Breaking Barriers in Mobile Game Development

JOHANNA BREWER, Smith College, USA
MORGAN ROMINE, AnyKey, USA

Mobile games occupy more market share than PC and console titles combined, while the designers responsible for delighting billions with their app store offerings remain relatively overlooked by avid players and academic researchers alike. Marginalized game developers in particular find themselves struggling to survive in the mammoth mobile marketplace, but few studies have yet to address their unique experiences. In this paper we present the results from a participatory research project to: discover the challenges that women, people of color, LGBTQIA+, and disabled game creators face in the mobile space; and develop actionable methods for dismantling those barriers to meaningful participation in smartphone play design. After summarizing the three most prominent hurdles underrepresented developers contend with, we then lay out ten key insights about how those impediments can be overcome. The piece concludes with a dozen brief proposals for concrete programs to implement a more representative and welcoming mobile gaming environment, and a call to action for us all to take part in building that better world.

CCS Concepts: • **Applied computing** → **Computer games**; • **Social and professional topics** → **Computing occupations**; • **Human-centered computing** → **Empirical studies in ubiquitous and mobile computing**.

Additional Key Words and Phrases: game developers; mobile games; participatory research; race; gender; sexuality; disability

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1 INTRODUCTION

Mobile devices have eclipsed both computers and consoles as the primary platform for video gameplay. In 2022 half of the $184B of revenue generated by the gaming market came through smartphone apps and today one third of people worldwide are playing games while on the go [53, 54]. In addition to the hundreds of thousands of made-for-mobile games available for download on Google Play and the Apple App Store, the latest generation of smartphones are now capable of running a host of AAA offerings at high frame rates; and cloud gaming services like Xbox Game Pass and GeForce Now allow mobile devices to stream an even wider range of processing power hungry titles. Even though gaming has gone majorly mobile, game studies have not quite kept pace as most research still revolves around PC and console play. Fewer still are studies that peer behind the screens to examine the experiences of the mobile game developers making that portable magic. With this paper, we seek to shed light on the underexplored reality of those creative laborers, particularly those who have found themselves marginalized by the mainstream mobile market.

Though people of all genders, races, sexualities, and abilities are equally likely to play video games [2, 9, 37], women play mobile games on smartphones at higher rates than men [16], and

Authors' addresses: Johanna Brewer, jbrewer@smith.edu, Smith College, Northampton, MA, USA, 01063; Morgan Romine, morgan@anykey.org, AnyKey, Santa Ana, CA, USA, 92705.

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disabled folks spend more time playing casual games than their able peers [43]. Nonetheless their participation is often obscured by a lack of representation in marketing and key art, in-game characters, or central narratives. A 2023 study of major studio releases found that 79% of game main characters were male and 54% were white, while only a paltry 8% of games featured a protagonist who was a woman of color [34]; another survey found that only a minuscule 1% of recent games featured LGBTQIA+ characters at any point in the narrative [46]. In a study of 80 "indie" titles (games released by independent publishers), characters of color were found to be vastly underrepresented; and out of the 4,966 main and secondary characters from these games, a staggering 85% of them were white [42]. Addressing mobile games directly, a recent self-study by Google Play showed that 44% more of the app icons in their store featured male game characters than female ones [14].

Even though women, people of color, LGBTQIA+, and disabled folks participate in gaming as much as, and in some contexts more frequently than, their cisgender heterosexual white male peers, they endure persistent erasure from the visible industry landscape. As other forms of media like television, film, and music have risen to the demands of contemporary society by providing proportional positive representation for marginalized consumers, the video game industry has struggled to keep pace with Generation Z's rising level of expectations for equity. Indeed, a 2022 study found that what 34% of mobile gamers most want to see from new titles is more diverse characters, especially playable ones [21]. The negative impacts of this lack of diverse representation reverberate throughout the broader gaming populations by reinforcing negative stereotypes of underrepresented groups [11], and signaling to players from those marginalized communities that they are not the intended audience for these games [20, 38, 45, 48]. Studios, publishers, and game distributors have become increasingly aware of their need to take action, but the industry still contends with the cultural damage done during the crash of the 1980s when video games were rebranded as toys for young white boys in a bid to rebound the market [33]. As Carly Kocurek recounts in her book *Coin-Op Americans* this dramatic shift in fictional narratives about computer gaming helped to perpetuate the now perniciously prevalent cultural assumption that masculinity, violence, youth, and computers are inherently linked [30].

Following that fateful trend, gaming and technology workplaces have built up reputations as toxic fields where harassment and discrimination against marginalized developers are pervasive and persistent. Today, just 28% of tech professionals are women; Latinx (5%) and Black (3%) coders are significantly underrepresented; and the numbers of Native American and non-binary developers are so small they often go unreported [3, 49]. Despite those troubling trends, there are signs of positive change. 59% of respondents to 2023 Game Developers Conference (GDC) state of the industry survey reported a moderate or significant focus on diversity, equity, and inclusion (DEI) at their studios; and 91% called for harassment and toxicity toward players and developers alike to be better addressed [17]. However, to truly catch up to other industries, and shift the the balance of representation so game characters better reflect their consumers, more marginalized creators will need to be involved in the development of new mobile games. Of course, systemic exclusion is never simply undone, so it will take concerted effort from the gaming community to reset the standards of inclusion. As researchers in and of that community, we reiterate our recent *Perspective on Play*, reminding readers that we have both an opportunity, and a duty, to shine our spotlight of inquiry on complex sociotechnical issues [8]. Accordingly, we ask:

Why are marginalized game developers underrepresented in today's mobile market? What professional challenges do women, people of color, LGBTQIA+, and disabled game creators face? How might we remove some of the hurdles to participation for marginalized designers in mobile gaming?

Seeking answers to these questions we conducted a participatory research study to better illustrate the barriers faced by marginalized mobile game developers and propose concrete ways to remove those obstacles. In this paper we present the results from that inquiry. After an outline of the study's

context and methodological approach, the article summarizes the three main barriers to meaningful participation that most historically underserved mobile game creators were found to encounter. We then lay out ten key insights about those impediments and ways they can be effectively overcome. The piece then concludes with a dozen brief proposals for actionable ideas, both small steps and big swings, to usher in an era of more equitable participation for underrepresented mobile game developers.

