Playing on Hard Mode: Accessibility, Difficulty, and Joy in Video Game Adoption for Gamers with Disabilities

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ABSTRACT

Video games often pose accessibility barriers to gamers with disabilities, yet there is no standard method for identifying which games have barriers, what those barriers are, and whether and how they can be overcome. We propose and explore three phases of the "game adoption process": Discovery, Evaluation, and Adaptation. To advance understanding of how gamers with disabilities experience this process, the resources and strategies they use, and the challenges experienced, we conducted an interview study with thirteen gamers with disabilities with differing backgrounds. We then engage with existing theories of consequence-based accessibility, of difficulty, and of identity-based gaming to better understand how these processes manifest "access difficulty" and to characterize the experience of "disabled gaming." Finally, we present design recommendations for game developers and distributors to better support gamers with disabilities in the game adoption process by engaging with community-made resources, supporting socially-created access, and creating customizable experiences with opportunities for unconventional play.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in accessibility**; **Accessibility**; **Accessibility technologies**; • **Applied computing** → *Computer games*.

KEYWORDS

video games, accessibility, adaptation, difficulty

1 INTRODUCTION

Video games are increasingly a part of everyday life and culture in our society, but they are too often designed without people with disabilities in mind [55, 68]. Nevertheless, many people with disabilities engage with video games, whether by searching for games that meet their access needs or by coming up with ways to modify inaccessible games to overcome accessibility barriers.

Recognizing the significant work that gamers with disabilities currently do to navigate the games "ecosystem" (i.e., encompassing everything from video games themselves to the distribution platforms and communities surrounding them), we sought to better understand existing processes related to finding games to play and getting set up with a new game—a process we term *game adoption.* We adopt and adapt Lee et al.'s model of "*discovery, access, and organization*" [46] of information about video games to construct a three-phase model of game adoption, consisting of:

- the **Discovery Phase**—the task of finding a game one might want to play;
- the **Evaluation Phase**—steps taken to evaluate whether a game meets a player's personal criteria, including access needs;
- and the **Adaptation Phase**, where players learn to play a game and develop their playstyle, including developing solutions to access issues.

In this model, Lee et al.'s process maps onto Discovery and Evaluation. We introduce Adaptation as a third phase that has received less attention in HCI research, but has been explored in game studies literature as "learning" and "specialization" behaviors [13, 60]. We use these phases to scaffold our exploration in part because each phase has clear objectives for a general audience (i.e., including nondisabled individuals) as well as specific goals for disabled gamers. We present examples of these goals in Figure 1. Through better understanding game adoption processes among gamers with disabilities, we aim to identify key challenges and opportunities that arise during this process that can inform future research in the accessible gaming space, as well as to advise game developers and distributors on how to take the burden off the gamer and better support their gameplay.
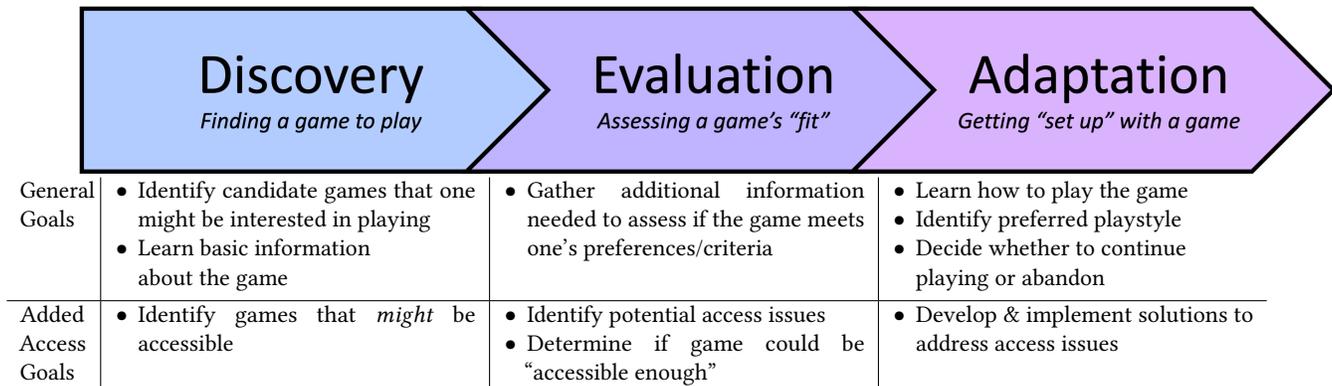
To explore these topics, we conducted an interview study with thirteen gamers with disabilities discussing their current game adoption practices and challenges they encounter therein. We analyzed our interview data using reflexive thematic analysis [17] to surface insights related to each phase of the game adoption process, discussing barriers participants currently face, the work already performed to navigate these barriers, and the utility of various features in the games ecosystem in supporting the adoption process.

We then consider disabled participant experiences with game adoption in conversation with existing literature around conceptual organization of games and "hacking" accessibility. We also engage with key theoretical frameworks from games studies to develop a deeper understanding of how the gameplay

	Discovery *Finding a game to play*	Evaluation *Assessing a game's "fit"*	Adaptation *Getting "set up" with a game*
General Goals	• Identify candidate games that one might be interested in playing • Learn basic information about the game	• Gather additional information needed to assess if the game meets one's preferences/criteria	• Learn how to play the game • Identify preferred playstyle • Decide whether to continue playing or abandon
Added Access Goals	• Identify games that *might* be accessible	• Identify potential access issues • Determine if game could be "accessible enough"	• Develop & implement solutions to address access issues

Figure 1: The three phases of the game adoption process and their related objectives. During Discovery, players seek to identify games they may be interested in playing. During Evaluation, players gather additional information about a game and assess whether they are interested in playing it. During Adaptation, players learn the game and develop their personal style of playing it, including developing relevant workarounds to access barriers.

experiences of gamers with disabilities might differ from existing understandings of game experiences. Specifically, we (1) introduce the concept of "access difficulty" in games and explore how it relates to existing theories of difficulty and conflict in games as constituted by the work of various scholars including Salen & Zimmerman [60], Jagoda [38, 39], Bowman [14, 15, 23, 43], and Hamilton [34]; and (2) use the lens of identity-based gaming, as instantiated in Gray's exploration of black gaming [29–32] and Ruberg and Chang's exploration of queer gaming [19, 59], to deepen the understanding of experiences of gamers with disabilities and "disabled gaming." We also briefly explore our findings using the lens of consequence-based accessibility [50].

Finally, based on our findings and analysis, we contribute a set of actionable design recommendations for game developers, publishers, and distributors to improve the experience of game adoption for gamers with disabilities through engagement with community-made resources, through supporting socially-created access, and through augmenting games with opt-in features, customizable experiences, and opportunities for unconventional play.

2 RELATED WORK

2.1 Video Game Accessibility

Prior work in video game accessibility has documented access challenges in games, explored the experience of gamers with disabilities, and recommended accessible practices for game developers. We explore these three categories further, and build on their respective practices within this paper.

Work documenting accessibility challenges posed by games has included: work that surveys games to identify common elements that create accessibility barriers during gameplay [9, 42, 51, 68]; work that identifies successful commercial case studies of games that consider accessibility [11, 63]; and a systematic literature review of game accessibility research [6]. An additional body of literature has begun to characterize the *experience* of gamers with disabilities. Quantitative and qualitative research by Porter et al.

[55] and Andrade et al. [8] has used survey and interview methods to identify disabled gamer challenges and goals while gaming, and to examine what parts of the gameplay experience gamers with disabilities would most like game developers to address. In particular, this research has highlighted tensions between game complexity and accessibility as well as emerging challenges and opportunities for accessibility in social gaming or multiplayer contexts. This work primarily highlights barriers that arise *during* gameplay (i.e., during and after Adaptation); we complement this with exploration of access barriers gamers with disabilities encounter *before* gameplay (during Discovery and Evaluation) and the challenges related to *addressing* barriers that arise during gameplay.

Work related to identifying strategies for navigating access barriers has explored numerous practices: social support (e.g., [22, 56, 57]), *"playing your own game"* [28], integrating game-modifying software solutions (e.g., [7, 20, 45, 67]), using new accessible input devices [3, 4, 27], and creating accessible-by-design games (e.g., [21, 26, 54]). We bolster this work through further exploration of diverse strategies employed by gamers with disabilities throughout the game adoption process, highlighting opportunities for these practices to be applied in novel contexts.

Finally, the literature also provides rules for accessible game development. In 2004, the International Game Developers Association published a set of guidelines for accessible game development [63], and since then, many researchers have included recommendations in their work for game designers and developers to improve the accessibility of their games (e.g., [11, 18, 40, 44]). Notably, these recommendations span many phases of the game design and development process. We consider this in our work by orienting our design recommendations around various facets of the game design, development, and distribution process.

