Chapter 12. Twitch and Livestreaming as User Experience Platforms

Amelia Chesley
Embry-Riddle Aeronautical University, Prescott

Cody Reimer
University of Wisconsin, Stout

Abstract. This chapter examines Twitch.tv for its potential as a platform for user experience (UX) collaborations and research. Twitch has the potential to support many common UX methods, enable combinations of old and new methods, and open possibilities for serendipitous research discoveries via wide sampling of random participants. We analyze the features and affordances of Twitch from a theoretical standpoint, review existing UX and UX-adjacent work present on the platform, and explore how game companies specifically, and other companies more broadly, can leverage Twitch's features for productive UX work and adapt established UX methods for use with the unique affordances of the platform. We acknowledge the risks involved in using a public and sometimes toxic platform, but ultimately argue that mainstream tools such as Twitch can make UX research more visible and can help center previously marginalized voices and perspectives for more empathetic UX work.

Hiko is a streamer on the website Twitch.tv, broadcasting his real-time gameplay of a new hero shooter from Riot Games, *Valorant* (2020). It's the end of May, 2020. Thousands of people watch Hiko play, some dedicated members of the massive community he has cultivated, others simply interested in the much-hyped game, set to launch later in the year. As they watch, viewers set the chat panel scrolling with questions, emotes, banter, and comments, which Hiko's moderators filter, answer, relay, and highlight.

In addition to the screencast of his gameplay, Hiko uses two webcams: one showing his face as he concentrates on play and chats with his viewers, and one showing his mouse hand which glides and flicks to aim his hero's weapon in *Valorant*. As new viewers tune in, they are greeted with a popup indicating that Hiko uses an eye tracking extension called Tobii Ghost. Overlaid on the screen showing his gameplay, a blue circle flits and flows to indicate where on the screen Hiko is looking at any given moment: a glance at the scoreboard, a glimpse at the game's mini-map (as in Figure 12.1), a look hovering near his targeting reticule, or skimming his skill's cooldown indicators at the bottom of the game's interface.

DOI: https://doi.org/10.37514/TPC-B.2025.2517.2.12

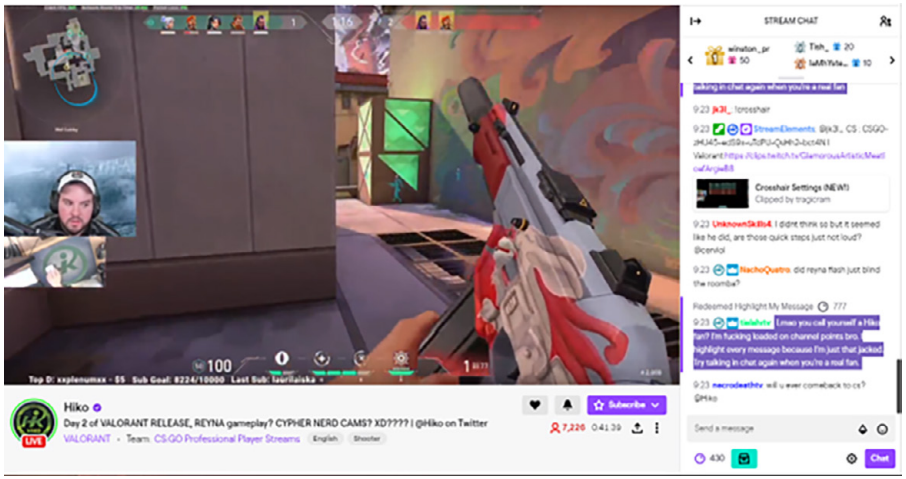

Figure 12.1. Screenshot of Twitch streamer Hiko broadcasting gameplay of a forthcoming game, with an eyetracking extension enabled, visible as the blue circle, top left.

Viewers in the chat ask how the game compares to another popular first-person shooter. Hiko muses aloud on the subject. Another viewer asks whether eyetracking is enabled. A moderator commands a chatbot to relay info which links to the Tobii Ghost website and clarifies the eyetracker's specifications: the tracking circle doesn't display on mobile or Firefox browsers. Hiko reiterates to viewers that the extension is, indeed, turned on. He verbally checks in with his in-game teammates to coordinate tactics and strategy. He reflects on his own gameplay and on the game itself.

Hiko plays and does well at both winning the game and entertaining his audience. The number of viewers watching the stream rises. Riot Games' decision to give him access to the closed-beta game appears to have been savvy. He's drawing attention to their new title by broadcasting his playthrough experience. One wonders to what extent Riot is leveraging the user-data Hiko's channel is generating—physiological data from Tobii Ghost, concurrent think-aloud (CTA) data on his observations about the game's UI and design and balance, a corpus of text and emotes from an ad hoc focus group, and so forth—to polish their game prior to its official public launch.

However the developers at Riot Games may be analyzing and learning from the wealth of data generated by Hiko's Twitch stream, it's clear that this nexus of critical gameplay, spectatorship, and technology can be considered a site of informal user experience research (UXR) for anyone interested in learning from and with users. Twitch makes it possible to watch users' screens, users' faces, users' eye movements, and much more, alongside their audiences' responses. In the case of Hiko and *Valorant*, both player and viewers are users experiencing the game;

Twitch, Riot Games, and the various tech developers involved with both companies are also stakeholders in this collaborative, mediated user experience.

Twitch's multimodal affordances and interactions, as described above, make it a worthwhile platform for robust, collaborative, multimethod user experience (UX) work. Livestreaming media in general, and Twitch in particular, offer possibilities for collecting and storing UX data, conducting UX research (and meta-UX research), or hosting UX collaborations; livestreaming platforms can be part of reconfiguring what public UX looks like in ways that are mutually beneficial to a wide range of parties. Given these platforms' growing popularity and relatively open, lower-cost tools, the variety of informal, agile, user-centered UXR studies that might be conducted on and with spaces like Twitch can help broaden and strengthen UX's reach and influence beyond game design. The potential methods and research questions we offer provide a starting point from which more organizations might move to follow the example set by Riot Games and its fairly public, open collaborations with university researchers (Hsu, 2015) and its players (Reimer, 2017), all in pursuit of more positive experiences for users.

Game companies in particular have the opportunity to leverage the dynamic environments and interactions afforded by Twitch in exploring and developing user-centered collaborations and research. In fact, Twitch already logs plenty of data about users—the devices and browsers they use, the games they play, when, and for how long—and shares it with game developers (Twitch, 2020). As streaming non-gaming activity becomes more common on Twitch, there is potential for other industries to be involved in this kind of user research as well. Through leveraging the popularity and customizability of the Twitch platform, UX researchers and designers can collaborate with each other and with users across distances and cultures even without expensive lab space or centralized equipment.

Of course, Twitch is not the only site for livestreaming. Over the last decade, livestreaming has grown in popularity and cultural relevance, giving rise to numerous other services (e.g., YouTube Live, Facebook Live, Instagram Live, Vimeo Enterprise, LinkedIn Live, TikTok Live, Restream.io) that offer similar capabilities. Of these platforms, Twitch is the oldest and most established among gaming industries and gamers, dating back to 2011. Because, as Katherine Payne and colleagues (2017) recognize, Twitch "was developed for and adopted by gamers rather than organizations" (p. 96), it has become widely available and accessible for viewers and developers such as those behind the Tobii Ghost eye tracking extension. This openness and potential for Twitch to host users with a wide range of experience levels makes the platform a valuable space for finding, attracting, recruiting, and participating with everyday users. The maturity and relevance of Twitch for gaming research prompt us to limit our discussion to Twitch, while acknowledging that other streaming platforms likely afford many of the same UX possibilities we discuss in this chapter. To be clear, we are not claiming that Twitch is the only, or even the best, platform for UX collaborations. It is, however, a useful starting point for thinking about possibilities.

In this theoretical exploration of UXR with and on livestreaming platforms, we hold up gaming as a lens for two reasons: historically, game development and UX have overlapped a great deal, and the popularity of games makes them a ubiquitous example of how UX design and research matter in popular culture and everyday life. This chapter reviews some history of the overlap between UX and videogame development, provides an overview of Twitch as an interactive platform (along with discussion of its benefits and risks), and explores how Twitch can be (and has been) leveraged for productive UXR. We discuss how core features of Twitch can be adapted for use with established UX methods, tools, and approaches and begin to envision potential collaborative research trajectories. We end with a call for more research and collaboration between UXR and livestreamers, noting the need for close attention to the risks and limitations of Twitch specifically.