2 RELATED WORK

When the game industry rebooted itself in the 1980s, contemporary film media from those early days of gaming began to popularize stories about the mechanization of war and to portray the "mastery of computer technologies as the domain of the technocultural male elite" [30]; this mistaken idea that video games should be for and about angry white men has dominated cultural conversation for decades. There have been growing calls for change in recent years, but games featuring women and non-binary individuals, Black, Indigenous, and people of color (BIPOC), LGBTQIA+ folks, and characters with disabilities, are still vastly outnumbered in the market despite the steady growth of the player communities those characters would appeal to [20, 24, 42, 45, 55].

Specifically within a North American context, this underrepresentation of women and people of color in game content and marketing [11, 12, 55] has been so drastic that it propagated "longstanding media stereotypes of minorities and women" [7]. For example, one of the most prevalent tropes sees white women characters depicted as sexual objects, like prizes for the hero, while Black, Latina, and Native American women characters are completely absent, thus reinforcing beauty standards of femininity in terms of whiteness and the male gaze [11, 24, 30, 36, 55]. The persistence of these representational patterns are furthermore encouraged by market trends. Christopher Near's study of female characters in video game box art showed a positive relationship between the sexualized depiction of marginalized women and the sales success of those games [36]. In contrast, he observed a negative relationship between games sales and the depiction of female central characters, or women without male characters in view. This pattern points to an economic incentive to lean on familiar forms rather than explore alternative depictions. Harmful stereotypes in games, like many other forms of media, are recursively reinforced by self-fulfilling, market-driven systems; and these forces press upon creators large and small alike. Gardner and Tanenbaum found that there was no significant difference between character representations in AAA and indie games [20], potentially undercutting some assumptions about how those ecosystems might be differently motivated.

Representations of video game characters in advertising imagery have been shown to impact the perceptions and feelings of players before gameplay begins; and while there has been noted lack of representation of characters of color, those that are included are often harmful caricatures [19]. Being exposed to negative stereotypes in advertising and in-game content, combined with a lack of meaningful, positive representation, can negatively impact perceptions of self and others, create ideas of who is and is not welcome in a gaming space, and discourage the growth of supportive communities. Cale Passmore, Rowan Yates, Max Birk, and Regan Mandryk noted in their study of racial diversity in indie games that the underrepresentation of non-white characters stands in especially stark contrast to the statistics showing that the great majority of teens of color play video games. They underscore the gross inequity of these players not being able to access the "cognitive, emotional, and social benefits" of seeing representation of people like them in their play spaces [42]. Similarly, in her foundational book *Gaming at the Edge*, Adrienne Shaw examines representation of LGBTQIA+ characters and story lines in games, and highlights how meaningful media representation can be because it serves as "an external acknowledgement of one's existence" [45].

The underrepresentation of women and people of color in game content parallels the underrepresentation of women and people of color working in the game industry. Eric Bailey, Kazunori Miyata, and Tetsuhiko Yoshida offered a deep study of the gender gap among video game company employees by analyzing how women and men are distributed across game development roles. Reviewing the backgrounds of 14,265 staff members listed in the credits for 27 representative console video games produced by top publishers, they found that there are noteworthy gender disparities across multiple sub-disciplines, and that women working in the game industry are concentrated in the "lower paying roles and outside of leadership" [3]. One of their primary recommendations for reversing this trend was to focus on increasing the number of women in game industry leadership roles.

Studies specifically focused on mobile game developers have thus far been rare, but research concerning creators of PC and console games has several decades of history. Though much of that qualitative work has centered around the specialized software engineering techniques that set game designers apart from their peers at mainstream technology companies [26, 27, 32, 35], there has been significant progress made examining not just the unique development practices, but also the parallel professional pipeline, that characterizes the gaming industry. Surveys of students in the earliest Game Design & Development programs to be offered at colleges found that over a quarter were drawn to the major because it allowed them to express their creativity, and twice as many women enrolled in those tracks compared to their counterparts in traditional CS and IT [6]. However, as those graduates try to break into industry, some of them bump into seemingly invisible obstacles. Just as in academia, gaming has a hidden curriculum.

Casey O'Donnell's research provides insight into the often opaque process behind game development and highlights some of the particular challenges faced by early stage creators [39]. Whether applying to a massive company or a small studio, prospective hires are often assessed for their "culture fit" with the team, their technical qualifications becoming a secondary consideration [23]. Hiring managers tend to prioritize candidates who are willing to work extra hours during "crunch times," putting primary caregivers with inflexible schedules at a disadvantage, and ageism plagues the industry, so those who lacked early access to essential resources for mastering the craft are often also screened out [41]. Even those who secure employment still find themselves in a precarious position due to intense studio churn, with very few developers lasting more than five years at the same company [5].

Since many marginalized folks find it difficult to fit into corporate game jobs, an enticing alternative for some is to pursue their game-making goals as independent developers. By 2017, new gaming startups were overwhelmingly focused on the mobile space [25], where self-publishing can initially seem more accessible for individuals and small teams, and less funding is required in the early stages of development. But mobile games are, and have been for some time, debuting on already mature platforms with almost impenetrable algorithms where the most common way that users discover new or upcoming games is on the app stores themselves [21]. Though many independent game developers now rely on recommendation platforms to promote their titles, as Marta Kholodylo and Christine Strauss note, they "do not feel very empowered over their products within them, even if they are formally not tied to many of the standards the contract with a publisher would oblige them to put up with" [29]. The ever rising baselines of success set by industry giants can serve to further sideline independent game developers. Magy Seif El-Nasr and Erica Kleinman explicate how the data-driven decision making that tipifies today's game development has the ability to inflict real harm by increasing the tendency towards predatory monetization, misrepresentation, and exclusion of already marginalized folks [15]. To counteract such forces, Jennifer Whitson, Bart Simon and Felan Parker call attention to the need for adequate funding for indie game development, specifically underscoring the crucial role that consistent and sustainable support plays in the growth

of emerging industry sectors [52]. Pressing further, Egrin Bulut highlights the inequities inherent to the game development process by mapping the mechanisms of exploitation that underrepresented independent creators are up against, and motivating the need for more mindful investment in the health of the industry [10].