2.2 Video Game Discovery & Evaluation

Our work also explores how video gamers with disabilities discover and evaluate games. Prior work in this area includes Lee et al. who

conducted an interview study explicitly exploring the topics of user discovery, access, and conceptual organization of video games [46]. They highlight the variety of metadata individuals want when discovering and evaluating games, ranging from high-level genre information to more detailed information about game content, such as if it contains mature language, if it contains educational content, or if the content is geared towards underrepresented demographics in the gaming community. Although other work has explored how people use social media posts and online gaming communities to discover games [12], such work has not had an accessibility focus. We address this by exploring how these discovery strategies and more are utilized by gamers with disabilities in their game discovery process.

2.3 Adaptation & "Hacking" for Accessibility

Within the field of accessibility, adaptation and "hacking" are long-standing practices for people with disabilities to overcome access barriers in all areas of life. Hamraie and Fritsch's Crip Technoscience Manifesto [35] formalizes many details of this role of people with disabilities as knowers, makers, hackers, and designers, and points to current issues and failings within accessibility research that does not consider the existing work that people with disabilities do to overcome access barriers. Within the accessible gaming space, some work has featured examples of hacks developed by gamers with disabilities (e.g., Gonçalves featured strategic gameplay hacks in [28]), but the process of developing hacks and adaptations has not been a primary focus. We center this process in our exploration of the Adaptation Phase.

Additional work has also highlighted how "hacks" employed by disabled people can be studied to understand existing accessibility failings of certain ecosystems (e.g., [16, 52, 66]), and to inform the design of future technology based on lives experiences of people with disabilities (e.g., [24, 36, 37, 47, 58]). We similarly analyze the hacks developed by our participants throughout game adoption, which we both present as an evaluation of the state of the gaming ecosystem and leverage in the development of our design recommendations.

3 METHODS

3.1 Interview Process

We conducted a semi-structured interview study with thirteen gamers with disabilities. The interview started with a discussion of each participant's disability, background, and general experience and relationship with games. Then we asked about three main topics: how to find games to potentially play ("Discovery"), how to assess if a game was a good fit for them, including whether it meets their access needs ("Evaluation"), and how (if at all) they adapt games or change their play style to navigate accessibility barriers ("Adaptation"). Finally, the interview closed with several debrief and reflections questions, including a discussion of what developments participants would most like to see related to accessibility in the games ecosystem.

We recruited participants online, including public posts in gamer communities and for people with disabilities, such as Reddit's r/DisabledGamers subreddit. Given our holistic, cross-disability focus, we did not target any specific disability groups. Instead, our recruitment criteria was "anyone with a disability, chronic illness, or mental health condition that affects how they interact with games, as well as people who are d/Deaf and Hard of Hearing."

We conducted a total of sixteen interviews, which included three interviews with two fraudulent participants. We include this detail for transparency and to inform researchers of the prevalence of fraudulent participants in online HCI and accessibility research. We initially identified the two participants as fraudulent when their interview answers contradicted information reported in their screening form, and the interviewer subsequently recognized one of them in a later interview. To ensure authenticity, we exclude these three interviews from our analysis, resulting in a total of thirteen participants. See Table 1 for brief profiles of the thirteen participants, including demographics, disability identity, and gaming practices.

All but one of our sessions were conducted as one-on-one interviews with participants on Zoom. Our session with Dylan, who is nonverbal, was conducted as an in-person interview with two family members who act as his aides, paired with an interactive observation of a gameplay session. The two interview transcripts and the interviewer's notes on the gameplay session were then included in analysis. We found this modification to be necessary to include this participant's perspective in the study, and believe this process produced a response comparable to our other interviews. This modification was developed on the recommended practices of adjusting a study protocol to a disabled participant's needs [49] and thoughtfully considering the role a proxy plays in research with people with disabilities [48].

3.2 Analysis

We analyzed interview data using reflexive thematic analysis [17]. We take a constructivist approach to analysis and utilize a critical lens, leveraging participant lived expertise to analyze the 'games ecosystem' as a complex sociotechnical system. We adopted a combined deductive-inductive approach to coding. Deductive codes were defined according to our framing model's three phases of Discovery, Evaluation, and Adaptation. Inductive codes were developed for "challenges", "resources", and "strategies" in each phase, yielding a total of nine sub-codes. Additional coding was also inductive and primarily focused on analyzing meaningful experiences participants had with the game adoption process. This inductive coding was done by the first author using an open coding approach. Our complete codebook is available in our supplementary materials.

Braun & Clarke's reflexive approach to thematic analysis emphasizes the researcher's subjective perspective in analysis. The first author, who led the thematic analysis, is neurodivergent, has four years of professional experience in game accessibility, and has seven years of professional and life experience with transmedia game design and game hacking for inclusion. The second and third authors, who participated in theme development, are HCI researchers each with 10+ years of experience in accessibility research, and do not identify as disabled. From this perspective, our analysis was primarily oriented around an awareness of the everyday labor people with disabilities perform to make gaming experiences more accessible, as well as an understanding of the

ID Pseudo	Self-Reported Demographics	Profile
P1 Dylan	Caucasian Male Aged 18-29	**Dylan** is autistic, has ADHD and several developmental disabilities, and is nonverbal and non-reading. He primarily plays games with his brother or aide on his iPad or Nintendo 64.
P2 Blue	Caucasian Genderqueer (they/them) Aged 18-29	**Blue** is disabled by chronic illness and experience chronic fatigue and other symptoms triggered by overwhelming visual motion, physical exertion, and other triggers. They seek out games with steady camerawork, which they play on PC and Nintendo Switch.
P3 Ken	Asian Male Aged 18-29	**Ken** has hemiplegia and tremors on one side of his body, and a speech impediment resulting from partial facial paralysis. He primarily plays online multiplayer FPS games on PC, and uses a programmable mouse for gaming.
P4 Aaron	Caucasian & Hispanic/Latino Male, Aged 18-29	**Aaron** is legally blind and uses text-to-speech and screen magnification when gaming. He primarily plays multiplayer FPS games on PC.
P5 Kristina	Asian & Latina Female Aged 18-29	**Kristina** is autistic, has ADHD, OCD, Auditory Processing Disorder, and chronic PTSD that can be triggered by graphic game content. She plays story-driven games on PC and usually enabled closed captioning when available.
P6 David	Caucasian Male Aged 40-49	**David** is colorblind and primarily plays on PC with color-identification tools. He tends to avoid real-time games, and enables color adjustment settings in games when available.
P7 Caleb	Caucasian Male Aged 30-39	**Caleb** has partial hemiplegia from a stroke, which limits use of his left hand while gaming. He primarily plays action/adventure games and plays on multiple platforms with AT including an Xbox Adaptive Controller with foot pedals and a modified one-handed PS5 controller from The Controller Project [5].
P8 Mira	Caucasian (she/they) Aged 18-29	**Mira** is disabled by chronic illness that causes symptoms including chronic pain, fatigue, brain fog, dizziness, and audio & visual processing challenges. They also have ADHD, which causes executive dysfunction & trouble focusing, and cPTSD that can be triggered by sensitive game content. They seek out "action-packed" games with compelling visual style, which they play on Nintendo Switch or PC.
P9 Erich	Caucasian (he/they) Aged 50-59	**Erich** has psoriatic arthritis that affects their manual dexterity and keyboard/controller usage, and avoid games with topics that might trigger their depression or anxiety. They primarily play on PC, Playstation, and iOS.
P10 Avi	Asian Male Aged 18-29	**Avi** is congenitally blind and primarily games on iOS using Voiceover (when available) and screen recognition when a game lacks built-in Voiceover compatibility. He also occasionally plays multiplayer games on console with friends.
P11 Eddy	Caucasian Male Aged 40-49	**Eddy** is disabled by a condition that has affected the development of his hands, resulting in access needs around manual input and dexterity. He uses a variety of custom AT including a 3D-printed wrist mount for his specialty gaming mouse, and an Xbox Adaptive Controller. He is a Twitch streamer, plays on various desktop and console platforms, and plays a wide range of games including FPS, adventure, and roleplaying games.
P12 Marc	Caucasian Male Aged 18-29	**Marc** is blind and has ADHD, and plays on a variety of consoles. He uses a screen reader when available, and otherwise navigates games auditorially. He is a Twitch streamer, and often plays games while engaging with his streaming audience.
P13 Tristan	Caucasian Male Aged 30-39	**Tristan** is is deaf-blind and uses various AT including a cochlear implant, text-to-speech, and screen magnification. He plays FPS and RPG games on PC, Nintendo Switch, and Android.

Table 1: Participant Profiles. Each Profile summarizes information shared by the participant about their personal identity and their relationship with video games, including game and platform preferences as well as selected details of their disability that were discussed in the interview.

limitations of traditional HCI frameworks to fully describe these experiences.

