indie game development largely focused on creativity, novelty, and experimentation.

5 DISCUSSION

We have shown that indie game development 1) seeks to promote an alternative to business models of game development that depend on free and immaterial labor; 2) builds offline networks at different scales to develop collectives that can sustain their production; and 3) emphasizes how distributed collaboration, co-creation, and the use of free tools and middleware make game production more widely accessible. We now situate our findings in studies of technology and labor in HCI and summarize indie developers' strategies to mitigate the potential exploitation of their labor. We then explore how these strategies inform the design of future technologies that are specific to the principles of mitigating exploitation. Lastly, as critical scholars, we critique their practices and strategies both to open it up and to identify what we view as reconfigurations of labor in technology of value to the broader CSCW research community.

5.1 Strategies to Mitigate Exploitation in Indie Game Development

Similar to other forms of technology-labor relations, in our study indie game developers are not immune to potential exploitation of their labor. As in moral labor [36], indie game developers struggle with the tension between their independence and the dominant economic power of the mainstream gaming industry. Like free labor as presented in open source and online fandom [10, 23, 60], indie game developers face challenges to be appropriately credited, acknowledged, and considered "legitimate" due to the lack of traditional capital. And as in the sharing economy [27, 46], indie game developers are concerned about their working condition and economic stability.

However, our data also show that indie game development 1) offers developers agency to participate in and control the decision-making process; 2) can be diverse as the community strives for engaging tech newcomers and underrepresented developers and lowering down the technical barriers to enter game development; and 3) is becoming visible due to its efforts to increase social capital both for individual developers and for the networked community as a whole. As indie game development continues to play a significant role in today's gaming economy and grows as an alternative to game production, it may suggest promising strategies to explicate and mitigate exploitation of labor. We summarize and further discuss these strategies as follows.

Strategy 1: A clear and ambitious goal to shake the existing power structure in technology as a community. Many new forms of labor relations and practices enabled by technology have significantly affected the traditional work and workplace (e.g., Uber vs. Taxi business). Yet in our study, indie game development seems to be more ambitious, as it has clearly demonstrated an explicit goal to shake the existing power structure in technology, calling itself a community of anti-establishment, resistance, or counter-culture. This ambition and passion for changes, in some ways, protects them from being exploited. For example, while many indie developers are willing to provide free labor, they are empowered by their labor rather than "being used" – they develop professional skills that are both high paying and high satisfaction; they also collectively build a community that can bring in profound changes to the mainstream gaming industry. This parallels a traditional goal of labor unions, which is to develop, not just exploit, a workforce. Such development is reinforced in an environment that supports experimentation, risk-taking, and failure tolerance and leads to their bravery to explore and innovate – sometimes in ways that AAA developers may never think of. Engaging in the indie game community thus becomes a promising approach to mentor, empower, and direct the future technology labor force: many everyday users who are non-professional software developers considerably improve their technical, design, business and other skills.

Strategy 2: Build explicit organizational, social, and technical mechanisms and infrastructures that encourage diverse labor force. Such mechanisms and infrastructures include comprehensive online tutorials and learning materials; collective commenting and widespread sharing through social media; easy-to-find and easy-to-join special interest groups that jointly solve technical, design, and business issues regarding game development; hosting global events to pool information and resources; and a culture of free help and learning through practice. These mechanisms and infrastructures emerge bottom-up rather than being established top-down by a certain organization. They foster creative games and more open-minded and collaborative labor relations. In return, the empowered labor forces continue to appropriate and deploy mechanisms and infrastructures to foster supportive and friendly labor relations by engaging more diverse labor force and promoting the indie culture.

Strategy 3: The prevalence of powerful, easy to use, and well-documented toolkit and middleware lowers barriers to engage new labor in production and opens the previously "closed" production process. Indie developers believe that the traditional gaming industry can be exploitative because it encourages a "closed" production process: game development often happens behind the door and mainly by highly skilled workers working long and stressful hours; it can also be exploitation because studios and publishers, not developers, own the developed games. In our data, participants suggest that tools such as easy-to-use free game engines, free development environments, and direct developer-to-consumer digital distribution platforms help indie game development rise as a counter culture to the exploitative and alienated gaming industry. These tools help developers be "independent" from the traditional gaming production and directly lower technical barrier to make games, which bring accessibility and transparency to the gaming economy.