A growing number of HCI and game studies researchers are turning their attention towards the intersectional inequities that game developers currently contend with. Solip Park, Annakaisa Kultima, Miikka Lehtonen, and Jeanine Krath's recent 2022 article examines how the globalization of the game industry is having an isolating effect on many of the digital nomads whose labor fuels the international entertainment engines [40]; while a resonant piece from Elizabeth Caravella, Rich Shivener, and Nanditha Narayanamoorthy traces the effects of the COVID-19 pandemic on the mental health of game developers who were pushed into remote work situations. Their mixed methods study found that women and non-binary developers experienced more negative effects than men in the workforce, and the authors urged that further studies should "focus specifically on how women and marginalized developers are coping with the industry's new normal" [13].

For inspiration as we pursue that very project, we can look to Jozef Kulik, Jen Beeston, and Paul Cairns's recent paper outlining a grounded theory of accessible game development which offers an excellent example of how ethnographic methods can provide a rich understanding of the challenges to embracing inclusion that designers face [31]. Their exploration helps highlight the systemic nature of the impediments to implementing accessible game features, and encourages the ideation of solutions beyond the level of individual developer actions, towards more holistic approaches at all levels of gaming organizations. Echoing that mandate, we align ourselves with the recent wave of researchers exploring more broadly how the application of alternative frameworks such as Critical Race Theory [38], Black Feminist Thought [44], and Anti-Racist HCI [51], and the reimagining of community-centered participatory design processes [18, 22, 28, 47, 48], can offer productive ways to disrupt persistently exclusive cultural barriers. Our intention with this piece is to extend that critical yet generative lens to the mobile gaming arena.

3 METHODOLOGY

Barriers to entry and participation in mobile game design clearly exist, but there has been relatively little inquiry into these obstacles or their impacts on marginalized developers. As we began our own research into the area, our team was struck by the lack of available statistics regarding developer participation across various mobile game platforms. Even our research sponsor Google Play was unable to offer demographic information about the programmers who distribute games through their app store. Collecting and verifying data about the personal identities of independent game designers and small studios is not a straightforward task, and so unfortunately metrics about underrepresented creators often go unmonitored. Even without an accurate quantification of the extent to which marginalized developers are represented in the mobile game space, there is still much to be learned from qualitative data about their experiences. Accordingly, we adopted a multi-modal strategy to engage in a multi-sited ethnographic study of underrepresented mobile game designers from a broad range of backgrounds.

In late 2022 we undertook a preliminary area study that started with context analysis of public game developer spaces including the presentations and discussion boards for GDC and IndieCade, as well as the discussion spaces for the International Game Developers Association (IGDA) and their relevant special interest groups (SIGs). In addition to analyzing the contemporary discourse about industry challenges in these professional venues, we also reviewed a series of public subreddits and invite-only Facebook groups. In these community-moderated spaces we were able to find informants with direct experience as marginalized folks in mobile game development. We conducted in-depth, semi-structured interviews with three of those key informants who were willing to voice

their perspectives and experiences as industry professionals who had been marginalized in the mobile game industry space because of their gender, race, disability, and/or sexual orientation. These informants also pointed us towards other potential interviewees that they had positive community connection with thanks to their shared experience of being underrepresented game-makers.

Complimenting this cohort, we facilitated online community discussions in private Facebook forums and Discord chat servers with other participants who had nuanced knowledge of both the indie game scene and the AAA development circuit. These conversations helped to expand our contextual understanding of how underrepresented creators fare in the broader game industry. Our team intentionally talked to folks who had worked on different kinds of mobile game projects, from those who had launched their own independent mobile games, to developers who created offerings for larger companies with vast catalogs of mobile titles. During this initial context analysis, we engaged approximately twenty informants in small group discussions and conducted five individual semi-structured interviews. Our diverse group of informants included the voices of self-identified: women, non-binary and trans programmers; Black, Indigenous, Latinx, and People of East Asian and South Asian descent; neurodivergent individuals; creators with disabilities; and LGBTQIA+ folks–all of whom had personal experience with, or grounded knowledge of, mobile game development.

Upon completion of this foundational study of the area, our focus shifted to designing and organizing a participatory research workshop with the intention of collaboratively uncovering viable strategies to dismantle the barriers faced by marginalized game makers. We recruited a group of people working in mobile game development who could represent a diverse array of perspectives and experiences as marginalized developers themselves. Pulling from the pool of informants and informant referrals that we cultivated during the initial context analysis phase, we invited ten underrepresented mobile gaming professionals, two games researchers who study inclusion and representation in games, and three AnyKey staff members for a remote workshop held March 30-31, 2023 on the interactive virtual platform, Gather. For six hours over the course of the two-day event, the participants shared richly detailed accounts of their experiences and offered ideas for improving the mobile game industry.

Our team facilitated large group discussions and smaller breakout sessions to explore the problem space in deep detail during the workshop. On the first day, we aimed to lay the foundations for community building and identifying common ground by starting with a prompt for participants to share more about themselves, including what inspired them to make games and how they first got started in the industry. After those introductions, we organized breakout groups, each with a diverse mixture of perspectives, rather than aggregating people by identity trait or industry background. The groups were tasked with: outlining the distinct phases of the mobile game development pipeline; summarizing the goal of each phase; and identifying barriers they had experienced or observed along the pipeline. During the activity participants discussed things like early ideation, team building, platform/tech-stack selection, prototyping, funding, distribution, marketing, metrics, and user engagement. Breakout teams then reported back to share their outlines, and together we used a collaborative Miro board to identify the collective's most commonly cited barriers.

On the second day, we began by soliciting "sparks of inspiration" from the participants, asking folks to describe examples of standout strategies that they had seen successfully implemented in games or other media spaces to meaningfully address the barriers to inclusion faced by marginalized creators. Several participants had mentioned such programs during interviews from the context analysis phase of the project, so we prompted them to discuss those in more detail with the larger group. Other participants followed on, sharing their examples ad hoc. The types of programs surfaced included concepts like editorial spotlight campaigns, mentorship, childcare support, app store features, media coverage, conference scholarships, skill-share events, investor funding, crowdfunding, and community networks.

For the second breakout group activity, we revisited the list of barriers generated on the first day, and asked participants to rank which obstacles they were most interested in tackling. Based on those preferences, we organized attendees into three barrier-breaking groups; and springboarding off of the inspirational examples of successful initiatives discussed at the start of the day, we asked the participants to propose a series of "power-up programs" given three different funding levels: $10K, $100K, and $10M. We urged them to articulate the potential impact they might expect from each program idea, and to consider which aspects of their proposals might help the initiatives be maximally supportive of developers from all marginalized groups. After this exercise, we collectively reconvened for a final discussion to share and evaluate all of the proposed ideas with the full workshop cohort.