As part of our analysis, we also developed design recommendations for third parties, including game developers and distributors, regarding how to better support people with disabilities in game adoption. We fully present these recommendations in Section 5.5, and we surface specific details that informed these recommendations throughout our Results.

4 RESULTS

We organize our analysis around the three-phase game adoption process. Within each phase (Discovery, Evaluation, and Adaptation), we explore the strategies, resources, and challenges participants described. We then explore two cross-cutting themes that emerged in inductive analysis: socially-created accessibility (Section 4.4.1) and appropriation for access (Section 4.4.2).

4.1 Game Discovery

The Discovery Phase, in which participants sought to identify "candidate" games to potentially play, was a familiar process to all participants. Some participants engaged in Discovery more often than others, and approaches varied from highly involved, targeted searching to more passive, incidental learning about games.

4.1.1 Strategies & Resources Used.

Participants primarily utilized social relationships, online communities, and game distributors during the Discovery process, and employed a range of strategies regarding how many games they aimed to discover.

Social Relationships. Most prominently, recommendations by friends were considered a reliable source for both content-based and access-based considerations: *"I'll just hear from my blind friends 'oh, this game could be playable!', but I never actually Google like, 'blind accessible games'—usually you just find out about them as they come out."* (Marc). Friends also made the Discovery process itself more accessible: *"I can get triggered pretty easily, so it's nice to have an information-seeking process that's guaranteed to not trigger me... [I ask] people 'hey, what do you think of this game, do you think that this would be interesting to me and worth my time to look into? [...] Or is it just going to be a disaster?'"* (Blue).

Some participants were introduced to games when friends invited them to play, but this did not necessarily imply the game would be accessible. Although Ken appreciated being introduced to the high-speed shooter *Valorant*, it did not bring him any closer to finding an accessible game: *"Theoretically, Valorant is a really fun game...I'm just not good at it. [...] I'm not doing most shooters, except for Valorant because my friends are into that and they make me play with them."* In other cases, friends introduced participants to games with a limited concept of how they might play it. Marc and Avi had sighted friends give them a hyper-specific role in a much larger game: Marc steered his team's ship in the sailing adventure game *Sea of Thieves*, and Avi's role was to rapidly mash buttons at specific points in the action racing game *Burnout Paradise*. Marc felt these recommendations did help with discovering new games and provided opportunities for enjoyable co-play, but Avi lamented that the games were still overwhelmingly inaccessible and these experiences were sometimes *"othering"* and *"not the same fun."*

Online Communities. Online gaming communities were often easy places to find new games. Some communities offered explicitly accessibility-oriented discussion, such as Reddit's r/DisabledGaming subreddit, disabled gamer Twitch communities, or the "game accessibility side of Twitter," centered around the accounts of prominent game accessibility advocates (e.g., participants specifically mentioned Caleb Kraft, Steve Saylor, Grant Stoner, and Tara Voelker in this category). In these communities, Discovery overlapped significantly with Evaluation, allowing participants to discover games with endorsements, warnings, and specialized information relevant to assessing accessibility. Gaming communities not centered around accessibility were still considered useful, as gameplay videos on YouTube and Twitch and publisher trailers were information-rich resources that provided additional context going into Evaluation.

Game Stores. Participants noted that although stores did not provide them reliable ways to search for games with accessibility as a primary focus, they learned to infer details about a game's accessibility from other channels. Ken relies on games having remappable inputs, but did not know of any mechanisms for searching for this feature. However, he learned that US- and Europe-based game studios were more likely to include this and other accessibility features than other studios, which he often used as a proxy in game stores.

Quantity of Games. Participants employed different strategies related to how many candidate games they sought to identify during Discovery. Some acquired large numbers of games, with limited consideration for whether the game would be a good fit for them. Avi and Mira both bought bundles of games when they would go on sale, in hopes that at least one game might fit their needs. David found a similar benefit in Xbox's "Game Pass Ultimate" subscription service, which provides a large library of games on various devices: *"I can play anything, anywhere. That's approachability [and] accessibility...for $15 a month. [...] To be able to [try] a lot of [Xbox's] games without putting out $500 or more is really cool"*.

Other participants were more targeted, looking for games in specific franchises or genres they already were familiar with. Although this approach produced fewer candidate games, they could already make initial accessibility judgments going into Evaluation. A couple participants shared that they seldom look for new games to play, in part due to the associated challenge of finding something that is actually accessible. For instance, due to a steep learning curve with new games and the lack of new games with the same sturdiness as the Nintendo64's plastic game cartridges, Dylan's family has not looked for new games since the console's discontinuation in 2002.

4.1.2 Challenges to Discovery.

Though personal taste is a common consideration during Discovery [46], participants often felt they needed to choose between taste and accessibility. For some, personal taste was the primary guiding factor in the Discovery phase, deferring judgments around accessibility until later phases of the adoption process (e.g., these participants also generally prioritized finding a large number of games during this phase). However, for participants with relatively stringent access criteria, personal taste was forced to be a secondary consideration in Discovery: judgment

on factors like genre or difficulty were deferred until after they had found a game and confirmed its accessibility. When asked what types of games he likes to play, Marc stated, *"I'll really play anything that's accessible– it's usually so limited to where I don't have a choice."*

Challenges also arose related to the visibility of certain categories of games. Indie games (i.e., games produced by independent artists or smaller games studios) were considered harder to discover than major studio games, which was problematic for Mira who found indie games had graphics that were less overstimulating than big-budget "AAA games". This was further complicated by *"false advertising"* of game visuals, where store advertisement art differed significantly from a game's actual visual style.

The Discovery process itself was also inaccessible at times. Many of the platforms used for Discovery had their own accessibility challenges: Marc highlighted Steam's poor screen reader support, Mira and Kristina experienced ableism in online communities of certain games, and Kristina and Blue expressed frustration with missing captions and audio description in game trailers as well as triggering content in gameplay videos.

4.1.3 Design Takeaways.
Our exploration of Game Discovery surfaced several key insights that informed our design recommendations:

(1) Community resources play a core role in Game Discovery. Third-party content was frequently used (e.g., Twitch streams, game accessibility reviews on Twitter), but also sometimes considered difficult to find. This informed our recommendation to **Spotlight and Develop Community Resources.**

(2) Game Discovery is also often a social activity, with participants turning to friends for recommendations and guidance on where to focus their efforts. This informed our recommendation to design for **Social and Independent Access Solutions.**

(3) Participants also expressed that game stores often lack functionality to search specifically based on accessibility needs. This informed our recommendation for distributors to highlight **Opt-In Features and Customizability**.

4.2 Game Evaluation

Having identified candidate games in Discovery, participants then engaged in Evaluation, assessing these games for "fit". The predominant access goal in this phase was to gather additional information about a game needed to determine whether a game would be accessible to them (or at the very least, not *too* inaccessible to be dealt with during Adaptation).

4.2.1 Strategies & Resources Used.
Participants primarily used four types of resources to evaluate a game's accessibility: peer, content-based, official, and contextual. We describe each below.

Peer Resources. Once again, recommendations from friends who knew a participant's access needs were considered the most reliable source of information. *"My accessibility needs are so really freakin' specific, it would be hard to find internet resources that have the information I need, versus my friends... they know all the kinds*

of things that trigger me so they know what to tell me about the game" (Blue). Notably, this also circumvented the need to engage directly with a game's content, which participants with triggerable conditions like Blue and Kristina found particularly useful when evaluating games that could trigger their symptoms. Even if the friend did not feel equipped to make the final judgment, they could still offer useful information about potential concerns to consider.

Friends also sometimes provided direct access to games, enabling participants to watch or freely explore the game themselves without needing to purchase it first. Avi's local game store also served as this resource for him: *"I would go to the same store over and over... they would be nice to me and be like 'Okay, I have a console, if you want to just play and see and plan.' They didn't know accessibility, for them it's like... 'this customer is trying to play, let's be nice to this guy and let him figure things out.'"*

Community-Created Resources. Game online communities once again proved useful to participants. Twitch streams and YouTube gaming channels provided a valuable window into gameplay, which participants could use to inform whether a game would be accessible to them. As Ken described it, *"it's sort of like getting a free trial."* The interactive nature of these platforms also proved especially beneficial: Eddy would occasionally ask streamers to show specific game elements on their streams, such as the accessibility settings and game options for input remapping, which were relevant to his evaluation. Eddy has also begun highlighting specific accessibility settings on his own Twitch streams, as he feels it is information that is often difficult to find.