Games Research & UX

Videogame industries have long embraced usability-adjacent concepts such as iterative design and playtesting, but until the last decade they have lacked an overarching definition, framework, and consensus for how user research principles could be applied throughout the various phases of game development. In her book on UX and game design, Celia Hodent (2018) notes that games-UX principles were still coalescing in the early 2000s, and that even in 2008 when she joined Ubisoft—one of the largest game studios in the world—games UX still wasn't "a thing." However, it's not as though the games industry was unaware of UX. Early games user research (GUR) distinguished itself from UX by nuancing differences between users and players (Lazarro, 2008; Lazzaro & Keeker, 2004). Nicole Lazarro (2008) defines UX as "the experience of use, how easily and well suited to the task, what the person expects to accomplish" and player experience (PX) as "the experience of play. How well the game supports and provides the type of fun players want to have" (p. 320). She contrasts the different purposes in UX (productivity) and PX (entertainment) by focusing on the rhetorical nature of games, and in so doing she illuminates the challenges that researchers face in applying general UX goals to the specialized medium of videogames. Nevertheless, players *are* users of a game, and games are experiences, so it would seem that UX principles should apply, in some cases and degrees, when researching players' experiences.

Some dissonance between UX and PX has driven many games industry members to conceive of UX as dealing primarily with technicalities of the game's user interface (UI), while PX principles should inform the design of the game as a challenging but rewarding player experience. As the differences between UX and PX, UI and design were explored, various efforts at GUR appeared, including: RITE, rapid iterative testing and evaluation (Medlock et al., 2002); SAGA-ML, semi-automated gameplay analysis by machine learning (Southey et al., 2005); and TRUE, tracking real-time user experience (Schuh et al.,

2008). Graham McAllister and Gareth White (2015) identify other contributions to early GUR, pointing to Chuck Clanton's assertion (1998) that good games are decided by good gameplay, which Larsen (as cited by McAllister & White, 2015) tried to investigate by examining how professional reviewers rated games. They also identify efforts to unify heuristic measures in a "GameFlow process" (Sweetster & Wyeth, 2005), and measure and define immersion (Jennet et al., 2008). Like UX, PX and its principles grew haphazardly within various competing companies and academic fields. There was "no overarching definition of what a game user experience entails or a defined UX framework" (Hodent, 2018, p. 98); industry practitioners and academics alike were all introducing concepts and strategies for improving player experience.

Scholarship on GUR identifies the industry's debt to the field of Human Computer Interaction (HCI) in guiding its approach to UI-UX—often branded as GRUX (games research on user experience). GRUX is not limited to UI or HCI, however, despite its debts to those fields. In her edited collection *Game User Experience Evaluation*, Regina Bernhaupt (2015) indicates game development's approach to UX is beholden to the field of HCI. McAllister and White (2015) also point to early HCI-UX work in games, citing Anker Helms Jørgensen (2004) and Steve Cornett (2004). Others, like Hodent, strongly value Don Norman's conceptualization of UX, and take issue with HCI because it "does not consider the whole experience people have with a product" (Hodent, 2018, p. 99). Along these lines, games researchers have been mindful of uncritically adopting HCI's methods and principles. Randy Pagulayan and Dennis Wixon (2008) warn about the dangers of "hot research topics" and of treating as novel what has already been established by other fields; they argue for interdisciplinarity so long as it is done with "due diligence in studying games and their unique challenge and culture" (p. ix). Their insistence on interdisciplinarity is not only out of respect for varied contexts, but also out of timeliness; in GUR, a classical approach slowed things down and was too sterile for iterative design efforts. Games researchers' efforts to contextualize usability methods for games often resulted in "discount" usability methods, owing to usability's origins in productivity applications and the resultant inconsistency for leisure applications (Amaya et al., 2008).

Games research eventually began to include non-traditional usability research aims and rely on increasingly multimethod approaches. Previously, research had concerned itself with player attitudes: how did players *feel* about the game, its play, its UI, its flow? Collecting this kind of attitudinal data was often the aim of playtesting, though it's worth noting that there is still no single shared definition or approach to such testing. In contrast, Pagulayan and Wixon (2008) advocate for the value of behavioral data: what players *do* in the game, rather than how they *feel* about it. This shift away from player attitudes to behaviors came about in part because of the growth of virtual gaming worlds and game development's need for user research after product launch. This evolution became behavioral game telemetry.

Game telemetry is "data logged from clients or servers about how players play games, or conversely about how the game client itself responds to player behavior" (Drachen, 2015, p. 137). Its low costs and high yield data make game telemetry especially attractive in comparison with more resource-intensive playtesting.[1] Games analytics and GUR overlap where they concern users (Drachen, 2015). Both contribute to multimethod approaches and allow researchers to triangulate behavioral (typically quantitative) data with GUR-supplied attitudinal (typically qualitative or semi-quantitative) data (Drachen, 2015, p. 140).

An example of this marriage between attitudinal and behavioral data is Microsoft Game Studios' early multimethod GRUX approach, TRUE—tracking real-time user experience. Facing a need to "understand what issues people encountered late in the game, why they were having those difficulties, and have a good idea of what we needed to do to fix those problems," the team initially considered think-aloud testing but felt they "couldn't afford the ~160 hours of observation time that testing would cost" (Schuh et al., 2008, p. 239). The team's solution, TRUE, uses three categories of in-game surveys (event-based, on-demand, and time-based), gathers necessary contextual data with game telemetry (e.g., build number, participant ID, timestamp, player position coordinates), and video captures on-screen play, and then maps player position with survey data. TRUE thus enables triangulation across behavioral data (e.g., heatmaps of player deaths on a particular level) and attitudinal data (e.g., that the level was particularly confusing for players, rather than an enjoyable challenge). Once researchers identified a problem, they could collaborate with the designers to diagnose and address the problem. Eric Schuh and colleagues (2008) write about one such instance in another case study, explaining "After watching these videos, the designers were able to immediately pick up on a subtle nuance in the game mechanic that only they were able to identify" (p. 249). Multimethod research yields UX data that empowers collaboration among designers, researchers, and players. With such multimethod approaches, researchers can understand both what players are doing in the game (their behavior) and how they feel about the game (their attitudes) and use this more complete understanding to guide design decisions.

Hodent's (2018) analysis of games and UX similarly supports multimethod approaches. She cites the challenges of single methods like think-aloud protocols and explains that "verbal protocol analysis seems to be much less suitable to address the level of enjoyability of the game, to investigate the potential engaging power of a game: Having to think aloud is 'killing' the experience, or at least changing it" (Hodent, 2018, p. 66-67). Jettie Hoonhout's (2008) treatment of think-aloud research offers some solutions about the costs and challenges.

1. Jakob Nielsen & Thomas Landauer's (1993) suggestion of five users per test to keep costs low cannot apply to experiences that take dozens of hours to complete, as is the case with some videogames.

She contrasts the strictness of think-aloud methods of K. Anders Ericsson and Herbert Simon (1984) with the opportunities McAllister and White might call "discount" usability, explaining that "in a usability evaluation context adopting a less strict approach to think-aloud studies than advocated by Ericsson and Simon does result in usable and useful data about important product aspects" (Hoonhout, 2008, p. 67) so long as the protocol's limitations are acknowledged. Those limitations, in part, require careful attention to participant selection, representativeness, and recruitment of "people who are relatively at ease with thinking aloud while performing a task" (Hoonhout, 2008, p. 68).

Even with careful consideration of think-aloud limitations, however, Ericsson (2006) reminds us that "verbal reports are only one indicator of the thought processes that occur during problem solving. Other indicators include reaction times (RTs), error rates, patterns of brain activation, and sequences of eye fixations" (p. 229). Tom Tullis and Bill Albert (2013) observe that retrospective think aloud (RTA) is gaining popularity among usability professionals as a way to benefit from user insight without disrupting their focus during testing. Hoonhout (2008) suggests an alternate, informal approach still useful for usability wherein the researcher analyzes comments, adding that it "should be adopted only in combination with other forms of data collection, for example logging of interactions, recording observable behavior, conducting a close interview, and perhaps administering questionnaires, to ensure a richer 'picture' of the issues" (p. 71). These indicators are precisely the sort of data streaming services gather as a matter of their function.