In order to foster candid conversations and preserve the privacy of our participants, rather than video recording the event, we captured the output of the workshop through extensive live note-taking, chat logs, collaborative Miro boards, and anonymous post-workshop surveys. With this robust qualitative dataset in hand, we continued the analysis we had begun with our participants. Through a series of individual work sessions and group meetings in the months following the workshop, our team members identified the open codes repeating throughout the data, drew out the axial connections between them, and ultimately developed a grounded theory to: identify the biggest barriers faced by marginalized mobile game developers; distill key learnings from their hard-won experiences; and outline a playbook of actionable ideas for improvement. In the remainder of this article, we present those findings.

4 BIGGEST BARRIERS

Before we can set about dismantling the barriers that prevent marginalized game creators from meaningfully participating in the mobile market, we must first develop a clear understanding of the obstacles we seek to remove. While nearly all game developers are aware that systemic discrimination is an issue in the industry, many of the cisgender white men, who are overrepresented in the space, have not experienced identity-based prejudice firsthand. Similarly, the everyday bias that underrepresented folks can encounter often differs greatly depending on their personal backgrounds and professional workplaces. It is therefore vital that we ground our proposals for change on a solid awareness of the overarching issues that affect the ability of all marginalized game designers to equitably engage with the industry. Though our methodology relies on the individual stories our participants have shared, the results of our analysis reflect the universal patterns that women, people of color, LGBTQIA+, and disabled game developers are collectively up against when they attempt to operate in the mobile game space. This section identifies the three biggest barriers that affect underrepresented creators and explicates the nature of each of those deterrents in turn.

Homogenous Leadership, Performative DEI, and Exploitation

Perhaps the most complex and entrenched cultural obstacle that marginalized creators contend with, is the one which plagues our society at large: white male dominance. While the undercurrent of toxic masculinity in the broader gaming industry surged into the public spotlight with Gamergate, that hardcore level of harassment in some ways eclipsed the far lowerkey forms of discrimination that exist, ones that deserve our attention because they should prove far easier to address. To counteract the subtle, unintentional bias that disadvantages the peers we hope to meaningfully support, we merely have to recognize our own individual privilege, and acknowledge that we will need to pass some of it along to those with less if we are to rebalance the playing field.

As highlighted previously, the game industry remains predominantly white and male [17]. Participants in our workshop corroborated these statistics with their own work experiences,

indicating that the mobile sector lacks diversity, and, by many accounts, is even less diverse than development communities for PC, console, and virtual reality (VR). Owing to this persistent demographic trend, those in leadership roles also tend to be white men; and when the people in positions of power share a similar background, when they all experience moving through the world with similar kinds of privilege, then those leadership teams have limited perspective on what it is like to be one of the few, or only, representatives of a particular gender or race in the metaphorical room. In such environments, the minority employees are more likely to be truly marginalized and treated as outsiders in their own workplace. Outsider status can make marginalized employees more likely to be undervalued, underpaid, and laid off when budgets tighten. These patterns are sometimes explained away in human resources (HR) terms as "poor culture fit." But without deeper reflection by those in leadership positions, it is impossible to determine if a marginalized employee has not fit into the company culture because they have vastly divergent values, or because their coworkers are biased against them as a member of a minority group who does not share their majority perspective.

Homogeneity at the leadership level presents even further challenges for marginalized developers. Our participants reported disappointing experiences with DEI initiatives undertaken by their own companies that they described as being *"ultimately performative."* Company leadership would tout these programs as headline news of positive progress, but initiatives were short-lived and undersupported. Every participant had a story about a program that seemed so promising at first, but then was only funded for a brief time, and fell short of creating meaningful change when donors or managers were not willing to continue sustaining the effort. In particular, one attendee called out the damage done by: *"the surge of very loudly, publicly greenlighting projects from Black devs a couple years ago, then funders quietly withdrawing support, and the initiatives disappearing."*

No matter how well intentioned, taking social credit by publicizing programs that support marginalized folks, and then failing to follow through on those commitments, amounts to performative diversity-washing. Whether accidental or intentional, this all too common public relations practice is exploitative as it ultimately enriches the reputations of major donors and studios at the (sometimes devastating) expense of independent creators. Similar exploitation was found to occur internally as well. Participants recounted instances of corporate leaders asking marginalized workers to invest their time and knowledge into a new DEI initiative, emphasizing how their perspectives would ensure the development of an effective program, only to then have management cancel the whole thing a year after launch. Repeatedly tasking minority developers with extra work that leads nowhere is not only demoralizing, it also wastes precious cycles those designers could spend creating games. As one underscored: *"Performative DEI initiatives rob our time and energy."* Indeed, Sara Ahmen's eye-opening work on systemic discrimination demonstrates precisely how such performative DEI initiatives perpetuate the institutional harms they purport to remediate [1].

While we may not set out to put already under-resourced creators into more precarious positions, it is essential to acknowledge the damage wrought by spinning up new initiatives that we encourage developers to count on, only to slash those programs shortly thereafter. Going further, a number of workshop participants described their personal experiences with an even more troubling trend in setting marginalized folks up for failure. Several women in the group shared how some of what they thought were their biggest career opportunities turned out to be *"Glass Cliff"* offers, which one game developer defined as: *"promotions into positions of greater responsibility, visibility, and leadership in times of crisis, or when the success of a project was already seen as beyond rescue."* Here we can see how: a lack of meaningful diversity in game company leadership can breed an exclusive studio culture; that pats itself on the back for engaging in illusionary DEI efforts; which ultimately lead to the exploitation of the very colleagues they purported to want to uplift. Though it may be unpleasant to admit, we must flag this critical bug in our cultural code so it can be fixed.

Lack of Guidance, Support, and Resources for Newbies

Given the challenges posed by breaking into the industry as "outsiders," marginalized game creators are more likely to pursue an independent development path for their projects. Landing a full time position at a big mobile game company is often not a viable option for those without financial means or social connections; so underrepresented and under-resourced creators often find that going indie is the only route available to them. While that unfettered approach may sound ideal, as we have seen with the proliferation of the gig economy, when the only option for work available to marginalized folks are precarious "independent contractor" positions, then "entrepreneurship" quickly becomes just a polite euphemism for labor exploitation. Those who are determined to make a living making mobile games must therefore get especially creative to achieve their goals.