Online accessible gaming resources, such as blogs CanIPlayThat [1] and DAGERSystem [2], allowed participants to evaluate game accessibility with a reasonable degree of confidence. Game reviews sometimes provided similar benefits: *"If [a reviewer] said something like 'oh, it was overwhelming', I might not buy that game simply because if it was overwhelming for* **you***... that makes me believe it will be not enjoyable for me to play."* (Mira)

Official Resources. In contrast, participants only occasionally used content officially published by game developers and distributors during Evaluation. Trailers or official gameplay previews were often considered useful in understanding elements of the gameplay experience, particularly for games that had not yet been released or that did not have much community-created content, but these previews did not necessarily provide a comprehensive overview of the game experience. This proved problematic for some participants, such as Blue and Kristina, who found some trailers did not provide a sufficient sample of visuals and plot details from a game, sometimes surprising them with content that would trigger them when they actually played the game.

Contextual Resources. Finally, some players relied on contextual knowledge (i.e., also called 'relational metadata' [46]) about different game genres and franchises for their evaluation process. For some, this involved extending prior knowledge about a franchise: Aaron had played every game in the *Battlefield* franchise, and this provided a sense of confidence he could play the latest iteration, as he knew the core mechanics were accessible to him and would not change. Some participants identified patterns of access barriers across a particular studio's games, like Respawn Entertainment regularly requiring complex button combinations

that were inaccessible to Caleb. This knowledge served as an additional filter during their search.

4.2.2 Challenges to Evaluation.

Participants discussed three primary challenges that arose during Evaluation: the difficulty of finding specific game information, uncertainty around whether an evaluation would be correct, and the consequences of an incorrect assessment.

Hard-to-Find Information. Many participants knew exactly what information they wanted in order to evaluate a game, but there were no guarantees that information would exist in a form they could access or that they would be able to find (i.e., short of buying the game outright). Several participants cited the potential value of standardizing and compiling accessibility information in an easily discoverable place, such as a game's store page: *"You're putting out "minimum specs" for a game on PC; put out "minimum specs" on some scale of accessibility!"* (Eddy). A particularly difficult piece of information to find was a game's accessibility settings, which frustrated participants. This was a particular challenge for participants who relied on community-created content, as they shared that few gaming videos displayed the options menus in their videos, and when they did, it would be brief, incomplete, or difficult to find within the videos.

Uncertainty. Even in cases where participants could find the information they felt they needed, there was still looming uncertainty around whether their judgment would be correct. Almost all participants described instances where they expected a game to be accessible to them, yet encountered an unexpected barrier. Blue shared that, despite being very familiar with the Pokémon game franchise and having access to the list of settings in *Pokémon Sword & Shield*, they were confounded by a vaguely named setting: they expected "Disable Battle Animations" to stop the game's visually overwhelming camera movement in battle sequences, but it instead disabled a different non-problematic animation, leaving the game inaccessible to them.

Cost. Incorrect evaluations often had a financial cost: almost all participants had purchased games that they subsequently found were inaccessible to them, making Evaluation a riskier task. In part due to the cost factor, Marc, Tristan and Avi all took advantage of *"unofficial"* means of playing games. Marc and Tristan both used free community-made emulators (i.e., software on a computer or smartphone that allows playing games from a particular console), which both minimized the cost of trying a new game and enabled playing community-made versions of a game that were more accessible (see Section 4.3.1). Avi found similar value in a local game store that sold discounted, pirated versions of games: *"There was a huge supply of pirated games for [about a dollar each]. It's still an affordability [issue]– but it's still better than paying full price for the game. Buying a [pirated] game and it not working was not really that much of a heavy price to pay."*

4.2.3 Design Takeaways.

Participant discussion of their Evaluation strategies surfaced the following key insights that informed our Design Recommendations:

(1) Peers and community-created content were again considered highly valuable resources, further informing our recommendations to **Spotlight and Develop Community**

Resources and support **Social and Independent Access Solutions.**

(2) Participants also expressed a lack of faith in the ability of external resources to make accessibility judgments on their behalf, due to a combination of their specific needs, game preferences, and desired gameplay experiences. This further emphasizes the importance of publicizing all of a game's **Opt-In Features & Customizability,** as well as the ways a game might support **Metagaming and Unconventional Play.**

4.3 Game Adaptation

After discussing how games "pass" participant Evaluations, we moved into discussing the Adaptation Phase, in which participants got set up with their games and determined how they might modify aspects of their gameplay to make the experience more accessible. This phase also acted as a test of their Evaluations: in some cases, it was not until they started playing a game that participants found the game was not actually accessible to them.

Participants varied more in Adaptation than in the other phases. Participants described engaging in four different styles of Adaptation (previewed in Figure 2), which we call "Adapting the Game," "Adapting the System," "Adapting Expectations," and "Adapting Play." We also found that participants varied in their expectations for Adaptation, which we discuss in Section 4.3.5.

4.3.1 Adapting the Game.

One class of strategy involved modifying the game to make its output more accessible. This often utilized existing features and settings within a game, such as enabling subtitles or disabling elements like quick-time events. Although most of our participants had specific settings they searched for, many commented on the ambiguous task of configuring settings in a game: *"It's totally an exploratory process with accessibility. In general, you often don't know what you need or what's available to you, right? At least for me, I kind of make it up as I go. [...] If there's a blurb that comes up, I'll read it, [check] what the name of the [setting] is, and then [try] it out."* (Aaron).

Difficulty levels were considered by many to be valuable for both accessibility and personalization. For Marc, *God of War: Ragnarok* was harder than expected due to an inaccessible menu that kept him from powering up his character, so he compensated by setting the difficulty option to an easier level. Unexpectedly, playing *Battlefield* on its hardest setting (i.e., "Hardcore Mode") with friends made the experience more accessible for Aaron than playing on its default setting: Hardcore Mode removed peripheral interface elements (e.g., current ammo and the map) that were already not visible to him, it thus equalized the playing field when competing against his nondisabled friends.

For some participants, mods (i.e., third-party software added to a game to add or change game elements) served as useful tools, such as by providing colorblind-friendly dual encodings for David or adding hotkeys to announce inaccessible on-screen content for Marc. However, Ken and Marc both noted there is a scarcity of mods related to accessibility, even in the mod-friendly game communities like *Minecraft*. Marc found most of his mods outside of 'official' channels, which created its own access issue: *"most of*

## Adapting the Game *Modifying a game to make its output more accessible* Examples: • Enabling subtitles or disabling quick-time events • Installing a mod that improves color contrast	## Adapting the System *Modifying the input & output of a game console or system* Examples: • Configuring a screen reader to work with a game • Using a specialized accessible controller
## Adapting Expectations *Rethinking what one's experience with a game will be* Examples: • Avoiding inaccessible online competitive gameplay • Abandoning a game after it adds an inaccessible mechanic	## Adapting Play *Changing one's playstyle or the rules of a game* Examples: • Choosing to play a ranged character, rather than melee • Creating personal objectives in a game

Figure 2: Overview of the four main strategies participants employed during Adaptation.

the mods, you have to download them and actually install them manually... put this file there and put this file here, so it's kind of a pain, especially for people who aren't good with computers."

4.3.2 Adapting the System.

Another strategy was to modify the input and output of a game system. In these cases, a game itself was left as-is, but the participant employed on specialized controller and assistive technology setups to play.

For some, this was a relatively simple process of configuring their regularly used assistive devices to work with the game (e.g., a screen reader, a hotkey mouse). System adaptations sometimes had the benefit of being reusable across games: Erich found he rarely needed to use in-game options, because *"I've adapted all my equipment, I don't need them [the games] to adapt again too much for me. [I adapted my equipment] just because I had to—because [the games] didn't do it before. I'm used to playing this way."* In other cases, each game required developing a specialized setup, producing a significant overhead when starting a new game. However, some participants took particular pride in the creativity of their setups: Marc celebrated the ingenuity of using optical character recognition to read out inaccessible on-screen text in *Animal Crossing*, and Eddy proudly shared the design of his custom 3D-printed wrist mount for his mouse. For Eddy, remapping his controls was also part of the affective experience of a game, leading him to fine-tune his mapping to create the ideal gameplay experience (e.g., increasing immersion in a racing game by mapping acceleration to a foot pedal).

4.3.3 Adapting Expectations.

In some cases, participants did not expect to be able to reduce a barrier or find a workaround, so in lieu of changing the game, they changed their own expectations of what their experience with it would be as an inaccessible, unfixable object. Generally, these adjusted expectations left participants with two choices: to power through the inaccessibility, or to give up.