Strategy 4: Explicitly embrace and proactively pursue values of participation and diversity, with a special emphasis on social support. Though the indie community is a complex, heterogeneous entity, many indie developers seem to be on an activist agenda and advocate an ideology of universal access, free expression, and equal participation as a way to protect their community values, labor rights, and products. They enthusiastically preach this ideology to themselves and others; they endeavor to make this community more visible to the general public; and they strive to offer social support to community members in need – such as newcomers and underrepresented populations. For them, this ideology is built on a shared belief that everyone in principle can participate in game development despite of certain economic and social barriers (e.g., must be able to afford a computer

and love games); and that games can become cultural and ideological products for free expression and free speech – everyone can make games that represent their social and political views, e.g., anti-sexism in the workplace or supporting LGBT rights. For them, indie game development is restructuring the traditional gaming economy not because they claim it is but because they take actions to make it happen. Thus, these developers embrace an inclusive and diverse agenda within an actual social conflict – taking overt acts to use indie game development as an alternative approach for labor, capital, and production to confront misogyny, racism, and poor diversity in mainstream gaming industry.

Strategy 5: Reconsider the relationship between production, profits, and consumption through the view of independence and immaterial labor. In our study, indie developers advocate their agenda of anti-establishment and independence. Though generating wealth (e.g., profits) by consumption is often a direct goal of production in political economy, indie game developers seem to value their "independence" and personal experiences more than wealth in their production process. Or, at least, profits are not these indie developers' priorities. They are independent because it is not beholden to profits and shareholders (e.g., major game publishers). They are not even beholden to consumer demand – developers often make games to embody their creative ideas, ideologies, or personal experiences through immaterial labor not to fulfill desires for a certain genre of games on the market. Since indie game development is mostly self-motivated rather than revenue or market driven for these developers, they can tolerate risks and be experimental instead of taking a conservative and safe approach. This approach does not come without a cost. As we have shown in our data, many indie developers acknowledge that they struggle with the lack of capital and the financial instability. However, for many of them, it is important to escape from the traditional pursuit for profits and consumption (i.e., publisher or consumer demands) to make their production more creative, innovative, culturally sensitive, and emotionally fulfilling.

5.2 Design for Protecting Labor

Indie game developers' strategies to protect their creativity and independence while navigating through their complex relations with the mainstream gaming industry demonstrate potential implications beyond the gaming community, which may inform design implications that are specific to the principles of mitigating exploitation. Grounded on their practices and strategies, we identify three high-level design implications for rendering the complex relations between new labor relations and technology in HCI design. In doing so, we endeavor to explore how these design implications may benefit other technology-supported labor practices beyond game development; we also attempt to push the conversation in an open manner. It should be noted that these design implications are neither complete or exhaustive; additionally, only focusing on technology design may not be the solution – it is important to advocate real changes in material working conditions as unions, communities, and activist groups.

Implication 1: Design to enhance empowerment of free labor. A participative labor culture is one that enables free labor through the empowerment of humans. However, we want to be clear: humans in a free and participative labor market should be empowered and not used. Empowerment should not come at the cost of exploitation. There must be a defined understanding and awareness of what healthy empowerment looks like. In order to develop and maintain healthy empowerment and attempt to ensure that exploitation does not falsely mask itself in the name of empowerment, both the community and technologies used within the community need to explicitly allow for the ability to protect knowledge and acknowledging achievements. In addition, exploitation deprives workers of the products generated from their labor. To mitigate exploitation, all members of the labor community should be recognized, visible, and associated with their work and products. In

this sense, free must not mean without credit or acknowledgment to avoid exploitation. Specifically, we highlight four design features that may allow for empowerment via credit and achievements.

1. *Automatic documentation and sharing across platforms.* New forms of labor communities enabled by technology often use many different platforms to conduct their work, making tracking credit and achievement difficult. Yet, this should not deter us to aim towards developing integrated systems that allow different tools to interact with each other. Within that interaction, an understanding of credit needs to be defined and automatic tracking of that credit should occur in a manner that is visible to the entire community. An example of this type of tracking would be the frequency of contributions of information to a wiki. To better develop quality of tracking rather than just frequency of instances, community members could upvote specific contributions to provide increased credit.

2. *Tracking of achievements through profiles and history.* It would be important to offer an option to highlight one's history of contributions and achievements in one's online profile within the labor community. Profiles in this manner provide a quick snapshot of one's contributions, which makes it easier not only for the users to highlight their achievements but also for others in the community to quickly and easily acknowledge such achievements and contributions.

3. *Repository of contributions.* Each member of the labor community should be given the opportunity to store specific types of contributions in a shared repository that can be accessible by the broader community or even people outside of the community. The previous two affordances aim at providing automatic summary data that can be easily consumable by the entire community, whereas this affordance focuses on creating a virtual environment where people can actually store real contributions such as mockups, code, and sketches.