One of the most significant stumbling blocks our workshop participants identified was the glaring absence of accessible educational resources for new developers to learn about the particularities of the mobile game development pipeline. Describing why breaking into the sector was so frustrating, they explained: *"Mobile game development is a black box; it's more opaque. There is not enough light shed on the mobile game dev process."* When the only way to learn how to launch a successful mobile title is to get a job at a AAA studio, but those roles are out of reach for folks outside a certain demographic, this Catch-22 further calcifies that exclusionary culture with the creation of insider knowledge. But this cycle could just as easily be interrupted through intentional education and information sharing.

A workshop attendee with film and television experience surfaced the comparative wealth of resources for aspiring underrepresented directors, writers, and showrunners. Online learning portals for honing writing and production skills, as well as guides about the pitch process, are relatively easy for first-time filmmakers to find. Even better, there are grant programs intended specifically to support writers from minority backgrounds with funding, hands-on workshops, and networking. Yet currently, very few comparable programs support independent and marginalized developers in the mobile game space. This lack of material support affects not only nascent creators, it also negatively impacts those who have honed their skills in the sector when seeking funding for their own project. Marginalized designers working outside of AAA studios encounter extreme challenges when fundraising because their games often do not fit the mold set by the latest trending titles in the mobile marketplace. As with corporate leadership, investors in mobile games also tend to be white men; and those early-stage angels are more likely to invest in projects that reproduce mechanics and objectives that they themselves enjoy, and pick games with storylines that appeal to their particular perspectives.

Though there is nothing inherently wrong in going with what you know, when it happens on an industry-wide level, this phenomena creates an echo chamber effect wherein games from marginalized creators offering new mechanics, narratives, and viewpoints find themselves shut out from the economic conversation. Even when given an opportunity to pitch, several participants recalled struggling to convince investors about the value of their first mobile game because they were unfamiliar with the demands for certain analytics targets or could not meet expectations for a *"hyperspeed timeline for user acquisition"* that appears to be commonplace in the AAA mobile market. Clearly we can recognize now that the opacity of the mobile games sector makes learning and navigation a serious challenge for new developers, especially ones from marginalized backgrounds. Those who were lucky enough to make it inside without struggling to find their way likely had appropriate guidance; they never had to stumble over the obstacles that went unilluminated for their peers and thus have little ability to recognize the hazards. Shining more light on the hidden mechanics of the mobile game pipeline would surely be beneficial for all involved.

Oversaturated and Rigid Market that Excludes Fresh Voices

In the earliest days of the mobile market, some of the most successful games were created by independent developers. Titles like *Flappy Bird* [G1] and *Monument Valley* [G2] put the sector on the financial map thanks to their explosive popularity, but as is often the case in other creative niches, once big studios with deep-pocketed investors began competing for market dominance, the independent voices that made the space so vibrant were pushed back into the margins. Without multi-million dollar marketing budgets, emerging mobile developers could barely compete in the discoverability arena. As app stores grew, their recommendation features began to rely more heavily on user engagement metrics to drive discovery. By surfacing games that maximized the same performance metrics that investors were prioritizing, marginalized creators found themselves quietly being cut out from the loop.

One of our seasoned participants briefly summarized that history by saying: *"Indie devs are early adopters. They were early on iPhone. They are early on VR. They are nimble and can take risks. The first few indie games are hits; the community flocks to the platform and it starts to be swamped. Then the bigger studios come on board and crowd out the indies with their access, use of analytics, retention methods, and marketing dollars. With mobile the big shift came through F2P [free-to-play] which made it unsustainable for indie games trying to make money on the platform."* Other workshop attendees concurred that the F2P model has shifted the overall production and funding pipelines of mobile games in a way that makes success in the market far less attainable for indie developers. They described the investor expectation that early stage games should release beta tests which show impressive user acquisition and retention numbers before they will commit to funding support.

This criteria for capital investment becomes an insurmountable barrier for independent creators who do not have the savings to support 6-12 months of startup development work, let alone an advertising budget to reach millions of users in an oversaturated market. Expressing their disenchantment one developer quipped: *"Mobile F2P is essentially a marketing industry that has games tacked on at this point."* Marginalized game developers have found themselves contending with a set of serious obstacles to achieving success in the mobile sector. These participation roadblocks are not features of a thriving and vibrant marketplace; they are legacy barriers that restrict our collective enjoyment. But if we do not work swiftly to remove them, those who have had persistently unwelcoming experiences in the scene will likely move on to more inclusive platforms.

5 KEY LEARNINGS

Now with an extensive illustration of the complex problem space, we have a shared foundation to collectively consider. Reflecting, it is plain to see that marginalized mobile game creators face bigger barriers to meaningful participation in the market than many of their colleagues, especially those in positions of power, often realize. Of course, having laid bare the vast disparities at play, the scope and scale of the issues may suddenly seem daunting. Yet as emphasized earlier, grappling with that big picture is the best way to uncover insights necessary to break down the wall of obstacles keeping underrepresented creators out. By analyzing the overarching challenges of our individual research informants we developed a series of well-grounded maxims that capture the essence of our findings; in this section, we present ten key takeaways from our study that distill the knowledge gathered from our participants' diverse experiences into more quickly digestible learnings.

1️⃣ Spaces led by marginalized folks are more inclusive for all.

Diverse leadership teams are more capable of supporting and inspiring employees with a broad range of perspectives, backgrounds, and values. They can better understand the challenges faced by marginalized members of the company because typically they have contended with some of those

obstacles themselves. Such leaders are also better equipped to identify and implement policies fostering a welcoming and inclusive culture for all members of their team. Achieving proportional representation can be challenging for organizations trying to overcome a dearth of diversity. Indeed, corporate managers regularly report that despite efforts to hire leads from marginalized backgrounds, they are unable to find qualified candidates. While investment in support programs targeting early career stage development will increase the diversity of talent entering the pipeline, executives would also do well to reexamine the process by which suitable recruits are identified for leadership roles. Creatively rethinking the scope of potential qualifications could invite a far broader pool of candidates.

2️⃣ Sustained DEI outcomes require long-term commitments.