Choosing to power through an inaccessible portion of a game was described as a calculated risk: although the inaccessible portion would cause negative consequences (e.g., triggered symptoms, fatigue, frustration, discouragement), it was considered "worth it" to be able to engage with the other parts of the game. To some, powering through an accessibility obstacle was a satisfying challenge: Aaron enjoyed being able to beat his nondisabled friends in a competitive game where he was playing at a disadvantage due to its inaccessibility, and Eddy enjoyed streaming games on Twitch where he could show off his ability to overcome access challenges to an audience. As he described it, *"It's something as simple as: how well have I been able to do something that someone else finds difficult that [isn't disabled]? If I'm here with my keyboard and mouse that are all adapted and no fingers, and I got into a 3-vs-1 firefight and won... people watching are entertained and encouraged by that kind of thing. [...] I'm playing for those kind of challenges."*

"Powering through" was not always an option: in some cases, there was simply no viable way to overcome a barrier. Caleb played a game which required wall jumping using a combination of inputs beyond the number of inputs he could simultaneously manage. In these and some other cases, the best option was simply to give up. If the consequences of engaging with a barrier were too steep or the expected enjoyment of the inaccessible game was too small, the decision to stop trying to make an inaccessible game accessible and move on to something else was considered a valuable part of the adaptation process. Although giving up on a game was never described positively, many participants spoke of needing to give up on some games as a frank reality of being a gamer with a disability. Eddy described abandoning *Gears of War* after an inaccessible boss battle, saying *"if it's too hard to beat within four or five times, I'll get bored, I'll just walk away. I'm not going to sit there and get frustrated because the video game is inaccessible and won't let me pass without hitting ten buttons."* Many participants did lament having spent money on a game they had to abandon, but some found ways to make the most of the situation. David, Marc, and Eddy would publish game

accessibility reviews to provide feedback to developers and protect other disabled gamers from encountering the same issue.

4.3.4 Adapting Play.

Many participants navigated accessibility barriers by modifying how they played a game, including selecting which activities they performed within the game world, redefining what their goals were, and even changing the rules of the game. The degree to which participants customized their playstyle varied significantly between participants, and sometimes varied for a single participant depending on the game and context.

Smaller customizations included choosing not to engage with a particular game mechanic, adopting a certain interaction style, or playing as a specific character. In an attempt to reduce triggering on-screen motion in the fantasy roleplaying game *Diablo II*, Blue described how they often chose to play as a character who could teleport, as an instantaneous teleport action reduced the duration of camera panning compared to when their character walked between points with the camera keeping the character centered on screen. Other participants like Ken and Marc described playing with ranged- or sniper-type weapons in games with combat to give them more time to react to enemy actions. In social or multiplayer contexts, the social nature of gameplay enabled other small customizations, such as allowing Aaron to avoid inaccessible navigation tasks by taking the co-pilot/gunner seat in *Call of Duty* vehicles or allowing Blue and Avi to opt out of additional inaccessible gameplay portions by having friends play them.

Other participants made much larger changes to their playstyles to adapt to a game, often oriented around creating entirely new objectives or sets of rules for gameplay. Both Dylan and Mira utilized games from the *Mario Kart* franchise as 'world exploration' games rather than as competitive racing games, in part because the racing was difficult and inaccessible to them and in part because they found the level design exciting and wanted to explore it further. Eddy discussed how he and friends used *Grand Theft Auto V* as a playground for live storytelling and roleplay (part of a popular phenomenon on Twitch known as 'GTA RP' [10]), which made the game more accessible to him than its "standard" playstyle.

In discussing this, many participants brought up the conflict between what they believed a game designer or developer 'intended' and what actually worked for them in interacting with the game. For one participant, playing a game in a way they felt was 'unintended' was interpreted as being bad at the game, but most participants celebrated creating a new game they felt was better suited to them: *"I don't really care what the game guy wanted. [...] He made his game. I'm going to decide how I'm going to play it and how I'm going to enjoy [it]"* (Erich).

These changes, both small-scale and large-scale, highlighted that flexibility and options are a particularly valuable attribute that made games more accessible. In contrast to games which force players down a specific path or only support one or a small handful of playstyles, games that were less constraining in what paths players were able to take through the game were more likely to be adaptable to an accessible state.

4.3.5 Extent & Duration of Adaptation.

In discussing game adaptation with participants, we found that participants had widely different standards and expectations for the goal of this phase. All participants described expecting to engage in some amount of adaptation as they got set up with a game, as even the most accessible games generally needed to be integrated into a participant's overall system. However, the amount of adaptation varied, both in terms of how dramatically they changed the game and in how long they continued the process. Figure 3 shows sample timelines and progressions of three typical adaptation processes.

Repeated Discovery. For some, Adaptation was considered a last resort and avoided as much as possible (Figure 3(a)). For Kristina, needing to adapt a game indicated a failing in the Discovery or Evaluation phase that resulted in her playing a game that was not accessible to her from the start. When faced with an insufficiently accessible game, these participants described a preference for finding a new game to play rather than investing energy in developing workarounds.

One-Time Fix. For participants who used similar adaptation strategies across games (such as enabling specific game settings), Adaptation was often treated like an initial set-up process (Figure 3(b)). After this initial set-up, these participants expected to be able to play through the game without needing to modify things any further.

Iterative Adaptation. Other participants considered adaptation as an evolving, ongoing process throughout gameplay (Figure 3(c)). Rather than having a set list of options to check, Blue's adaptation process involved developing new gameplay strategies and testing mechanics to find a more accessible gameplay experience. For Ken, iteration took the form of regularly reassigning the hotkeys on his mouse as he identified which game actions needed to be performed more regularly than others. Rather than reaching a singular 'best' gameplay experience, this meant the gameplay experience could evolve and improve over time.

4.3.6 Design Takeaways.

Participant insights around Adaptation ultimately informed all four of our Design Recommendations:

(1) The Adaptation phase is where participants most actively leveraged flexibility in games, from leveraging built-in options to developing preferred playstyles and metagames. This informed our recommendations to offer **Opt-In Features and Customizability** and provide **Opportunities for Unconventional Play and Metagaming.**

(2) Given the social nature of some participant metagames and playstyle-based changes, our recommendation to support **Social and Independent Access Solutions** is further reinforced. Some participant playstyle adaptations were also rooted in larger community practices (e.g., GTA RP), providing another reason to **Spotlight & Develop Community Resources.**

4.4 Additional Themes

In addition to identifying resources, strategies, and challenges specific to each phase, we identified two strategies participants leveraged throughout all stages of the game adoption process: (1) creating accessibility through social support, and

(a) Repeated Discovery (b) One-Time Fix (c) Iterative Adaptation
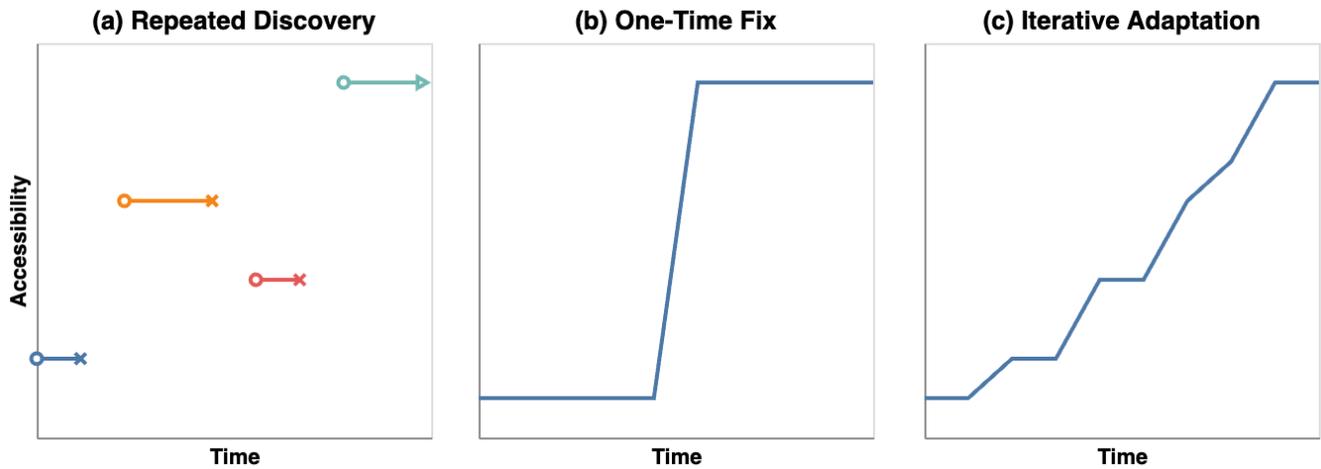
Figure 3: Sample timelines of participant adaptation behaviors. (a) A "Repeated Discovery" approach where a player tries many games looking for one that is sufficiently accessible to them from the start, abandoning games that are not. (b) A "One-Time Fix" approach where a player spends time developing a single primary adaptation to make the game accessible to them and relies on it for the duration of gameplay. (c) An "Iterative Adaptation" approach where a player progressively iterates on their adaptations or develops new adaptations throughout gameplay.

(2) appropriating non-accessibility content for accessibility purposes.