Many in the UX field acknowledge how rarely developers have the time and resources to create ideal situations for thoroughly testing and evaluating user experiences for their games (Hodent, 2018; McAllister & White, 2015). Even the most carefully designed UX tests are never perfect; developers must often prioritize what matters most, both for players (Hodent, 2018), and for collaboration with designers (Schuh et al., 2008). This is a good reminder that in industry, quick actionable data is de rigueur, and not necessarily the same as academic rigor. With game design's need for quick iteration and cheap, actionable data, it makes sense to forego some of the strictness of think-aloud protocols, to supplement them with a multimethod approach akin to TRUE, to triangulate attitudinal and behavioral data to bring to designers for informed discussion and decision-making. On Twitch, as players verbalize their decision-making processes and engaging with an ad hoc focus group of viewers, their stream is recorded and archived for posterity, their chat often moderated and full of viewer text and emote reactions; in this space we see readymade triangulation, ripe for further research in GRUX as well as UX. We must also recognize that imperfect or less-than-ideal situations necessitated by expedience for iteration must never come at the cost of participant and researcher safety. UX Researchers considering studies through livestreaming platforms, especially one such as Twitch, must safeguard against potential harassment and abuse, especially in racist, sexist, toxic public spaces (Gray, 2020).

Twitch and Its Users

Twitch bills itself as a community for people involved in creating their own entertainment. As a platform, Twitch brings content creators, audiences, sponsors, and other stakeholders (product designers or developers, brands, and researchers) together. Collaboration can range from large team projects to one-on-one tutorials. On Twitch, almost anyone can access rich video streams or recordings of people around the world using a wide range of tools, often in the context of their regular lives, from almost anywhere.

The Twitch platform affords streaming support, video-on-demand (VOD) capture, chat moderation, graphic overlays, screen sharing, live chat, and more. It is free to broadcast and view, generating revenue from advertising and optional subscriptions. Common affordances used by most Twitch broadcasters include webcams, microphones, notifications regarding subscribers or donations, added music, and social media tie-ins (Sjöblom et al., 2019). Twitch streamers often customize their channel pages and videos by adding overlays and other thematic elements to accompany the base video stream. The Twitch platform also includes live audience chat where viewers can type messages to the streamer and to each other during each livestream. Interaction like this, among streamers and audience members who may be experts or novices or anywhere in between, creates opportunities for learning by watching and through discussion (Payne et al., 2017).

As a media platform, Twitch has technologically, culturally, and socially enabled streamers to find and build an audience, to promote both personal and corporate branding, and position themselves as both influencers and entertainers, entering into "media industry work" in a manner no platform previously afforded (Taylor, 2018, p. 35). For many popular streamers, their work on Twitch is a full-time career (Johnson & Woodcock, 2017). Streamers with the time and inclination to stream regularly can partner with Twitch for the privilege of earning ad revenue from their streams. Other streamers ask for donations and/or earn a portion of Twitch viewers' subscription fees (Hamilton et al., 2014). Streamers and the labor they perform are imbricated in a host of capitalist industries, the gaming and esports industries most prominently. Twitch becomes a workplace for many who rely on the platform for self-promotion, networking opportunities, and income from sponsors, donors, and subscribers. The streamer from our opening anecdote, Hiko, streams professionally; he generates income by subscriptions and by the promotions enabled by his broadcasts. Not all Twitch streamers participate in order to earn money, however. T. L. Taylor (2018) articulates six types of motivation for players to stream their gameplay, only two of which are financially motivated (Taylor, 2018). For others, Twitch remains primarily a site for entertainment and social interaction.

Although a majority of content streamed via Twitch is gaming-related, the roots of the platform go back to more general, everyday-life streaming. The 2007 livestreaming website Justin.tv hosted several categories, the most popular of which was for gaming; in 2011, the gaming category was split from the rest of the

site and branded Twitch.tv. The original site where users around the world livestreamed anything at all is no longer online—Justin.tv simply redirects to Twitch, which is now a property of Amazon.

Streaming categories on Twitch today include hundreds of game-specific categories ranging from Chess to the latest Mortal Kombat to The Legend of Zelda. Taylor (2018) demonstrates just how dynamic streaming spaces have become since their origins in the early 2000s, noting that non-gaming streams were only officially allowed on Twitch as of 2016. Before that year, non-gaming content was "actively prohibited" (Taylor, 2018, p. 64). Today, non-gaming Twitch categories like Talk Shows & Podcasts, Food & Drink, ASMR,[2] and Makers & Crafting include streams from people cooking, playing tabletop games, doing yoga, and making things—using all kinds of implements from workout equipment and power tools to looms and spinning wheels.

These streams and the resulting videos can be instructional as well as entertaining. A convention among livestreamers is to think aloud about their decisions and actions, talking to and with their viewers about the game as an intentionally designed experience. In fact, streamers are strongly incentivized to talk through their activities and connect verbally with audiences; this is part of the performance they offer to viewers. Such thinking-aloud activity layered onto a stream's visual elements is a key part of the "exteriorization of an otherwise unspoken ludic process," as Taylor (2018, p. 81) characterizes streaming. For UX professionals, understanding such unspoken, tacit processes is a crucial part of understanding, empathizing with, and serving users in the context of their lived experiences with a given product or process.

Empathy has become a foundational concept for user-centered design and related research methodologies, often listed as the first step in any iterative design process. But the ideal of individual empathy isn't enough. As we consider Twitch as a platform for multimethod UXR, we must acknowledge its implications in ratifying systemic issues of injustice. However playful games and gamespaces may appear, they often harbor and perpetuate toxic cultures (Hsu, 2015; Paul, 2018), particularly with regard to existing power structures. Acknowledging UX as a historically, systemically white and male discipline, Vivianne Castillo (2018) calls out UX's "inability to discuss, acknowledge and absolve the effects of unchecked white privilege and male privilege within our leadership, organizations, conferences, and research" (para 3). Without addressing systemic problems of racial and gendered privilege, there is little chance of breaking down those systems in order to build more equitable user experiences. Thus, our considerations of Twitch as a platform for UXR must be tempered by an awareness of systemic bias and an explicit understanding that, currently, not every user's experience and participation is valued equally or compensated fairly. We must be especially wary of inviting at-risk populations into toxic spaces solely for the benefit of

2. Autonomous sensory meridian response

our research needs. If researchers choose to use these spaces, they should do so with an eye toward actively valuing the cultural knowledge work of marginalized populations (Chan & Gray, 2020; Gray, 2017). That is, UX researchers must move beyond empathy and consistently work to amplify marginalized voices, address the harmful effects of bias and privilege, and promote anti-racist and anti-sexist policies and practices within and beyond the gaming industry.

UX on Twitch

In this section we review and describe UX or UX-adjacent work already happening on Twitch. The examples we include were discovered through exploring Twitch organically, searching the site, and sharing our own experiences as Twitch users. These examples demonstrate how livestreaming on Twitch corresponds with UXR practices and interests, highlighting a convergence of opportunities for observational and telemetric data on attitudes and behaviors across several modes. Videos subtitled with "New Player Experience," often also tagged "blind [*sic*] playthrough" or "first playthrough," are common on Twitch. Part of the appeal of Twitch embraces the desire for collaborative, community-based gaming, even in single-player videogames; this is evident in the popularity of first experience playthroughs, where viewers get to see the streamer experience a game for the first time. Twitch users' interest in initial ludic experiences extends to UX researchers, too. We found various clips including mentions of UX and usability as topics that streamers are aware of and interested in (bornfreetwitch, 2019; krosmarc, 2019; wright4thejob, 2022) and some UX professionals and enthusiasts with a presence on Twitch (derScharni, 2020; GameUserX, 2018). Another major category included formal presentations on topics related to UX. These collections show that people interested in UX have already identified Twitch's value for hosting such research. We also saw various simple recordings of traditional in-lab usability and user testing scenarios on Twitch (alexgwin, 2013; FranstarMTG, 2013; GameCircus, 2012). Most of these tests contain either recorded video of users interacting with a mobile device or a screen-capture (with audio, sometimes with a webcam to capture users' faces) of activity on a website. The existence of UX videos like these affirms the practical value of Twitch for such work and supports our call in this chapter for more research and exploration into what it can offer.