Creating positive social change, especially in spaces where cultural practices are already established, can take years. DEI policies are most effective when baked into a company's fundamental values and actively championed by designated members of the leadership team. One participant shared: *"Something very powerful to me is that every ERG [Employee Resource Group] at Zynga has an executive sponsor to make sure there is a seat at the table!"* Seeing measurable change in the balance of representation of mobile game creators will require funded programs that directly support marginalized employees and establish a feedback process with clear accountabilities.

3️⃣ Funding without strings attached has the most impact.

Giving capital directly to marginalized developers, with no strings attached, has the greatest potential to generate significant positive impact. Unrestricted funds encourage creativity, empower career growth, and mitigate the risk of burnout for vulnerable group members; yet many existing grant programs require outputs from their grantees like extensive reports or demoable prototypes. While funders may consider requesting information or setting milestone targets to be benign forms of guidance, such requirements often place an outsize burden on independent developers who struggle to achieve their goals under such constraints. Relaxing restrictions on the deliverables that recipients are beholden to produce as "proof of value" to the sponsor ensures that the funding is 100% beneficial to the marginalized folks who received it.

4️⃣ High metric requirements exclude under-resourced creators.

Hinging app store placement and funding opportunities on marketing reach only perpetuates exclusion. Marginalized developers working on independent projects struggle to raise money in the mobile market because investors expect early stage games to achieve extraordinarily high levels of user engagement before they will provide seed funding. Major studios have resources to back speculative projects, including marketing teams to recruit users for the beta tests needed to generate the acquisition and retention stats that funders desire. Indie developers, who often do not have the capital to get to that expected stage of development on their own, are thus unable to compete in a metric-driven market.

5️⃣ Visibility boosters are necessary in a saturated market.

Discoverability in the saturated mobile games market is driven by massive advertising outlays that independent developers can seldom afford. As one summarized: *"It is hard to get media attention for 'niche' titles when you have way less marketing budget."* Alternative mechanisms for raising visibility, such as editorial features and publisher highlights, go a long way to help marginalized indie developers find a larger audience. Social media campaigns and content creator partnerships are excellent ways to amplify games by underrepresented creators. While such organic marketing

efforts are often coordinated by charities and community organizations, the most effective visibility initiatives supporting marginalized developers are those done directly on publisher platforms where players come looking for new games to explore.

6️ Burnout is a big problem; careers average a mere five years.

Common industry practices like "crunch time" contribute to increased stress and decreased quality of life for developers across all gaming sectors. These stressors are exacerbated for marginalized developers who are more likely to also face bias and discrimination in the forms of lesser pay, fewer promotion opportunities, outsider status, and sometimes even direct harassment. Elevated burnout rates are thus the result of all these deleterious factors compounding in an already high-pressure environment, with careers averaging just five years before most underrepresented folks tap out. Women working in the game industry often find themselves squeezed out even sooner, especially when they have family to care for at home. Regardless of their race or age, women in the United States conduct 70% of the essential domestic labor like housework, child rearing, and eldercare, that keeps society functioning [4, 50]; and those extra responsibilities are often impossible to fulfill during 80-hour crunch weeks.

7️ Support networks play pivotal roles in cultivating success.

Social networks offer members not only emotional support and empathy from people with similar career experiences, but also opportunities shared by those who want to see their friends and colleagues succeed. Being marginalized often means feeling isolated from the most visible social scenes within a workplace; so proactively connecting marginalized folks with supportive networks of like-minded peers can be a means to upend exclusionary cultures. Creating structure for social support and opening access to the opportunities for success can give a meaningful boost to a budding career.

8️ Multi-modal mentorship is essential for career growth.

Effective mentorship in the mobile game industry is urgently needed across multiple modes. Whether it be for early-career direction or seasoned consultation, as one exasperated informant expressed: *"There is more mentoring, training, and support available if you aren't from a marginalized group."* While all developers benefit from having long-term mentors to guide them through different stages of their careers, this can be especially true for folks from minority groups. Intentional programs fostering longitudinal support are necessary, but so too are more lightweight opportunities for targeted assistance. Engaging with advisors that can offer expert counsel on specific game development challenges or workplace dilemmas can be especially enriching for marginalized folks without extensive industry networks.

9️ Dedicated mid-career assistance encourages longevity.

Developers who have already been active in the industry for several years need different types of support than those who are just starting out. Unfortunately, there are far too few programs and initiatives specifically tailored to the needs of mobile game developers who are grappling with mid-career issues like advancement decisions and managing work-life balance for developers with growing families. Placing more emphasis on providing assistance for those who are beginning to be besieged by burnout will ensure that marginalized developers are able to stay in the game long enough to take on leadership roles.

🔟 Accessible on-ramps ensure new devs enter the arena.

Unlocking the black box of mobile game development can be exceedingly challenging for those without a guide. Offering educational resources about the particularities of the mobile pipeline and instructions on finding a receptive audience of players in a saturated market would provide much needed demystification for newcomers. Mapping out walkthroughs for first-time mobile game designers will make participation more accessible to all those interested in applying their talents to the industry, thus encouraging more vibrant creativity and healthy competition in turn.

6 PROPOSED INTERVENTIONS

Having distilled key learnings about the overwhelming obstacles marginalized developers face, the seemingly staggering complexity of the issues fades away, leaving far more manageable matters. Shedding light on the situation, the shadows of doubt recede; and now any lingering fears that there is no way forward can be confidently set aside. Following the trend lines woven throughout those telling takeaways, we start to see clear directions for worthwhile interventions. As signposted early on, our ultimate objective with this study was not only to illustrate the barriers that prevent minority creators from meaningfully participating in mobile gaming, but to propose viable strategies for how we might efficiently dismantle those hurdles, and ideally usher in a more inclusive industry culture for all. The developers who attended our participatory research workshop, whether newbies in the mobile scene or seasoned senior executives, explicitly shared that goal of bringing about structural change to meet this moment.

Building on the generative energy that our participants brought to the virtual room, we devoted the second day of the event to identifying the implementable ideas most likely to yield sustainable DEI outcomes. Several informants helped us kick off day two by presenting "sparks of inspiration": existing initiatives in the game industry they thought would be worthy of emulating. Later, we broke off into smaller working groups to collaboratively brainstorm a series of "power-up programs": actionable solutions addressing one of the three barriers identified on the first day. We specifically prompted participants to offer interventions that could be executed at three different levels of funding scale, asking them to imagine how they would most effectively utilize: a $10K grant from a non-profit; a $100K corporate sponsorship; or a $10M VC investment. Drawing from the deeply-informed ideas of our research workshop attendees, the insights uncovered in the original area study, and our experiences as a non-profit organization striving to increase inclusion in gaming, we synthesized a short list of the dozen most promising programs that any organization seeking to welcome more marginalized mobile game creators would do well to implement. In the remainder of this article, we outline the fundamental parameters for each of those barrier-busting interventions.