4.4.1 Socially-Created Accessibility.

All three phases of the game adoption process featured social accessibility solutions, from giving recommendations and advice to active involvement in co-creating access adaptations. Social interactions took a variety of forms, from playing with long-established groups of friends and family to playing games online with strangers. Naturally, friend familiarity with a participant and their access needs affected how well they knew how to support their friend.

Game context also affected the social dynamic. When playing a competitive game against his brothers, Aaron did not expect them to go easy on him to try to make the game "more accessible" to him, saying "and I don't want them to!". In some cases, friends supported access without reducing competition: Blue's friends would move their pieces for them in a virtual board game, and Ken's friends made sure to communicate accessibly on voice chat, even when playfully talking trash.

Across these social interactions, participants described the interpersonal bonding that occurred throughout the process of working together through access issues in games, which we can view as a form of Access Intimacy [53]. For Ken, the opportunity to talk with friends in online games was a valued experience, as voice channels were often inaccessible when playing in public lobbies with people who did not know how to communicate with him and had trouble understanding his speech. Dylan's mom noted a particular joy and affection that Dylan would express when his brother would help him through a challenge in a game. For Blue, it was particularly impactful when their friends and family would help them develop new adaptation strategies or adopt more accessible gameplay habits without being asked: "it

helps us feel connected... when somebody is able to help you hack a game, to make it work for you, it's really quite nice."

However, social interaction around game adoption was not without friction. Mira and Blue both described how, given the specificity of their access needs, well-intentioned access judgments by friends were often incorrect: "I'm probably just going to ignore it" (Mira). This made the process of finding games more complicated due to newly added social pressure to try games they were confident would not work. Avi expressed that attempts to include him sometimes felt like "an afterthought", creating an uncomfortable social dynamic where the game was not actually accessible to him but his friends did not feel they needed to do more to include him.

Design Takeaways. Overall, participants generally appreciated having trusted friends supporting them and collaborating with them throughout the game adoption process. In some cases, friends enabled the process to be accessible in ways that would not otherwise be achievable. However, independently creating access was still core to all participant processes. This is the core of our recommendation to support **Social and Independent Access Solutions** in all stages of game adoption.

4.4.2 Appropriation for Access.

Another cross-cutting strategy was content appropriation, wherein participants used media which was not explicitly accessibility-oriented for accessibility purposes.

Many participants cited YouTube gameplay videos and Twitch streams as valuable sources during Discovery and Evaluation, as they allowed seeing elements of the gameplay experience not captured in official sources like trailers or gameplay previews. However, with only a few exceptions, this content was not created with the explicit intention of providing this insight to gamers with disabilities. Participants instead appropriated this content as a free, easily discoverable source of information about game accessibility.

Similarly, appropriation was a valuable tool in the Adaptation phase. In one case, Eddy utilized a specialized gaming mouse that recognized gestures related to the device's orientation and angle in 3D space. Although originally designed for flight mechanics in games like *Battlefield*, he co-opted this gesture support for use as a high-resolution input mechanism that did not necessitate a button press.

A notable aspect of appropriation in this context is the overwhelming degree to which participants relied on unintentional accessibility aids over intentional ones. Several participants noted that they did not even look for official accessibility resources from game developers, but instead turned to the sources that they knew would provide them with the relevant information (e.g., content creators on YouTube or Twitch). Some participants noted there was often a blurry distinction in whether a game feature was "intended" for accessibility. For Ken, the ability to 'ping' locations in multiplayer games (i.e., an action that lets a player non-verbally highlight an in-game location to teammates) was a useful tool for rapid, accessible online communication, leaving him uncertain as to whether it was "technically" an accessibility feature. Difficulty levels, which are a hotly debated topic in gaming and game accessibility communities (e.g., [34, 64]), were brought up by most participants and commonly fell into this gray area. The general sentiment was that, regardless of whether they were designed with people with disabilities in mind, they improved the flexibility and accessibility of games.

Similarly, when it came to practices related to Adapting Play or creating metagames, mechanics that were leveraged usually had other purposes in the game. Many participants noted that games that allowed varying play styles often had at least one play style that was more accessible than others. This was the case in very open games that gave players freedom to choose what portions of the game to engage with (e.g., *The Legend of Zelda: Breath of the Wild*, *Minecraft*) as well as narrower games that provided a few specific choices, such as choosing between characters with different abilities and fighting styles (e.g., *Fortnite*, *Diablo II*).

Design Takeaways.

(1) The expressed value of community-created content, whether accessibility-oriented or not, points to more ways game developers can **Spotlight and Develop Community Resources** to support accessibility.

(2) Similarly, player appropriation of features that may not have been designed *for* accessibility further underlines the value of **Opt-In Features and Customizability** and providing **Opportunities for Unconventional Play and Metagaming.**

5 DISCUSSION

5.1 Analysis: Comparison to Prior Work

5.1.1 Understanding Game Discovery and Evaluation for Gamers with Disabilities.
Our results find that prior work in understanding how people discover games only partially characterizes practices of gamers with disabilities in Discovery and Evaluation. Prior work identified various metadata people seek out when finding and evaluating games, such as a game's subject, ratings, visual style, or

relationships to other games [46]. We found participants utilized some of the same metadata, including genre information, visual style, and relational metadata (e.g., what studio produces a game, whether a game is part of a familiar franchise). The "four Rs" (i.e., reviews, ratings, rankings, and recommendations) [46] were selectively used and were primarily trusted when they came from sources participants knew considered accessibility (e.g., CanIPlayThat [1], friends who knew their access needs).

Participants also sought out metadata not explicitly documented by Lee et al., including what options and settings existed in a game and the degree to which they would be able to customize their gameplay experience. As previously discussed in Section 4.1, this metadata was often particularly difficult to find. Building off Lee et al.'s recommendations, we further encourage game publishers and distributors to compile and share this metadata to aid gamers with disabilities in their discovery and evaluation processes.

Consistent with prior work [46], we also found that multimedia and video resources were considered particularly valuable in the game discovery and evaluation process. Lee et al. highlighted the "concentrated" nature of video resources as beneficial for reducing the number of sources a person needs to consult in their process, and we found that this was additionally important to gamers with disabilities. Participants searched for more information and were able to consult fewer resources (e.g., due to inaccessibility of resources, as with difficulty navigating the Steam store with a screen reader), so a single video could often constitute a majority of research players did for a particular game.

5.1.2 Hacking & Adapting Games for Accessibility.
Consistent with Gonçalves et al. [28], Porter et al. [55], and Andrade et al. [8], we also found that social support was critical throughout all phases of the game adoption process. Participants cited friends and gaming communities as their most frequently used resources for navigating access issues. Within the space of adapting gameplay, we observed similar behaviors of copiloting [28, 55], the use of games as a jumping off point for social interaction [8], and segmentation of roles in play [55]. We also observed new social behaviors, including mutually agreed upon metagaming and collaborative development of accessibility adaptation, which further emphasize the importance of supporting socially-created access (see Section 5.5.3).

Our exploration of the adaptation phase also overlapped and extended prior work. In particular, our exploration of customization and personalized gameplay extends Gonçalves et al.'s concept of "playing your own game" [28]. However, we also identified adaptation strategies not previously discussed in literature, including 'adapting expectations' and 'adapting the system' in unique ways beyond the use of standard assistive technology.

5.2 Joy, Difficulty, and Disabled Gaming

Our results provide rich insight into how games produce experiences for gamers with disabilities that often differ from experiences of nondisabled players. However, rather than situating normative experiences of nondisabled players as the "goal" of accessibility for disabled gamers, we look to game studies literature around gameplay experiences to better understand what "accessibility" might mean in gaming.

5.2.1 Access Difficulty.

Salen & Zimmerman's widely used definition describes a game as "a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome" [60]. Present in this definition is the concept of engaging with "artificial conflict" as fundamental to a game. Players seek out games, in some capacity, *to be challenged.* This fundamentally changes how we can consider accessibility in games. In most other domains, "accessibility" involves removing as much interaction challenge as possible. In games, however, removing all challenge produces an undesirable experience. Johnson describes this as the principle of "Friction that Fits": while most UI/UX domains strive to eliminate as much friction as possible, *"Great games don't remove friction; they have the best possible friction in the best places"* [41].

Scholars in game studies have defined different types of difficulty [38, 39] and demand [14, 15] to better classify how players can be challenged, producing concepts like 'emotional demand' (i.e., the demand of processing emotions a game invokes) and 'interpretive difficulty' (i.e., the challenge of figuring out what to do in a game). Following this practice, we introduce the concept of **access difficulty** in games: a specific type of challenge present in a game related to the task of navigating accessibility barriers.