As we saw with the streamer Hiko in our opening section, UX-adjacent data collection tools and technologies are prevalent on Twitch. Along with the video recording, webcams, and eyetracking already mentioned, some Twitch streamers also use technologies that track and display the interactions of their hands and game controllers. For example, Twitch user AccountingNightmareSA (2019) streams playthroughs of *Devil May Cry 5* that include an icon showing her controller inputs in the bottom right corner of the video (Figure 12.2). As she presses buttons, the corresponding icons light up in sync with the gameplay being streamed. This controller-input map allows viewers to watch and potentially learn the controller

techniques she uses and could also provide valuable data about this user's interactions and experience with both the hardware and software of the game.

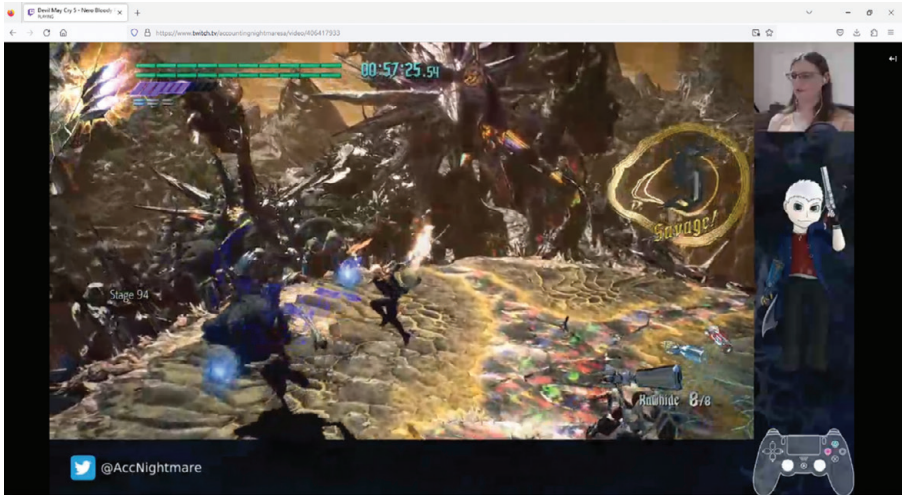

Figure 12.2. Screenshot of AccountingNightmareSA's DMC5 stream with controller map displayed bottom right.

A webcam view of TheMainManSWE's (2020) controller (Figure 12.3) is included in his stream of *Tekken 7*, which adds even more context than the dynamic controller map in the previous example. Here, viewers can see specific hand and finger positions in relation to the controller, so we see not only which buttons the player is pushing but also how he does so.

Figure 12.3. Screenshot of Tekken 7 stream. The webcam showing the streamer's hands is at bottom middle right, to the left of the streamer's face.

The eyetracking extension described earlier, Tobii Ghost (now "Tobii Eye Tracker 5"), is another example of a UX tool being used for livestreaming. This eyetracking system (Figure 12.4) has been developed and promoted by a global assistive technology company, Tobii. As part of a partnership with machine-learning startup Mobalytics, Tobii is applying eyetracking in esports training (Tobii, 2020; Ewalt, 2020). A post on the Tobii Blog pitches the technology to potential clients as a method for training professional gamers, specifically *League of Legends* players (Tobii, 2020). Mobalytics hopes to use the data gathered via Tobii to analyze and understand the strategies of professional gamers and thereby derive professional standards against which aspiring pro gamers can then measure their own gameplay: "For instance, Mobalytics' studies have found that top *League of Legends* players look at the mini-map almost twice as often as average players: By using the eye-tracking system, the software can tell a user whether they need to check it more or less often" (Ewalt, 2020, para. 5). The eyetracking system can provide this data not only to game companies, but also to players individually, allowing them to evaluate and reflect on their own player experience.

Increasingly convenient and affordable, eyetracking has many applications within and beyond UX studies as a source of physiological user data. This adaptation for professional esports is an example of UX-related collaboration opened up via Twitch. Professional gamers and their coaches study eyetracking data to hone their competitive edge, game companies leverage the data to understand their users and improve their products, and other streamers use it for added entertainment value, enabling their viewers to see where they look on screen and further shrinking the techno-mediated intimacy gap between streamer and viewer.

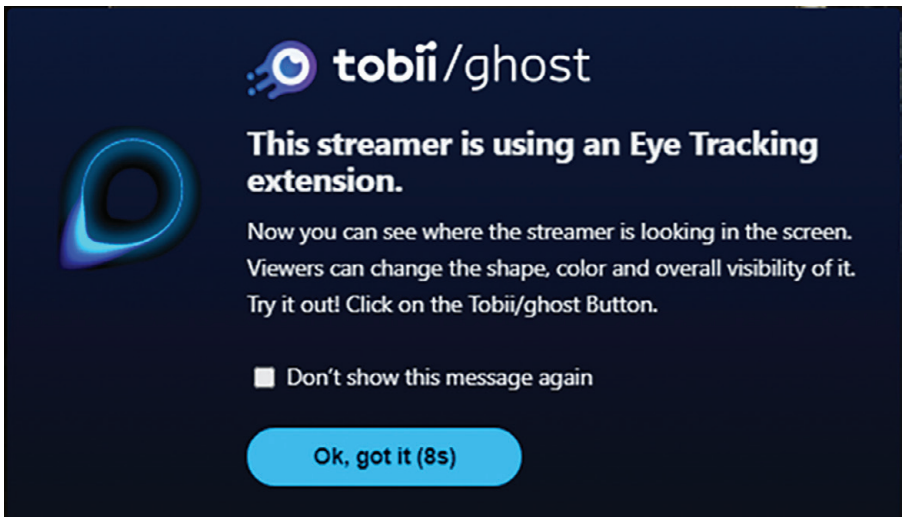

Figure 12.4. Screenshot showing the Tobii Ghost extension popup message.

We acknowledge that the examples covered here are centered in gaming and therefore won't necessarily illustrate the potential of Twitch to capture diverse user experiences in other areas. Because Twitch has long tailored itself to and prioritized gamers and their experiences, it may be that accessing the same kinds of data about user experiences in other arenas—crafting, fitness, etc.—may not be as simple or convenient, since the platform's affordances may be less meaningfully developed for non-gaming streamers and audiences. However, it is worthwhile to consider the platform's potential, particularly as non-game categories (e.g., IRL, Talk Shows & Podcasts, ASMR, Food & Drink, etc.) grow in popularity and as livestreaming becomes more mainstream across a variety of industries.

UXR Methods and Livestreaming

Many of the elements of everyday Twitch streams already incorporate classic UX tools and methods in some way, as we saw in the previous section. The following sections offer considerations for Institutional Review Board approval and ideas for research-based applications, trusting readers to consider how, where, and when livestreaming UX may be useful (see Rohrer, 2014). We also discuss prominent features of the Twitch platform and outline specific ways each can be integrated with existing UX tools and methods. The technical details of setting up and managing a Twitch stream are beyond the scope of this chapter, but we hope to provide points of inspiration for bold experimentation and innovation.

Navigating Institutional Review Board Processes

Obtaining IRB approval or exemption is valuable for any research involving human participants. Because UXR is not often concerned with producing generalizable knowledge, it commonly qualifies for exemption. Nevertheless, it is important to consider how participants will be informed of the study's parameters, whether and how any personal identifiable information will be gathered, and how that data will be protected and secured.

Because Twitch and most other livestreams are public broadcasts with VODs publicly available, we encourage researchers to consider using chat moderators or auto-moderators to make consent information available to participants, as appropriate. Chat functions can also convey details about the scope and aim of the research, its potential for publication, and relevant privacy considerations. Researchers should carefully consider where and how their participants will join the study: those invited to the platform are less likely to understand its public nature and the resultant privacy implications than those who arrive of their own volition. Researchers might consider enabling the subscriber-only chat feature and providing subscriptions (and thus chat capability) only to those who consent to participate in the study. This model could also serve to verify participants are not legally minors.

Livestreaming in general and Twitch in particular offer exciting new opportunities for collaboration in UXR, but researchers are well served when they respect their participants by engaging IRB processes or protocols to ensure participant safety.

Affordances and Applications

A range of UX methods—think-aloud protocols, observations, usability testing, gathering psycho-physiological and other metrics—can all be applied within a livestreaming context (Figure 12.5). Below, we describe several potential opportunities for multimethod UX. To be clear, these observations are not meant to be an explicit guide to enacting UX on Twitch, but a theoretical overview of how existing Twitch features can be leveraged in conducting, teaching, or exploring UXR.