4. *Identification and acknowledgement of indirect contributions.* Technology design should not only track credit and contributions of people who produce tangible outcomes and products but also identify and acknowledge those who contribute to the indirect (immaterial) processes that lead to these outcomes and products – either seen and unseen in the final product. Such contributions can both be quantified (e.g., the option to click "Thank You" on one's profile) and qualified (e.g., the option to write and send someone "Thank You" messages).

Implication 2: Design collective and united labor community to resist exploitation. Technology design should promote a proactive effort to foster collective labor relations, and not isolate a labor force, as exploitation may occur in contexts where collectivist initiatives are not apparent. For example, the collective context of a union provides both awareness and legal rights that guard against exploitative behaviors. Beyond just legal rights, unions also allow for an increased opportunity to define a community through the identification of community led values. Therefore, to mitigate potential exploitation, a system, tool, or technology should be designed to inherently allow for communities to define what that collectiveness and union are. For example, the design should allow all members of a labor force to contribute to defining what the community is and the parameters of that specific community (e.g., an about and rules page on Reddit). In addition, communication and coordination of information are fundamental to developing collective communities and behaviors. Therefore, chats and message boards should be available at a both micro (for just a group of people) and macro (entire community) levels.

Implication 3: Design for equal decision-making. The ability to equally participate in decision-making is also crucial to foster a healthy, participative, and empowered labor relation free of exploitation. To do so, it is important to afford open communication across many levels of labor force, including 1) community level, 2) the group level, and 3) the peer to peer level. This means that communication can occur at all perceived levels of importance within a community or organization, essentially allowing for no hierarchy or privilege of labor. Such design should also highlight shared goals and roles that are defined from the onset to facilitate guide when, where, and how to communicate members of the community. The ultimate goal is to provide members with the

availability to contribute to decision-making within and throughout the community and also be valued and recognized community-wide for their contributions.

5.3 Indie Game Developers' Account of Labor and Technology: A critique

As noted in the paper, our study is both empirical and critical: we have presented indie developers' view of recongfiguring labor in game development using their own accounts; we have also carefully separated our own views from theirs for further critical inquiry. In particular, viewing indie developers' practices and strategies to mitigate the potential exploitation of their labor makes our analysis more tractable: while acknowledging indie game developers' aspirations, endeavors, and promising insights for designing for protecting labor, we propose three critical questions that are subjected to their accounts, address each of them in turn, and summarize how studying and criticizing the indie community's view of labor and technology contributes to CSCW's research agenda on explicating and mitigating emerging forms of exploitation enabled by new technologies and processes.

Critique 1: Who is still excluded, and why? While the activist, non-profit oriented indie developers claim and take actions to welcome and encourage "everyone" to participate in new forms of labor, capital, and production in game development, it seems impossible (and unnecessary) to have a community that equally serves everyone. A typical example is participants' advocacy of reaching out better to lower socioeconomic status developers, implying that this community has economic barriers to entry, an awareness present but somewhat uncommon in our data. The criticism that some amateurs do not "follow through" their commitments implies a value of long-term commitment, reliability, and willingness to learn and improve, which makes various assumptions about who is participating and who is not welcomed. Our data throughout was convincing that this subset of indie community was intentionally inclusive and embracing of newcomers, but there was limited account of those that they were excluding due to socioeconomic disparities. In fact, such disparities, whether indie developers acknowledge them or not, may exclude a broader participation in indie game development. The question then becomes: is indie development an option only for those privileged?

Critique 2: Which practices and strategies seemed naïve or otherwise unconvincing? While indie developers considered their practices as alternatives to mitigate exploitation in game development, some of their strategies seemed to be overoptimistic, not substantiated by the evidence, or contradicted throughout their account. For example, the strategy of free tools contradicts strategy of independence due to the neglect of the intertwining power/labor relations between the mainstream gaming industry and the indie community: it is the very industry that they claim to be independent from that provides them with those tools. That industry does so not because it promotes participation and sharing but because it uses the indie game community as a creative resource; in other words, the indies do "pay" for those tools through the exploitation of their creative ideas and free labor. There is no definite boundary between the indie and the AAA workforces: very often AAA studios hire indie developers and AAA developers leave their studio and become indie for various reasons. Therefore, effectively indie developers also "pay" for their own professional development, which, once completed, makes them qualified labor force for the mainstream gaming industry. There is always a risk that if the indie developers ever become too progressive, the gaming industry would no longer offer them free tools or hire them, which may jeopardize the indie community's capability to create and innovate. Additionally, if the AAA industry is indeed ideologically compromised as a result of its poor representation of women and minorities (i.e., by perpetuating white male ideologies), then it follows that the tools and the professional path-ways that sustain indie developers may also be ideologically compromised in the same ways. As long

as the indie community is still dependent on free game engines and middleware created by third parties, it would be challenging to be a genuine counter culture.