Building on Hamilton's conceptualization of difficulty [34] and the social model of accessibility, we frame access difficulty as a product of the relationship *between a player and a game*, rather than something that can exist in a game in the abstract. Access difficulty is thus produced when a player ascribes challenge in a game as being the product of a mismatch between the player's set of abilities and their perception of the set of abilities for which the game was designed. Simply put, access difficulty is **inaccessibility understood through the lens of a game.**

Notably, a player does not need to identify as disabled to experience access difficulty: an inexperienced gamer might experience access difficulty when playing a game like *Elden Ring* that is designed for seasoned players, or someone experiencing 'brain fog' might experience access difficulty when playing a puzzle game. However, disabled gamers can regularly encounter access difficulty when playing games not designed with their abilities in mind.

Consistent with other forms of difficulty and demand, access difficulty is a form of challenge that has the potential to produce satisfying gameplay experiences and may be actively sought out. This is consistent with some participant descriptions of navigating access challenges, such as Aaron celebrating beating his nondisabled friends in a competitive game while overcoming access difficulty that they did not need to navigate, or Blue's description of access intimacy in working with friends to develop new access strategies. However, not all challenge in a game is desirable, particularly in cases when the ability mismatch implicit in access difficulty leaves a player feeling excluded. As participants described, many challenges related to creating accessibility in games were considered tedious and frustrating, and these challenges produced barriers that prevented them from engaging with *desired* game challenges.

5.2.2 Disabled Gaming.

Games research has explored the concept of *identity-based gaming,* or the idea that facets of one's own identity influences how one views and plays a game. In particular, this model has been explored with marginalized populations in gaming, including black gamers [29, 30, 61], women gamers [33, 62], and queer gamers [19, 31, 32, 59].

Fundamental to the identity-based gaming framework is the acknowledgement that people have different goals in gameplay. This is true independent of identity (e.g., [65]), but further instantiated when one brings their identity to a game not explicitly designed with their identity in mind. For instance, Shaw found women gamers may reject "traditional" goals of identifying with game characters that do not represent them [62], while Gray found new goals emerge as in-game objectives sometimes become secondary to social and community-building goals in black gamer communities [31, 32].

These goals, in turn, lead to differing gameplay behaviors, including identity reading (i.e., the practice of intentionally interpreting aspects of a game as reflective of one's identity [59]), intentionally "deviant" play (i.e., the practice of willfully violating expectations and social norms in play [29]), and queergaming (i.e., the practice of 'queering' games through creation of new playstyles that prioritize non-normative values [19]). Notably, this is most often an intentional, desired deviation from normative play that center's one's identity. These gamers *could* play the "normal" way, but choose not to as they often prefer their alternative gameplay style more.

With this framing in mind, we propose that gamers with disabilities similarly have alternative approaches and priorities in games, which we term **"disabled gaming".**

Disabled gaming can be characterized in part by player engagement with access difficulty. Disabled gamers bring a degree of expertise to the challenges posed by access difficulty, in part due to being more frequently confronted with access difficulty than nondisabled players (as well as experience navigating access challenges outside games). However, as access difficulty is not solely experienced by gamers with disabilities, disabled gaming is characterized in part by *how* players navigate access difficulty, alongside how frequently they engage with it.

Disabled gaming involves more than just navigating access difficulty: many participants also described participating in forms of deviant play, sometimes prompted by specific access barriers, and other times simply due to having differing priorities from those "expected" by the game. Participants' custom games and unique gameplay styles (see Section 4.3.4) often constituted deviant forms of play or 'metagaming' [13], and cases where they changed their gameplay expectations (Section 4.3.3) denoted specific instances of changing their gameplay behaviors from established norms. In some sense, even the act of developing access adaptations can be considered a form of deviant metagaming: participants celebrated their own ability to devise new solutions, as if playing a puzzle game built on top of the existing game.

5.2.3 Designing for Disabled Gaming.

Similar to how Ruberg describes queer gamers reading their identity in non-queer games [59], we can understand that processes of hacking, adapting, and reinterpreting games are similar forms of identity reading. Even when games are not necessarily designed with the intent of presenting these challenges to gamers with disabilities, gamers with disabilities can find these challenges and

engage with them to create new modes of interacting with the games. Inaccessible games unintentionally create opportunities for access intimacy, "hard mode" challenges to overcome, and adaptation "puzzles" that let players derive satisfaction from their creative solutions. The social nature of many participant approaches to Discovery, Evaluation and Adaptation also reflects the emergent community and shared experiences gamers with disabilities have navigating this space.

However, this is not to say that accessibility barriers are acceptable and do not need to be addressed. Instead, it is a testament to the richness of disabled gaming experience that should not be viewed as something to unilaterally "fix". For example, we can hypothesize how this instinct might manifest in potential "solutions" to access barriers in games. In the racing game *Mario Kart*, an access "solution" could be a "driving assistant" that ensures the player stays on the road, to help support players for whom the mechanical difficulty of controlling the vehicle is an unsatisfying access challenge. However, this would completely inhibit Dylan and Mira's open-world exploration metagame, prevent Aaron from being able to celebrate a "hard mode" victory, and inhibit Blue's access intimacy in developing workarounds with friends. Although few would argue that a driving assistant makes the game *less* accessible, it fundamentally changes the experience of playing and blocks disabled gamers from being able to engage in unconventional, disabled gaming.

Conversely, we can also see how designing for disabled gaming discourages "siloed" accessibility solutions, such as designing games that are specifically targeted at a disabled audience (i.e., a contrast to making games with a larger audience accessible for disabled players). Disabled gaming is rooted in finding one's own unique mode of play in a larger set of options, and it is further augmented in how individual unique modes of play interact with each other. Although genres like audiogames and single-button games still have their own merits, they are not a substitute for supporting disabled gamers in larger mixed-ability contexts.

In disabled gaming, player preferences can vary dramatically around what challenges are "satisfying": difficulty posed by an access barrier can be satisfying to one player, frustrating to another, and utterly game-breaking to a third. There is no one solution that will improve every player's gameplay experience. This points to the importance of options and customizability in disabled gaming: game designers should prioritize giving gamers the ability to select what challenges they wish to engage with while providing options to circumvent the challenges they do not.

5.3 Games & Consequence-Based Accessibility

Our exploration of 'adapting expectations' points to an opportunity to better understand video game accessibility (and accessible recreation at large) through the lens of consequence-based accessibility [50]. Consequence-based accessibility frames an interaction not as a binary 'accessible' or 'inaccessible', but as a personal calculation of the expected benefit (e.g., enjoyment, benefits to one's health) relative to potential consequences (e.g., aggravated symptoms, social discomfort). With this framework, we can better characterize judgments participants made during Evaluation about whether an inaccessible game was

"worth trying", as well as whether and how to adapt a game to better meet one's access needs.

Navigating an access barrier was sometimes a high-risk situation for participants (i.e., an action with a large potential consequence). For participants whose disabilities could be triggered or exacerbated (e.g., those with chronic health conditions or who experienced physical pain when navigating barriers), there was a relatively stringent threshold during Evaluation: a 'false positive' accessibility judgment (i.e., an inaccessible game being deemed accessible) had much more severe consequences than a 'false negative'.

Consequence-based accessibility also can characterize participant choices about how, if at all, to adapt games with accessibility barriers. Some participants who employed the 'Iterative Adaptation' approach (Figure 3(c)) described deriving joy from developing adaptations or progressively increasing skill in an inaccessible game. In these cases, we might conclude the 'consequence' of needing to develop an adaptation was less severe than the anticipated 'benefit' of the adaptation (or that the chance to develop an adaptation was a 'benefit' in itself), making continuous adaptation a worthwhile endeavor. On the other hand, for participants engaging in 'Repeated Discovery' (Figure 3(a)), the task of developing and implementing adaptations was considered overwhelmingly burdensome, and their calculation often led them to abandon a game if it was initially too inaccessible. It also bears noting that some participants reported using multiple of these adaptation behaviors in different situations, further emphasizing the importance of context in characterizing how and why gamers with disabilities might choose to adapt games.

This preliminary analysis points to the complexity underlying decisions by gamers with disabilities to engage with games, as many factors seem to underlie participant judgments around a game's accessibility and value. We encourage researchers to further investigate these considerations, and highlight the opportunity to use CBA as a tool for exploring accessibility considerations in games and recreation.

5.4 Shortcomings of Current "Official" Solutions

In recent years, game platforms and developers have worked to improve the visibility of game accessibility features. For example, Xbox's Accessibility Feature Tags [69] provide valuable details in the Xbox Store about game accessibility features, and studios like Naughty Dog have actively marketed cutting-edge accessibility features of their games [25] However, despite these features and assurances, very few participants cited using "official" resources to find and evaluate games. This begs the question: What are the shortcomings of the existing solutions, and how can they be made more useful for gamers with disabilities?