Figure 12.5 shows a screenshot of Hiko's stream (the same used in Figure 12.1), with specific features boxed and enumerated. Each element contributes to the interactive experience of the livestream: (1) the broadcast itself, the shared screen of the streamer; (2) the webcams overlaid on the stream, and the streamer's microphone; (3) the chat box, where viewers and moderators communicate through text and emotes; (4) the channel title and other relevant meta-data that accompanies the VOD capture of the broadcast; and (5) the eyetracking circle implemented with Tobii Ghost, here used to represent Twitch extensions in general.

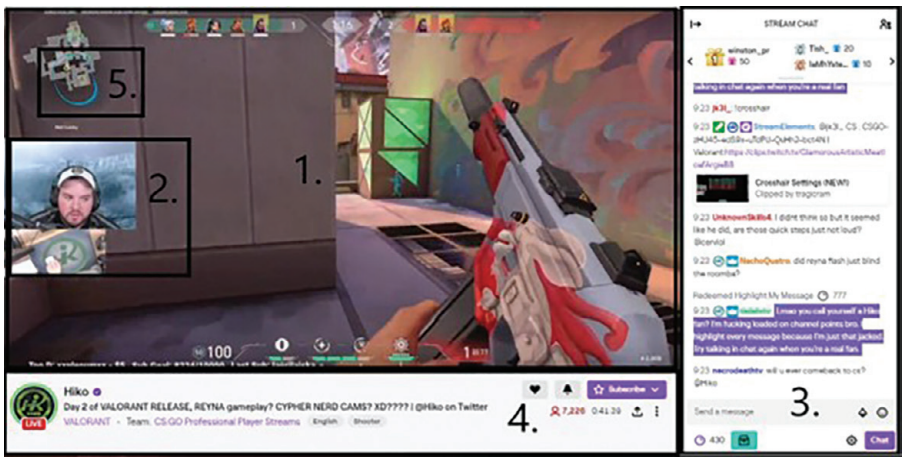

Figure 12.5. Screenshot of Hiko's stream (the same used in Figure 12.1), with specific features boxed and enumerated.

Screen Broadcasting

Observing a user interact with a tool or product is the most fundamental method of usability testing. Twitch and other livestreaming services were built to allow

viewers to see and follow along with streamers' on-screen activity. Conducting the simplest observation or delving into a more expansive contextual inquiry or ethnography can "produce ecologically sound data and can generate profound insights regarding user activities and their meaning" (Kim et al., 2008, p. 444). Accessing video of users' experiences via livestreaming can be a relatively simple, low-cost way of collecting observational data if participants already have the equipment and know-how to broadcast. Streaming the activity of a user's desktop via screensharing allows for synchronous observations, as well as later analysis if the stream is archived (see the section on VOD, below).

Twitch observations may involve sampling a wide selection of Twitch streams for general insights about certain groups of users or a certain game, or a more controlled observation with intentional user recruitment. The question of who to recruit as the streamer for a UXR project mainly hinges on when during the development process the research is being conducted. During a "closed beta" phase, outside experts are invited to play and test the product. Closed beta typically occurs just prior to launch, and playthroughs at this stage are often used to help finetune mechanics and balance as well as stress-test servers. Streamers given a key to participate in a closed beta pose an opportunity not unlike expert heuristic evaluations—they are savvy with the genre and type of software, well-versed and professional in their critical consumption or use, and able to identify resonances and dissonances between this experience and others. Alternately, UXR may prefer an insider, an internal employee, to broadcast or record. Though perhaps less likely to be versed in the work of broadcasting and thinking aloud than a streamer, they may be more representative, easier to find, or better disposed to engage with the product at a valence useful for that development phase. In any case, setting up UX observations over Twitch should be relatively simple if participants are already familiar with the platform or willing to learn it.

One significant constraint to recognize when working with Twitch is the public-by-default nature of livestreaming. Twitch does not currently allow for most streamers to purposefully limit viewership to a certain group or to require a password or login to access live Twitch content, but in response to an increase in targeted harassment the platform has implemented new tools, such as requiring a verified phone number to participate in chat (Parrish, 2021). In any development phase where the company is uncomfortable with broadcasting the product to the public, they would need to account for exposure, liability, privacy, and the like. The platform does not permit private streaming, although there exist imperfect ways to remain hidden from general viewers (Luci, 2020). This means that any UX work performed on Twitch will technically be public and perhaps prone to disruption. Distractions from the streamers' physical space or irrelevant comments from chat participants could somewhat dilute the data. As is the case in many online spaces, there is potential for disruptive or uncooperative behavior, trolling, flaming, toxicity, racism, sexism, and other unwanted intrusions. If researchers are to use Twitch or other online streaming services, they must anticipate and plan

to identify and mitigate abusive behavior using tools such as chat moderation.

Streaming on-screen activity is only part of how Twitch might be used for observations. By combining the affordances of microphones, webcams, and chat, UX researchers can gather additional user data for triangulation and participatory design work. The affordances of visual, audio, and interactive chat media are discussed in the sections below.

Webcams & Microphones

Webcams are one of the primary means streamers use to connect with their viewers. They are common, although not required, among streamers, with many streamers using multiple webcams, such as Hiko's webcam for his mouse; some streamers even use webcams to showcase their pets. Professional streamers invest in high quality recording hardware to elevate the quality of their broadcasts. Seeing streamers' reactions comprises a central part of the experience for many viewers, not unlike the common "reaction" video genre on platforms such as YouTube. The ability to see the streamer can also permit qualitative, observational research, enabling UX researchers to see reactions such as pain points (Fei, 2018).

As is the case with webcams, microphones function as a mainstay of the broadcast experience. They are the primary channel through which streamers communicate with viewers. In the case of Twitch specifically, the nature of the broadcast compels the streamer to articulate their reactions, thoughts, and opinions. Often streamers will reflect aloud on the game's design or interface, bringing to bear their prior gaming experiences and unique user perspectives. The widespread convention of talking aloud while livestreaming means that Twitch is host to many popular streamers who are adept at something akin to concurrent or retrospective think-aloud (CTA/RTA), who embrace the "Let's Play" genre: videos and walkthroughs where streamers demonstrate a videogame to viewers, either broadcast live or recorded, edited, and uploaded later (Let's Play Archive, 2007; PBS Digital Studios, 2013).

Recall the importance of "people who are relatively at ease with thinking aloud while performing a task" (Hoonhout, 2008, p. 68). Whether or not they're broadcasting Let's Plays or walkthroughs, streamers are incentivized to talk through their decision making, prompted both by viewer questions and remarks in chat, but also through the nature of streaming-as-performance. Recall, also, the value placed on multimethod approaches to complement the thought processes laid bare through think-alouds (Hoonhout, 2008; Tullis & Albert, 2013). Twitch specifically and streaming platforms generally are well-suited to mix and match such methods to suit context and improve validity, and accuracy.

If the test participant is a practiced streamer, they may need little guidance to provide useful data through CTA/RTA, whereas internal participants may need more. But the value of streamers' microphones reaches beyond think aloud practices. Audio broadcast means streams can include interviews, either prompted

through moderators in chat or through co-hosts. Interviews conducted or designed by UX researchers can yield different data than CTA/RTA and fit within a product's development phases more soundly. The ability to broadcast and record screens with an audio-video complement broadens UX researchers' options for the methods they employ at various phases of development. The chat function makes the breadth of options more dynamic still.

Chat & Chat Moderation

The chat features on Twitch allow for real-time conversation and interaction between streamers and their viewers, as well as among viewers from around the world. Very popular channels often employ moderators to manage the chat portion of their streams, in order to discourage or prevent inappropriate messaging and/or maintain the boundaries of a particular viewership via gatekeeping practices. Streamers can also amplify viewer comments and bring their questions into the central stream itself by repeating or responding to that content verbally. The affordances of chat and moderation could allow UX researchers to coordinate Twitch-based UX testing or to collect user feedback via modified interviews, surveys, questionnaires, and focus groups. Setting up any given Twitch stream as a user testing scenario could be relatively straightforward, provided that participants are already familiar or have time to familiarize themselves with Twitch beforehand and provided that the prototype or product being tested is available to them. Streamers could be provided with a game or other product to use and then follow chat-based instructions for completing a series of specific tasks.

