

Audience Participation Games: Blurring the Line Between Player and Spectator

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ABSTRACT

Audience Participation Games challenge traditional assumptions about gameplay by blurring the line between audience and player, allowing audience members to impact gameplay in a meaningful way. Their recent rise in popularity has created new opportunities for game research and development. To better understand this design space, we developed several versions of two prototype games as design probes. We livestreamed them to an online audience in order to develop a framework for audience motivations and participation styles, to explore ways in which mechanics can affect audience members' sense of agency, and to identify promising design spaces. Our results show the breadth of opportunities and challenges that designers face in creating engaging Audience Participation Games.

Author Keywords

Games and play; social media and online communities; entertainment

ACM Classification Keywords

H.5.3. Group and Organization Interfaces: Collaborative computing; K.8.0. General: Games

INTRODUCTION

Audience Participation Games (APGs) restructure the relationship between player, game, and game-watching spectators to allow audience members to have a meaningful impact on gameplay [19, 37, 45]. While APGs as a form of game are not new, they have grown in popularity in recent years due to the rise of livestreaming platforms such as Twitch, Youtube Gaming, and Hitbox, where users stream themselves playing games and can interact with a live audience [17, 22, 34, 47]. This form of games, coupled with the large numbers of viewers on platforms like Twitch, provides opportunities for

exploring game characteristics such as transitory participation, massive simultaneous engagement, and improvisational performance, but also presents new challenges for design.

High-level conceptual decisions facing designers of APGs stem from the reshaping of the relationship between audience and player. Game designers have typically focused on the player, such as by offering them “a series of interesting decisions” that affect outcomes of play [1], and theories of player motivation have emphasized the experience of the player who directly manipulates the game [58]. Work studying game spectators, on the other hand, emphasizes the pleasures of observation rather than action [6].

Audience participants are neither fish nor fowl. Like players, they can influence the game's outcome through their participation, yet they have limited agency to take action in the game [22, 47]. Like spectators, they observe gameplay, yet with the potential to shift their role and intervene. Additionally, new technologies such as livestreaming allow audience participants to construct themselves as an audience through *mutual awareness*, rather than as distributed spectators who simply happen to be watching the same game.

In this paper, we seek to understand the experiences and motivations of audience participants in livestreamed APGs. We also explore participants' sense of *agency*, or how able they feel to meet their needs and achieve their experience goals. To accomplish this, we created custom-designed APGs, which we livestreamed on Twitch to use as probes with audience participants. While APGs can exist in many forms, an exploration of this relatively new form of APG can help us understand the design space more broadly and can inform design of both online and offline APGs.

Through our study we uncover five categories of motivations that describe the goals of audience participants in the livestreamed APGs we created. We also develop a framework to help clarify the relationship between mechanics and both individual and social engagement in livestreamed APGs. Finally, we discuss a series of potential design spaces within the full breadth of APGs, including Performable Gameplay, Asymmetric Information, and Audience Impact. We conclude by discussing challenges and future opportunities.

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RELATED WORK

We begin by presenting a brief definition and history of APGs, providing examples of APGs from both before and after the rise of livestreaming, and highlighting their common elements. Next, we explore the literature on motivation in games, both as a player and as a spectator. Finally, we present agency as a concept that helps frame our lens for understanding the audience’s ability to participate.

Defining APGs

We define Audience Participation Games as games that empower audience members to engage with and impact gameplay. In this section we elaborate on what “audience” and “participation” mean in this context, and comment on how this affects traditional definitions of what counts as a game. We note that due to our choice of Twitch livestreaming to explore APGs, we explore only a subset of the APG design space in this paper. For example, APG participation may be either synchronous or asynchronous, but in this paper we focus specifically on synchronous games and use examples of APGs built around livestreaming platforms to explore future possibilities for design.

Audience

Existing work on pervasive games [31, 55] and game spectatorship [6] frames players as being “on stage” and the audience as observers. But when audience members can also participate in gameplay, what does it mean to be in the audience? To answer this question, we turn to the concept of the “magic circle.” Huizinga’s framing of play as an activity that takes place outside ordinary life [21, 42]. Recent research shows that the magic circle can have a porous boundary [5, 7, 8]. Audience participants exist in this liminal space, with the ability to shift closer to and further from what is typically understood as “play.” We therefore distinguish between the “audience” and the “player” primarily through *centrality* to play. A player in an APG serves as a coordinator, leader, or primary agent in gameplay, with a consistent and direct role. A player also typically establishes the time and conditions for play. The audience in aggregate can impact the gameplay, but no single member of the audience is required for the game to progress.