5.4.1 Lack of Resource Visibility. One key takeaway from our study was a general lack of awareness of the existence of existing resources. Historically, there has not been much "official" support for accessibility in games, and participants confirmed they do not expect to find official resources due to their established impressions of game companies. Thus, despite these recent improvements, it seems many gamers with disabilities may not currently be in the practice of seeking out these resources. As a potential solution to this issue, participants proposed to make these resources more

"in your face" and easier to unintentionally stumble upon, such as by listing accessibility features alongside other core information that is commonly looked up (e.g., device requirements on a PC game's store page). For games companies that have already invested in developing new accessibility resources, working to make their resources more easily discoverable might be a high-impact step towards more widespread accessibility.

5.4.2 Unreliable Judgments. Another issue highlighted was a general uncertainty regarding the accuracy of existing accessibility judgments provided by game companies. In some cases, this was attributed to a lack of context around what tools and solutions a participant was using that would change what features of a game pose barriers to them. For example, many of the more experienced participants have established their own workarounds for certain barriers (see Section 4.3) that might complicate a simple, binary judgment of "this game is (in)accessible to people with [some disability]". Even information around low-level input requirements of games, such as "requires holding down buttons," might not be sufficient in cases where context for an input affects what workarounds a player might be able to utilize.

In other cases, the participants, as experts in their own disabilities, felt their understanding of their own disability was not commonly or accurately reflected in resources attempting to aid in accessibility judgments. We can also look to Mack and McDonnell et al.'s work on the misrepresentation of people with chronic illness in existing models of disability [50] as further evidence that binary judgments about a game's accessibility might not be considered reliable or trustworthy by players. This issue might address some of the remaining uncertainty around why gamers with disabilities do not currently use official resources. Ultimately, many of these resources attempt to make judgments on an individual's behalf, rather than equipping them with the resources needed to make these judgments for themselves.

5.5 Design Recommendations

Based on our findings, we present four main guidelines for game developers and distributors to better support gamers with disabilities in the game adoption process.

5.5.1 Spotlighting & Developing Community Resources.
As we observed in our study, many gamers with disabilities rely on community-created resources (e.g., Twitch streams, YouTube Let's Play videos, blogs) for informing their discovery, evaluation, and adaptation processes. However, searching for resources that contained all the information they needed sometimes proved challenging, and obtaining desired information often required cross-referencing multiple sources.

Game Distributors. Based on this, game distributors should consider providing a centralized resource that compiles information from these various community-created sources, including text, images, and video information that gamers with disabilities can utilize to more easily retrieve the information they need. Of course, game distributors should also be careful not to exploit community-created content as a form of accessibility consideration without crediting and compensating the creators appropriately.

Game Developers. Additionally, several of our participants who stream on Twitch noted that they occasionally get sponsored by developers and distributors to play a particular game on their stream. With this infrastructure already in place, distributors can consider how they might better collaborate with streamers to spotlight a game's accessibility features, producing easily discoverable community resources with high-quality information on these features. Alternatively, given that game developers have access to the complete game prior to its release, they also have the ability to create gameplay videos that demonstrate the complete range of game elements players will encounter within the game.

Streamers & Content Creators. Furthermore, this points to a way that streamers and other gaming content creators can further support gamers with disabilities who are already in their communities. Although participants shared that they know what to look for as they search through this content, there is also an opportunity for content creators to explicitly highlight relevant accessibility information in an easily discoverable manner, such as by displaying the game's accessibility menu at the start of a gameplay video.

5.5.2 Opt-in Features & Customizability.
A primary takeaway from our study and analysis is the importance of customizability in the gameplay experience for accessibility. Different players have different needs and preferences, and there will never be one "universal" game experience that works for everyone. Based on this, a core principle that should be put forward in design is the idea of opt-in game features. There are various granularities where this can be implemented: at an input level (e.g., opting into button holds or motion controls), a mechanics level (e.g., opting into quick-time events), a thematic level (e.g., opting into gory content or jump-scares), or even a higher organizational level (e.g., opting into a stage or level of a game).

Game Developers & Designers. This can be integrated with the existing idea of game curation and balancing: game developers and designers can still curate a default or "recommended" game experience, but the added flexibility of allowing players to specify what challenges and tasks they want to engage with can make games significantly more approachable to people with diverse needs and preferences. For players who know what they want, having options will always make a game more accessible to them.

Game Distributors. Furthermore, participants explicitly expressed a desire for game distributors to surface what options exist in games, extending traditional store page sections (e.g., on hardware requirements, supported languages). When providing this information, distributors can also provide concrete examples of what is affected by different options, as option names were sometimes ambiguous or misleading. Notably, this is *not* a request to attempt to make judgments around who a game is accessible to, as participants expressed that that is a highly personal decision. Instead, this is a call to consolidate and publicize information that can inform player decisions.

5.5.3 Social and Independent Access Solutions.
As described in Section 4.4.1, social accessibility is a major component of existing practices of gamers with disabilities and a valuable part of the disabled gaming experience.

Game Developers & Designers. Based on this, we would encourage developers and designers to consider how they might more directly design for social forms of accessibility support within their games. This could be achieved in a variety of ways, including adding more split-role co-op features (e.g., as with the co-op crew mechanic of *Sea of Thieves* that let Marc steer his group's ship) or adding support for custom challenges in competitive games (e.g., inspired by Aaron's use of *Battlefield*'s limited HUD in Hardcore Mode that leveled the playing field with nondisabled friends).

Notably, it is important to ensure a game can still be accessible *without* the support of others. But in gaming contexts that are already inherently social, enabling friends and allies to support the creation of accessible gameplay experiences presents a major opportunity for improving the quality of game accessibility.

Player Communities. Participants primarily described making adjustments to gameplay when they were playing with friends who already knew their access needs, but there are certainly opportunities for well-intentioned player communities to more readily support gamers with disabilities in creating accessible experiences. Similar to how game developers might implement flexible game features, players might consider how to develop flexible gaming behaviors that can adjust to access needs of co-players. This could manifest in countless ways, like being willing to take the driver's seat in a *Call of Duty* vehicle or adjusting communication practices in an online voice chat. At a high level, normalizing communication around player access needs and willingness to collaboratively implement access hacks could go a long way to enabling gamers with disabilities to socially implement access in multiplayer games.

5.5.4 Opportunities for Unconventional Play & Metagaming. As seen throughout our research, gamers with disabilities often play games in "unconventional" ways that are not necessarily what the designers and developers intended. This is a core part of the disabled gaming experience, and a key tool for hacking access in inaccessible games.

Game Designers & Developers. With this in mind, we recommend that game designers keep opportunities open for these forms of play, rather than railroading players into an "intended" play style. To take this a step further, designers may even consider alternative play styles and metagames throughout the design and development process, and might explicitly create and highlight opportunities for these diverse play styles within their games.

Streamers & Player Communities. Learning from how *GTA RP* gained popularity in a wider community and was then appropriated by gamers with disabilities, gamers might consider accessibility benefits when developing their own new metagames and playstyles, especially if participating in larger social trends. Although an "accessible metagame" can vary greatly game to game, playstyles that increase flexibility beyond the typical expectation are a good place to start. Additionally, normalizing gameplay variants and informal "house rules" in multiplayer games can support gamers with disabilities who utilize unconventional playstyles for access. For example, a 'melee only' round of an FPS game may not be the traditional way to play, but a player might propose it because aiming weapons is inaccessible to them. For players that can play accessibly in either

mode, agreeing to change the rules can be a strong act of allyship and collaborative access creation.

6 CONCLUSION

We conducted an interview study with thirteen gamers with disabilities to explore challenges and opportunities related to their current game adoption processes. Our study and analysis surface the breadth of strategies and resources used by gamers with disabilities and the challenges they encounter to discover games to play, evaluate game accessibility, and adapt gameplay experiences to better suit their access needs. Additionally, we highlight the role that social support and content appropriation play in the process of creating access throughout the game adoption process.

We also contribute the concepts of **access difficulty** and **disabled gaming** as framings for discussing the gaming experiences of gamers with disabilities. These concepts can be further explored and developed to more richly characterize disabled gamer wants and needs related to making video games more accessible, and to better understand how "accessibility" can manifest differently across media domains.

Recognizing that our exploration of disabled gaming is just beginning to characterize a longstanding cultural practice, we see opportunities for future research to more deeply describe this practice, including nuances around how disabled gaming manifests differently in different gaming contexts or for gamers with varying access needs. We also see opportunities to compile and share information on what is currently done by gamers with disabilities to make games more accessible, including what game options are most impactful or what game-specific adaptations have already been developed by gamers with disabilities. We hope further documentation of these practices might reduce the barrier to engaging in game adaptation and aid game designers and developers in better understanding how to to make their games more inclusive.

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