Along with observing users' behavior, asking users about their experiences is another classic method for learning about what they need or want from a game or product. When implemented carefully, user surveys and questionnaires can be invaluable for accessing users' perceptions and experiences. The Presence, Involvement, Flow Framework (PIFF) and Core Elements of Gaming Experience (CEGE) questionnaires from Bernhaupt (2015) are established tools for assessing the UX of videogames. Questions from these instruments or others could be relayed to the streamer and/or their viewers via the Twitch chat interface. Given the conventional dynamics of livestreaming, where viewers communicate with streamers in this multimodal way, this type of data collection wouldn't necessarily interrupt gameplay or distract users, especially if done with respect to Jun Kim and colleagues' (2008) provisions about survey types and/or done with the coordination of trained chat moderators. Third party surveys (such as the PIFF and CEGE) could also be linked via Twitch chat for users to complete offsite.

Another method for collecting user input involves focus groups. This method is especially useful for market research and early stages of UX development, since focus groups allow researchers to learn more about what users expect and need, as well as what they're collectively excited about. Holding focus groups via Twitch chat won't be the same as doing so in person but does come with the built-in

benefits of easily stored text-based interaction as opposed to bulkier audio recordings. For a Twitch focus group, the streamer could lead a demonstration and ask for audience input, or a chat moderator could lead participants through questions about the ideas or activities being streamed. Focus groups may not work as well on very popular channels without heavy moderation. Scheduling specific "focus group" streams for specifically invited groups of users, or restricting chat to subscriber-only mode, could be ways to productively limit participation, although these tactics may not be available for all channels (Parrish, 2021).

When streamers choose to preserve the chat portion of their livestream, the saved chat transcripts can become the basis for other modes of deeper UX research, including corpus analysis and ethnography.

Video on Demand (VOD)

Twitch's built-in VOD gathers the chat exchanges in addition to the audio-visual broadcast. This allows researchers to return to the archive in perpetuity to analyze streamer facial and vocal reactions, viewer reactions, and questions/comments from chat. The value of archived broadcasts for multimethod UXR shines within the triangulation depicted in the case studies of the TRUE method described above. When the quantitative, behavioral data suggested there was an issue (i.e., too many players were dying on a particular level), researchers were able to use qualitative data from the video-recorded play to "drill down" and, in collaboration with designers, quickly identify the cause—in this case, that enemies on that level threw grenades "faster and with less of an arc," thus making them deadlier (Schuh et al., 2008).

Recorded footage can provide attitudinal data to contextualize the issue, framing researchers' understanding of the quantitative data (i.e., number of deaths) with the emotional reactions from the player (e.g., looks of concentration or confusion combined with shouts of joy or frustration). While visual reactions are an imperfect indicator of attitudinal data, they can be triangulated with think-aloud protocols from streamers' microphones, and returned to for consideration in the context of the shared screen in the archived VOD.

Extensions (for Eyetracking and More)

An impressive range of extensions is available to Twitch streamers—from static overlays to dynamic displays of data (e.g., live stats trackers) and more interactive elements to boost viewer engagement (e.g., suggestion boxes, stickers, polls). Twitch supports several extensions meant to integrate with specific games, scheduling and countdown extensions, loyalty and recognition extensions, streamer analytics extensions, music extensions, and extensions for polls and voting. Some of these work with openly available stats or other application programming interface (API) data on the web, while others are linked to specific hardware.

Extensions can gather and display data overlaid on a stream or facilitate unique kinds of interaction among viewers. The eyetracking tools Hiko and others are using work through the Twitch extension Tobii Ghost (circled in Figure 13.1); controller input maps like the one used in AccountingNightmareSA's stream (see Figure 13.2) are javascript extensions. These and other analytics extensions are obvious points of interest for UXR. These tools may be useful for collecting other physiological data from users, as well as other telemetric data or user feedback for later triangulation.

The intersection between Twitch extensions and UX work suggests a wealth of future possibilities for collaboration. Documentation is available on Twitch for any would-be extension developers, and Twitch encourages users to add any extensions they want to see and use. Future research and experimentation could involve conceptualizing and building specific UX-focused Twitch extensions. Established Twitch developers, UX researchers in academia and industry, and even other tech companies (like Tobii) might collaborate to make UX work on Twitch even more agile and accessible.

Accessing UX data via these various features of the Twitch platform, rather than in a more formal UX lab setting, means accepting some amount of unpredictability in exchange for the benefits of convenient online access and timeliness. A loss in formal rigor is offset by the benefits of quicker data collection and more agile iterations of analysis and testing. The opportunities for triangulation afforded by Twitch can help mitigate the drawbacks of this trade-off. For many designers, production cycles move too quickly for the types of rigor sought by academics. Using Twitch to gather user data and feedback more quickly allows for UX research to be useful even during the demanding timelines upheld in the games industry. And perhaps because of the relative informality of such public UX, unexpected or serendipitous discoveries may be more likely to be considered seriously, rather than merely noted as interesting afterthoughts.

Envisioning New Collaborations

Because Twitch remains significantly gaming-centric, the types of studies we envision begin within that realm and venture beyond it only slightly. Foundational UXR in Twitch gaming circles may build a basis from which non-gaming UX work can draw inspiration. As we think about making the most of Twitch as a hub of UX collaboration, there are several key questions and possible research trajectories we envision as necessary starting points. This section lays out what we perceive as important areas of inquiry, pointed research questions, potential for collaboration, and problems facing that work.

Game development and UX research are both collaborative yet often tightly controlled spaces. Josh Zimmerman (2014) explores how almost any collaboration between game developers and players/fans is often carefully and strictly managed by the developer—part of maintaining the power dynamics where developers

control their intellectual property, tightly manage proprietary information, and shape games discourse to serve their profit-based interests. The prominence of non-disclosure agreements (NDAs) among game developers further evinces these power dynamics. The use of NDAs and the secrecy that rationalizes them complicates workplace studies that would seek to investigate the relationship between developers, fans, UX/PX, and technology such as Twitch. So, while a workplace study focusing on streamers and their collaborations with game developers might be an ideal starting place for any research focused on streaming's value for and impact on product development, the hurdles/barriers of NDAs commonplace in videogame development make such research difficult. In cases where NDAs complicate or stymie inquiry, we suggest an alternate approach—reaching out to the gamers who have been sponsored to stream by game developers, and those broadcasters' viewers.

Bernhaupt (2015) provides an overview of the applicability of UX methods during game design and development phases (see Bernhaupt's table 1.2, p. 6), indicating that some data able to be gathered from streamers may be less useful or even useless at the point during the development that streamers are typically asked to showcase the game. For instance, she indicates that focus groups and interviews are useful during conceptualization and prototyping, but not once the pre-production phase begins. However, several important applications stand out as both lining up with sponsored streaming (which usually occurs in late production) and the types of data Twitch streaming offers, namely observation, playtesting, physiological UX evaluation, experiments that include game controller evaluation, heuristic-based evaluations, video heuristics, and behavioral game telemetry.

We wonder, then, how well sponsored streams lend themselves to producing data useful for such methods. If streamers are being approached from a largely marketing perspective, to promote the game as it nears release or a big update, how are their streams and the constituent elements used to gather UX/PX data, if at all? Moreover, if NDAs prohibit or complicate the researchers' access to workplace studies on use of streamer data, what can we learn about this power dynamic from the streamer, stream, and viewers? We encourage further research here, including inquiry targeting the collaboration between Twitch streamers and developers/designers, but also involving UX practitioners and academics. Specifically, we pose some initial questions:

- How are game companies currently collaborating with streamers via Twitch (or other platforms)?
- What are the common processes/workflows practiced among streamers who partner with game companies?
- What variations are evident among streamers' think-aloud behaviors, and how do these behaviors align (or not) with similar protocols in UX fields?
- How do the contexts of Twitch and in particular the presence of an internet audience affect a participant's thinking aloud?

- How do streamers understand the role(s) of their viewers within their work and collaborations?
- How do Twitch viewers understand the work of the streamers they watch (in terms of performance, use/demonstration, competition, etc.)?
- What comparable partnerships happen via Twitch in non-gaming circles? Are there emerging opportunities for sponsorship non-gaming industries should be aware of?