Early On-Ramps

Though it is essential to address the high churn and burnout rates that contribute to the attrition of marginalized mobile game developers, it is equally important that we focus on the experiences of those new to the sector. While some of the initiatives shared below may be deceptively simple, it is important to remember if we are unable to meet the basic needs of those navigating the mobile development space for the first time, it is unlikely we will be able to retain them in the longer term.

📋 ***Resource List.*** Over the course of the workshop, participants surfaced numerous examples of existing programs doing excellent work to support marginalized game developers. Many of those in attendance were surprised to see how long the running list of initiatives we began to tally grew, and several expressed wishing they had known about some of the opportunities earlier. As an immediate response to that clear need, we compiled a spreadsheet with relevant details about these resources and circulated it to our informants; but as an obvious next step, opening such

a reference list up for public consultation and contribution would provide a clear benefit to the community. Even a lightweight low-cost intervention like a resource list would be a massive boon to new developers who find themselves struggling to break in.

👩‍🏫 ***Job Coaching.*** Though many marginalized creators ended up taking the independent route to publishing their first mobile game, they often follow this path because securing an entry-level position at an established game studio is not a viable option. To develop a wider talent base, comprehensive coaching programs for those entering the job market will be needed. Publishing and platform companies alike would do well to spin up in-house programs that offer on-demand resume review and interview coaching for aspiring mobile devs. Similarly, game studios and tech companies might consider sponsoring hands-on coaching events at college campuses as a meaningful extension of traditional recruitment fairs. If we are sincere about our desire for more diverse candidates, then we must make more effort to guide them through what has unintentionally become an opaque application process.

🛠️ ***Learn How-Tos.*** Knowledge, both technical and social, is key to unlocking the black box of mobile game development. While learning the ropes in other industries like film, television, music, and even software engineering can be quite approachable, the mobile game sector is far more insular. Sponsoring recurring educational events freely open to the public would go a long way towards equipping a new generation of developers eager to enter the pipeline. Such effective learning-focused events could take on a variety of forms, both in-person and virtually. Game jams (similar to hackathons) themed around specific mobile platform technologies would help introduce essential tools and techniques in a fun, community-oriented atmosphere. Brief micro-courses introducing topics like short-form narrative, mobile marketing, or app deployment could be facilitated by seasoned professionals as part of a corporate outreach program or independently as a hybrid summer camp. Offering educational opportunities explicitly tailored to the needs of budding mobile developers sends a clear message that newcomers are welcome in the space.

Mid-Career Boosts

Underrepresented game designers who endure in the mobile industry for three years quickly find that they have become veterans in the space. If we hope to see those developers continue past the average five year mark before being churned or burned out, then it is imperative we invest as much, if not more, of our collective resources into sustaining mid-career creators.

🖐🏾 ***Hands-On Workshops.*** Lightweight learning opportunities are excellent for drawing curious new developers to the mobile space, but battle-weary creators with published titles under their belts have often outgrown game jams and bootcamp courses, and are more likely to be organizing those events than attending. Instead, mid-career developers benefit most from hands-on educational workshops that are organized specifically for marginalized creators to build community and share their hard-won insider knowledge amongst peers. Establishing seasonal programs, with regular application cycles, that are designed as sustained skill-swapping opportunities for a selected cohort of underrepresented developers would be a substantial boon to the industry. While tailored workshops following this format are plentiful in other media sectors, the mobile gaming field is wide open for a sponsor to show their commitment and leadership by underwriting a series of workshops to uplift marginalized mid-career creators.

🧯 ***Burnout Respite.*** Flashy initiatives, programs that promise more productivity, and event announcements that command news headlines are most often the ideas that grab our attention. Executives focused on maximizing the impact of every dollar spent will accordingly gravitate

towards DEI proposals that offer the most bang for their buck. Nonetheless, it is sometimes the simplest aid that is truly the most effective. Repeatedly over the course of the workshop our participants surfaced the need for meaningful respite from the burnout they had faced during the midpoint of their mobile careers. Working parents, programmers caring for elders, and not-so-recent graduates struggling with student loans all reported feeling plowed under by the demands placed on them while trying to secure their spots in the mobile game sector. Sponsoring sabbatical-style short-term leaves, in the form of one-time grants that allow mid-career devs to catch their breath and regroup, would doubtless be a celebrated lifeline for the community of minority creators.

🍼 ***Conference Care***. The need for relief from the outsize burdens that fall on women and other marginalized game designers became clear through our research; and workshop attendees further underscored how resources tailored to caregivers can dramatically improve their ability to participate in the field. Establishing oneself in the industry, landing a lead engineer role, or getting your game funded, often requires some serious professional networking. Conferences like GDC and PAX are crucial spaces where deals are made, but they can cost thousands in ticket fees, transportation, and lodging to attend. For those already struggling financially, sponsoring free kindercare and family support programs at major conferences would unlock participation for many folks trying to make ends meet in this precarious market.

Multi-Modal Mentorship

Educational and financial support are essential elements in seeding and sustaining the careers of marginalized mobile game developers. Meaningful mentorship is equally indispensable to ensuring healthy professional growth. Yet minority creators often lack access to this less tangible, less visible, resource. The chance to connect with folks who understand your career challenges, and can help you overcome them, is so often the missing ingredient that defines the experience of being underprivileged. Marginalized developers are in urgent need of mentorship support, and the overstretched minority mentors who are currently filling that gap direly require real recognition and material resources.

🧙 ***Guide Matching***. Long-term mentorship can drastically impact the longevity of anyone's career, but this is especially the case for folks treated as outsiders in the field, who often endure regular discrimination and harassment. Having a committed coach in one's corner can alter a career arc; in moments where throwing in the towel seems like the only option, a good mentor can help you summon the strength for another round. Standing up and sustaining mentorship matching programs could provide much needed structural support for marginalized mentees and mentors alike. Creating a virtual center, or funding an existing local program to go national, would both be wise ways to lay the foundation for multi-stage mentorship to flourish in the mobile sector.