Critique 3: Which claims, examples, and evidence seem worthy of reconfiguring labor in technology? We hope to highlight practices in the indie game community that embody and validate what we already know about the technology-labor relationship as well as those practices that merit recognition and replication in other computing communities seeking to explicating and mitigate emerging forms of exploitation enabled by new technologies and processes. For example, we have seen maker spaces that self-identify as recongfiguring labor and mitigating exploitation in technology in part because they have open-door policies (i.e., because everyone is welcomed) and flat organizational hierarchies (i.e., because everyone has an equal voice). Yet they seem not to notice or concern themselves with the fact that most people who enter the door are white middle class college educated men, or that a small group of individuals dominates the organization with the so-called flat hierarchy.

In summary, the subset of activist, non-profit driven indie game community has a different stance of recongfiguring labor and mitigating exploitation in technology, for which it deserves research recognition in the CSCW community. They embrace equality and openness. Yet, and this is significant, they also recognize and admit that elements of their own culture and community have failed to meet those ideals – the Gamergate incident for example. By viewing themselves as a counter movement to Gamergate, they situate their values in a critical view of their own community, seen as situated within actual social conflicts. But they do not stop at merely acknowledging the flaws. They further hold themselves (or at least some of them do) to the outcomes of those conflicts and take overt actions to intentionally pursue the desirable changes — for instance by ensuring that tech newcomers and the underrepresented are welcomed, included, and credited.

This is a different approach to recongfigure labor and mitigate exploitation than relying on an open door policy and a flat organizational hierarchy. One reason is that it is proactive; it does not wait for recongfiguration and mitigation to happen on its own, but it goes after it. Another reason is that it is tractable: if the community in general is seen as hostile to women, then the counter movement is to engage in overt acts that welcome and support women. Additionally, there is a level of reflection: we saw participants ask, should men champion women, or create conditions under which women can champion themselves? This group of activist and non-profit oriented indie game developers has developed an alternative to approach labor and technology, one which recognizes structural injustice and collective power (for good or bad), rather than merely individual freedoms. Therefore, a critical review of this different approach contributes to extending the current conceptualization of labor and technology in HCI: situating labor practices practices in actual social conflicts and real life phenomena and point to the importance of taking overt, collective actions to overcome these conflicts.

5.4 Limitations

It should be noted that this study has a few limitations. First, we understand that people engage in indie game development for various purposes and not everyone is on an anti-establishment and non-profit agenda. In this study, our analysis is scoped to the socio-technological practice of indie game developers who seek to introduce new forms of labor, capital, and production to the gaming industry. We also focus on indie game developers, game production, and the gaming economy in the USA. This sample may not represent indie game developers as a whole and indie game development as a global phenomenon. Second, there may also be a bias toward indie game developers who were active social media users due to our recruitment method. In future research, a variety of other data sources (e.g., large-scale surveys) and multi-site cross-cultural studies could

be used to reach a broader participant population and further validate findings from the interviews and online forum data.

6 CONCLUSIONS

How can HCI address the tension between the increasing demand for more just and participative labor relations and practices and emerging forms of exploitation enabled by new technologies and processes? We have investigated U.S. indie game developers' socio-technological practices regarding labor, capital, and production as an empirical basis for such discussions. Despite its niche technological stance, we see this community as a valuable sociotechnical instance that contributes to HCI studies on technology, work, and labor. Its mechanisms of free and immaterial labor, distributed collaboration, co-creation, collective visibility and innovation, newcomer-friendliness culture, and the identity as part of a counter movement against sexism in the gaming culture offer promising strategies to mitigate potential risks of exploitation of labor in technology. While acknowledging indie game developers' aspirations, endeavors, and promising insights for designing for protecting labor, we highlight how studying and criticizing the indie community's view of labor and technology contributes to extending the current conceptualization of technology and labor in CSCW. We, therefore, believe that these insights worth recognition and replication in other communities seeking more just and participative labor relations and practices supported by emerging technologies. We also believe that these insights contribute to an emerging research agenda in CSCW. Such an agenda would especially focus on how the organization of work and labor significantly impacts what new technologies and processes we can build and produce, especially with regards to how funding, power structure, production models, and work atmosphere are constantly shaping our technological innovation.

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