We envision a potential research trajectory built on these questions would begin with interviewing a selection of sponsored Twitch streamers on their experiences with how they collaborate with game companies, with their audiences, and others. Researchers might begin by asking:

- What were the stated goals of the sponsorship? Was it explicitly intended to promote and market the game, or were there other goals?
- Who began the sponsorship process? Who approached whom? Did the streamer solicit the company, or the other way around?
- Who from the game company was involved in the sponsorship? Was it the developer? Marketer? Other?
- With which organization/company departments did they interact?
- Were there specific criteria the streamer was required to meet prior to the collaboration?
- What kinds of instruction were they given for accessing game content? for streaming? for communicating with viewers/fans?
- How does the streamer consider and engage their viewers when streaming sponsored content as opposed to non-sponsored content?
- Were there other stipulations or agreements in place as to the nature of character of the sponsored stream?

Following preliminary interviews, researchers might design surveys or focus groups around the most interesting findings. Additional findings from such surveys could form the basis for more in-depth research into specific Twitch-UX applications, such as think aloud protocols for streamers or analysis tools for developers. Using Twitch for UX-based collaborations offers a value-multiplier for sponsored streaming: if companies are paying streamers to market their game anyway, they might also get valuable data with which to improve their design or development, and streamers may find that an attention to or use of think aloud protocols maps onto and perhaps even improves viewer engagement. Even in cases with no sponsorship, if researchers can better understand how streaming practices produce useful user research data, independent game developers and small studios—the sort with limited resources for UX—can more affordably and efficiently conduct such research. Academics also stand to benefit from these findings when conducting user research from a distance.

Limitations and Ethical Responsibilities

There are limitations and risks to collaborating via Twitch, some of which we have touched on above. The distributed, public nature of Twitch means that UX work on such a platform can be easily interrupted or derailed. Confidentiality and privacy are difficult to manage on such an open platform, to the extent that if the product being tested is not ready for the public or if participants prefer anonymity, any benefits of using Twitch may be outweighed by these ethical concerns. Livestreaming tools other than Twitch may be more practical in certain contexts.

Perhaps more importantly, researchers and professionals should be mindful and equitably inclusive as they seek collaborations with Twitch users. As a gaming-centric space, Twitch undeniably harbors toxic racist and sexist cultures (see Gray, 2017, 2020; Paul, 2018; Taylor, 2018). Researchers considering Twitch-based UX hold an obligation to center marginalized voices and perspectives in their work and must allow and support radically inclusive representation (in gaming and in UX) to counterbalance the overrepresentation of white male participants in such spaces. Researchers might begin by recognizing the harms of racially color-blind approaches to UXR (Sano-Franchini, 2017), by adopting careful and considered chat moderation practices, and by listening to and acting on recommendations from marginalized steaming communities.

Addressing the effects of privilege and systemic inequalities will always be especially important for building products and systems that are user-centered for more than merely a subset or even a majority of users. The obligation to do so extends beyond the fields of UX and game design into product design, interface design, and communication design of all kinds (Acharya, 2018; Noble, 2018) as well as academia (Walton et al., 2019). Although our discussion of these issues here is inadequate, acknowledging these realities and our responsibilities for addressing such issues is undeniably important. By inviting and supporting (financially and socially) the participation of users from as many backgrounds and ability levels as possible, UX researchers have the potential to open conversations and build connections across historically divided groups, widening access to and awareness of UX along the way. Doing so will be an important part of working past the ingrained privilege still common in UX generally (Castillo, 2018).

Conclusion

This chapter has not covered all potential ways UX principles and methods can be taken up via Twitch and similar livestreaming spaces, but the examples described above and our speculative exploration of how to apply a variety of UX methods on Twitch show that livestreaming services offer productive multimethod platforms for collaborative UX research. Although games have been our focus in this chapter, leveraging Twitch and other livestreaming platforms for UX is likely possible beyond the gaming industry. The affordances of Twitch make it

especially useful for multimethod research and collaboration for researchers in any sector of UX invested in collaborating to make positive change for users. The openness and the popularity of Twitch, a platform where hundreds of thousands of users are already showcasing their use of a variety of interfaces and tools, make it a noteworthy site for further research and investigation.

References

AccountingNightmareSA. (2019). *Devil May Cry 5 – Nero Bloody Palace (Stream 05/04/19)* [archived Twitch stream]. Twitch. https://tinyurl.com/nkvw9wht

Acharya, K. R. (2018, August 3). Usability for user empowerment: Promoting social justice and human rights through localized UX design. SIGDOC '18: *Proceedings of the 36th ACM International Conference on the Design of Communication, 6*, 1–7. https://doi.org/10.1145/3233756.3233960

alexgwin. (2013). *usability test 1* [archived Twitch stream]. Twitch. https://www.twitch.tv/alexgwin/video/49873772

Amaya, G., Davis, J. P., Gunn, D. V., Harrison, C., Pagulayan, R. J., Philips, B., & Wixon, D. (2008). Games user research (GUR): Our experience with and evolution of four methods. In K. Isbister & N. Schaffer (Eds.), *Game usability: Advice from the experts for advancing the player experience* (pp. 35–64). Morgan Kaufmann Publishers.

Bernhaupt, R. (2015). User experience evaluation methods in the games development life cycle. In R. Bernhaupt (Ed.), *Game user experience evaluation* (pp. 1–10) Springer.

bornfreetwitch. (2019). *UX* [archived Twitch stream]. Twitch. https://www.twitch.tv/bornfreetwitch/video/425465268

Castillo, V. (2018, June 24). *An overdue conversation: The UX research industry's Achilles heel.* UX Planet Blog. https://uxplanet.org/an-overdue-conversation-the-ux-research-industrys-achilles-heel-3524b1c6f908

Chan, B., & Gray, K. (2020). Microstreaming, microcelebrity, and marginalized masculinity: Pathways to visibility and self-definition for Black men in gaming. *Women's Studies in Comm, 43*(4), 354–362. https://doi.org/10.1080/07491409.2020.1833634

Clanton C. (1998, April). An interpreted demonstration of computer game design. In *CHI 98 Conference Summary on Human Factors in Computing Systems* (pp. 1–2). ACM.

Cornett, S. (2004, April 25). The usability of massively multiplayer online roleplaying games: Designing for new users. *CHI '04: Proceedings of the SIGCHI conference on Human factors in computing systems*, 703–710. https://doi.org/10.1145/985692.985781

CouchTeamGaming. (2018, August 27). How much money do small Twitch streamers make [Video]. YouTube. https://www.youtube.com/watch?v=fkMnWJ6xl3Q

derScharni. (2020). *The UX and Chill Show* [Twitch channel]. Twitch. https://www.twitch.tv/derscharni

Drachen, A. (2015). Behavioral telemetry in games user research. In R. Bernhaupt (Ed.), *Game User Experience Evaluation* (pp. 135–168). Springer.

Ericsson, K. A. (2006). Protocol analysis and expert thought: Concurrent verbalizations of thinking during experts' performance on representative tasks. In K.A. Ericsson, N. Charness, R. R. Hoffman, & P. J. Feltovich (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 223–241). Cambridge University Press. https://psycnet.apa.org/record/2006–10094–000