🎯 ***Expert Hub***. Cultivating the deep commitments that underpin long-term mentorship relationships is not a trivial effort; such bonds take time to grow, as do the programs which nurture them. Those eager to see more immediate growth in the mobile game industry might consider underwriting targeted initiatives that provide marginalized developers with timely guidance about challenges they face in the moment. Currently, there is no centralized spot where mobile game developers can go to seek help for specific problems or pose one-off questions. There is an obvious gap which a major studio or distribution platform can step up to fill; starting up and staffing an expert hub open for half hour drop-ins would give all creators a chance to connect with seasoned mentors when they need them most.

🤝 ***Co-Op Mode.*** Soaking in the wisdom of seasoned colleagues helps those aiming to follow in those footsteps chart a clearer course. While getting seasoned guidance can be great, sometimes it is our peers that are more capable of showing us the way. As with other modalities, peer-mentoring programs centered around mobile games are sorely lacking in the space. Partnering with grassroots community organizations that run Discord servers and local meetups for marginalized folks in the industry would help elevate awareness of such organizations and further build the critical bonds between peers that foster empathy, solidarity, and moral support.

Game-Changing Innovations

Focusing funding towards the low-hanging, sometimes less glamorous, fruit that waits ripe in reach on the tree of progress should surely be the objective of those overseeing DEI budgets in the coming quarters. Nonetheless, if we are to make big changes in the mobile game industry, then those with deep pockets would do well to take a few big swings. Underwriting a landmark initiative, and following through with a seven-figure commitment, would demonstrate to all mobile developers that those leading the industry are truly serious about enacting substantial social change.

📚 ***Endowed Scholarships.*** Graduate degrees in game design are relatively rare, and entry into the programs can be incredibly competitive. Many first-generation college students are already confronted with a resource gap when entering the field of computer science, and given that such a STEM background is often the prerequisite for master's-level study in game design, these marginalized students can feel that they have fallen behind in the race to join the game industry before they even knew it had begun. Endowing a recurring full-ride scholarship to support a marginalized game designer studying mobile development at a major university would be a banner-waving initiative that demonstrates how invested the community is in supporting new voices.

🎮 ***Developers Union.*** People are the reason games get made, and unions representing the interests of those people would be especially beneficial for marginalized industry professionals who suffer the most from exploitative employment practices. Efforts to unionize within the game industry are still new and few, but they demonstrate that there is a burgeoning will among game developers to use their collective power to push for more sustainable and equitable employment policies. Creating new workplace standards through collective worker action could unlock a chain reaction of improved game studio conditions across the whole industry. An initial outlay of funding would enable these emerging worker groups to support organizing efforts and hire the legal counsel needed to navigate union laws and negotiate new contracts.

🚀 ***Million-Dollar Moonshots.*** Funding without strings attached yields maximal impact amongst all of the methods for support we have highlighted. Accordingly, sizeable outlays of financial assistance can make even more enormous waves of change. Investors are often reluctant to take big bets on unproven talent, but without shooting for the moon, we would never have gotten there. Seeing a major donor step up to underwrite a dozen million-dollar grants for marginalized game creators seeking to found their own studios would be a momentous inflection point for the industry. For mobile platforms to decisively expand their reach, and stay in the rapidly changing game, a bold move to bring the underrepresented programmers to the party could inject new life into the industry.

7 CONCLUSION

Not long after breaking ground on our study of the barriers to meaningful participation that marginalized developers face, we were confronted with the fact that relatively little work had been done to address the unique challenges of the mobile game space. While many of the symptoms of

discrimination and exclusion endured by underrepresented mobile game developers are similar to those experienced by their marginalized peers programming PC and console releases, the particulars of the mobile landscape offer unique potential for innovation. Taken together, the technological accessibility of cross-platform mobile game development engines like Unity and Godot, the relatively low funding requirements of solo developers and small independent teams, the ease of self-publishing a game on one of several popular mobile platforms, and the built-in global audience of potential players, are a unique set of features that gives mobile games the astounding potential to be a site of success for developers who want to create games that tell underrepresented stories with the perspectives of marginalized characters. The mobile games economy is massive, yet it is itself marginalized in the mind of the mainstream market. Our work helps us begin to see that the experiences of marginalized mobile game developers tend towards the outer limits of the spectrum, and at the vanguard there is opportunity to learn more about how to make change.

There clearly exist significant gaps in both academic scholarship, and practical industry approaches, that grapple with the underrepresentation of marginalized voices in mobile gaming. While this article begins to fill some of those lacunae, more work must be done if we are to manifest a substantial paradigm shift. Over the course of this paper, we have moved the needle of knowledge about mobile game development forward for others to reflect upon. Through our work, we identified and explicated the three biggest barriers preventing women, people of color, disabled, and LGBTQIA+ developers from thriving in the mobile sector. From this fresh foundational understanding, we distilled ten key learnings that bring clarity to the nature of those obstacles. Finally, we proposed a dozen initiatives to directly address the issues uncovered through our in-depth participatory research study.

This piece offers a foundation for those who find themselves unmoored during their initial investigations as we did; but it is only just a base camp for mounting deeper inquiries. To build on our findings, wider-reaching longitudinal surveys that quantify and further explore the efficacy of various initiatives should be done. And just as with mobile game development itself, more researchers representing a wider variety of perspectives should be designing and conducting those scholarly studies. If we are to dismantle the inequitable hurdles placed in the paths of marginalized mobile game creators, we will need as many active stakeholders in that mission as possible.

Course correcting a multi-billion dollar market requires concerted collective effort. The problems we have identified can be fixed, but entrenched patterns do not change overnight. Sustained engagement with the legacy of exclusion we have inherited will be necessary, and that uncomfortable process is one best endured as a community. By welcoming more folks to the conversation – whether HCI researchers, budding game designers, lead mobile developers, DEI specialists, studio executives, or junior games studies scholars – we will make more rapid progress towards our common goal of meaningful representation for those who game on the go. Readers of this paper eager to heed that call to action are encouraged to reach out to the AnyKey team for further resources or guidance on supporting marginalized mobile game developers. For those in relative positions of power, we hope that you will share this article with your peers, bring it up in committee meetings, read it with your students, or use it to help steer your organization's DEI efforts towards impactful objectives. Please pull from our crowd-tested menu of meaningful interventions as you consider which levels you will push for the mobile game industry to unlock for the benefit of all.

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