Ericsson, K. A., & Simon, H. A. (1984). *Protocol analysis: Verbal reports as data*. MIT Press.
Ewalt, D. (2020, January 3). The pro gamer's secret training tool? Eye tracking. *Forbes*. https://tinyurl.com/2s445n6s
Fei, R. (2018, February 11). *Personas, jobs to be done, user needs = goals + pain points.* UX Collective. https://uxdesign.cc/personas-jtbd-user-needs-goals-pain-points-7eaa81976f0
FranstarMTG. (2013). *Usability study* [archived Twitch stream]. Twitch. https://www.twitch.tv/franstarmtg/video/50823054
GameCircus. (2012). *Phillip Paplinko usability* [archived Twitch stream]. Twitch. https://www.twitch.tv/videos/46223117
GameUserX. (2018). *[ENG] The Witcher 3: Wild Hunt + all DLC + game UX evaluation [PART 1.1]* [archived Twitch stream]. Twitch. https://www.twitch.tv/videos/292359981
Gray, K. L. (2017). They're just too "urban": Black gamers streaming on Twitch. In J. Daniels, K. Gregory, & T. M. Cotton (Eds.), *Digital sociologies* (pp. 355–368). Policy Press.
Gray, K. L. (2020). *Intersectional tech: Black users in digital gaming.* Louisiana State University Press.
Hamilton, W. A., Garretson, O., & Kerne, A. (2014, April 26). Streaming on Twitch: Fostering participatory communities of play within live mixed media. *CHI '14: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 1315–1324). http://doi.org/10.1145/2556288.2557048
Hodent, C. (2017). *The gamer's brain: How neuroscience and UX can impact video game design*. CRC Press.
Hoonhout, H. (2008). Let the game tester do the talking: Think aloud and interviewing to learn about the game experience. In K. Isbister & N. Schaffer (Eds.), *Game usability: advice from the experts for advancing the player experience* (pp. 115–126). Morgan Kaufmann Publishers. https://tinyurl.com/yc3k2wr9
Hsu, J. (2015, January 27). Inside the largest virtual psychology lab in the world. *Wired*. https://www.wired.com/2015/01/inside-the-largest-virtual-psychology-lab-in-the-world/
Isbister, K., & Schaffer, N. (2008). *Game usability: Advice from the experts for advancing the player experience.* Morgan Kaufmann Publishers.
Jennett, C., Cox, A. L., Cairns, P., Dhoparee, S., Epps, A., Tijs, T., & Walton, A. (2008). Measuring and defining the experience of immersion in games. *International Journal of Human-Computer Studies,* 66(9), 641–661. https://doi.org/10.1016/j.ijhcs.2008.04.004
Johnson, M. R., & Woodcock, J. (2017). "It's like the gold rush": The lives and careers of professional video game streamers on Twitch.tv. *Information, Communication & Society, 22*(3), 336–351 https://doi.org/10.1080/1369118X.2017.1386229
Jørgensen, A. H. (2004, October 23). Marrying HCI/usability and computer games: A preliminary look. *NordiCHI '04: Proceedings of Third Nordic Conference on Human-Computer Interaction, 393–396.* https://doi.org/10.1145/1028014.1028078
Kim, J. H., Gunn, D. V., Schuh, E., Phillips, B., Pagulayan, R. J., & Wixon, D. (2008, April 6). Tracking real-time user experience (TRUE): A comprehensive instrumentation solution for complex systems. *CHI '08: Proceedings of SIGCHI Conference on Human Factors in Computing Systems* (pp. 443–452). https://doi.org/10.1145/1357054.1357126
krosmarc. (2019). *Woaaaaaah. Denkt doch mal an die usability!* [archived Twitch stream, unavailable as of publication]. Twitch.
Lazzaro, N. (2008). The four fun keys. In K. Isbister & N. Schaffer (Eds.), *Game usability: Advice from the experts for advancing the player experience* (pp. 317–343). Morgan Kaufmann Publishers.

Lazzaro, N., & Keeker, K. (2004, April). "What's my method?" A game show on games. *CHI EA '04: CHI '04 Extended Abstracts on Human Factors in Computing Systems* (pp. 1093–1094). https://dl.acm.org/doi/abs/10.1145/985921.985922

Let's Play Archive. (n.d.). *The history of the Let's Play Archive*. Let's Play Archive. https://lparchive.org/history

Luci. (2020, May 7). *How to private stream on Twitch.* Stream Scheme. https://www.streamscheme.com/how-to-private-stream-on-twitch/

McAllister, G., & White, G. R. (2015). Video game development and user experience. In R. Bernhaupt (Ed.), *Game user experience evaluation* (pp. 11–36). Springer.

Medlock, M. C., Wixon, D., Terrano, M., Romero, R., & Fulton, B. (2002, July 8–12). Using the RITE method to improve products: A definition and a case study [Presentation]. 11th Annual Usability Professionals Association Conference: Humanizing Design, Orlando, FL, United States.

Nielsen, J., & Landauer, T. K. (1993, May 1). A mathematical model of the finding of usability problems. *INTERCHI '93: Proceedings of the INTERCHI '93 Conference on Human Factors in Computing Systems* (pp. 206–213). https://dl.acm.org/doi/10.5555/164632.164904

Noble, S. U. (2019). *Algorithms of oppression: How search engines reinforce racism*. New York University Press.

Pagulayan, R., & Wixon, D. (2008). Games user research at the crossroads. In K. Isbister & N. Schaffer (Eds.), *Game usability: Advice from the experts for advancing the player experience* (pp. vii-x). Morgan Kaufmann Publishers.

Parrish, A. (2021, Sept. 29). Twitch announces new safety tools in the fight against hate raids. The Verge. https://tinyurl.com/mtyj5j84

Paul, C. A. (2018). *The toxic meritocracy of video games: Why gaming culture is the worst.* University of Minnesota Press.

Payne, K., Keith, M. J., Schuetzler, R. M., & Giboney, J. S. (2017). Examining the learning effects of live streaming video game instruction over Twitch. *Computers in Human Behavior, 77*, 95–109. https://doi.org/10.1016/j.chb.2017.08.029

PBS Digital Studios. (2013, September 3). Why Is LET'S PLAY So Huge? [Video]. Youtube. https://www.youtube.com/watch?v=pQ9bpcdMd_U

Pires, K., & Simon, G. (2015). YouTube Live and Twitch: A tour of user-generated live streaming systems. *MMSys '15: Proceedings of the 6th ACM Multimedia Systems Conference* (pp. 225–230). https://dl.acm.org/doi/10.1145/2713168.2713195

Reimer, C. (2017). Dialogic, data-driven design: UX and League of Legends. In L. Potts & M. J. Salvo (Eds.), *Rhetoric and experience architecture*. (241–257). Parlor Press.

Rohrer, C. (2014, October 12). *When to use which user-experience research methods.* Nielsen Norman Group. https://www.nngroup.com/articles/which-ux-research-methods/

Sano-Franchini, J. (2017). What can Asian eyelids teach us about user experience design? A culturally reflexive framework for UX/I design. *Rhetoric, Professional Communication, and Globalization*, *10*(1), 27–53.

Schuh, E., Gunn, D. V., Phillips, B., Pagulayan, R. J., Kim, J. H., & Wixon, D. (2008). TRUE instrumentation: Tracking real-time user experience in games. In K. Isbister & N. Schaffer (Eds.), *Game usability: Advice from the experts for advancing the player experience* (pp. 237–265). Morgan Kaufmann Publishers.

Sjöblom, M., Törhönena, M., Hamaria, J., & Maceya, J. (2019). The ingredients of Twitch streaming: Affordances of game streams. *Computers in Human Behavior, 92*, 20–28. https://doi.org/10.1016/j.chb.2018.10.012

Southey, F., Xiao, G., Holte, R. C., Trommelen, M., & Buchanan, J. (2005). Semi-automated gameplay analysis by machine learning. *Proceedings of the AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment, 1*(1), 123–128. https://doi.org/10.1609/aiide.v1i1.18727

Sweetster, P., & Wyeth, P. (2005). GameFlow: a model for evaluating player enjoyment in games. *ACM Computer Entertainment,* 3(3), 1–24. https://doi.org/10.1145/1077246.1077253

Tullis, T., & Albert, B. (2013). *Measuring the user experience: Collecting, analyzing, and presenting usability metrics* (2nd ed.). Morgan Kauffman.

Taylor, T. L. (2018). *Watch me play: Twitch and the rise of game live streaming*. Princeton University Press. http://watchmeplay.cc/

TheMainManSWE. (2020). Highlight: Tekken 7 ranked [archived Twitch stream]. Twitch. https://www.twitch.tv/videos/576069073

Tobii. (2020, Feb. 4). Tobii and Mobalytics kick off beta tests featuring eye tracking analytics for League of Legends players. Tobii Corporate. https://tinyurl.com/3n7fd6zw

Twitch (2019, June 26). *Superfans welcome: Subscriber streams are coming to Twitch.* Twitch Blog. https://tinyurl.com/mryphrre

Twitch. (2020). *Insights & analytics.* Twitch.tv. https://dev.twitch.tv/docs/insights

Walton, R., Moore, K. R., & Jones, N. N. (2019). *Technical communication after the social justice turn: Building coalitions for action.* Routledge.

wright4thejob. (2022). User experience design for a bike tail bar! Switches and indicators mechanical and electrical design. [archived Twitch stream, unavailable as of publication]. Twitch.

Wodtke, C. (2018, August 16). The design of everyday games [Video]. YouTube. https://www.youtube.com/watch?v=bhxhL6ChYko

Zimmerman, J. (2014). Psyche and eros: Rhetorics of secrecy and disclosure in game developer–fan relations. In J. deWinter & R. Moeller (Eds.), *Computer games and technical communication: Critical methods and applications at the intersection* (pp. 141–156). Ashgate.