Additionally, we differentiate the notion of “audience” from that of “spectator.” Spectatorship can be accidental, such as encountering a performance in public space [40]. Audiences, on the other hand, are typically understood to be intentional [44]. For example, the game *Cruel 2 B Kind* involves engagement with passersby who are not playing the game (or may not even be aware that it is being played), who in this definition would not be counted as members of an “audience” [29]. Spectatorship also does not imply mutual awareness between spectators; for example, viewers of the popular television show “American Idol” have the ability to impact the results of the show by voting, but have no coherent social structure or awareness of each other as a group [15]. In our definition of audience participation games, we consider audiences to be mutually aware and able to interact, which allows the construction of a group identity and goals [12].

Participation

We define “participation” in a game as the ability to produce an effect that plays out *within the magic circle of the game*, using game rules or mechanics. In the case of APGs, audience members might directly manipulate the game world, as in *Legend of Dungeon: Masters* [26]; they might change the powers or abilities available to the primary player, as in *Choice Chamber* [47]; or they might act as judges of whether the player wins or loses, such as in *Quiplash* [22]. While this definition may seem expansive, it excludes several types of audience behaviors that might at first seem like participation. For example, one channel on Twitch features audiences who place bets on the outcomes of an arcade-style fighting game while they react to the gameplay and discuss the results [43]. However, their actions have no impact on the course of the game. If the audience had no people in it, the game would proceed in exactly the same way. We also do not include audiences for traditional sports games; while the crowd at a baseball game might impact the game by energizing the home team with their cheers, this mechanism is not in any way formalized or incorporated into the rules of the game.

Games

Existing definitions of games can be extended to include audience participants. For example, Juul develops six themes common to definitions of games, such as “Player effort” and “Negotiable consequences” [25]. While audience participants may have different motivations for participation and different levels of agency from a more traditional player, audience participants can be understood as a particular case within these themes. While players and audience participants may have different modes of interaction, use different sets of game rules, or value outcomes differently, differentiation between player types is already a common pattern in game design. Examples include traitor-based board games like *Shadows over Camelot* and *Battlestar Galactica* where one player’s secret goal is to make all other players lose [16, 33]. What makes these games distinct from other games is that Audience Participation Games must be watchable by an audience that is formed by gameplay and in turn forms gameplay, which emerges from the concepts of “audience” and “participation” as described above.

A Brief History of APGs

Pre-livestreaming APGs typically incorporated live gameplay with an in-person audience that was given clearly defined roles. Pausch, Seitz, and Maynes-Aminzade developed a set of games based on motion tracking where an audience in a movie-theater-style seating arrangement controlled content on a large screen, including a version of the classic game *Pole Position* where the car turned based on which way the audience leaned in their seats, and another game based on fans playing with beach balls at a concert [28]. The popular television show “Who Wants to be a Millionaire?” focused on a player advancing through a series of increasingly difficult trivia questions to win a cash prize. If the player needed help, they could choose to poll the studio audience for their opinions once per game. The audience would then vote by using a keypad device attached to their seat [10].

The increasing availability of social computing technologies facilitated a blending of online and offline environments in audience participation. “Uncle Roy All Around You” [3], an interactive experience mixing offline participation across London with online participation, explored the possibilities of creating engaging experiences. The authors found that it was challenging to involve online participants in the narrative in a meaningful way.

As livestreaming grew in popularity, existing games began to be adapted to the streamer/audience format. For example, Jackbox Games (formerly Jellyvision Games Inc.) originally created small-group party games such as the game-show-style trivia game *You Don’t Know Jack*, in which one to four in-house players compete to answer humorous questions [23]. In 2014, Jackbox Games began to release games like *Quiplash* with Twitch integration [22]. In *Quiplash*, up to eight players answer a series of humorous questions, while any number of audience participants can join by voting on which answer is the best for each question. The audience participants watch the game on a Twitch stream and vote in a separate browser window. In this setup, only the streamer is required to own a copy of the game. Hamilton, Garretson, and Kerne note that streamers have also developed a variety of methods for allowing viewers to impact the stream, from informal conversations to formal polls [19].

Today, many APGs use structured forms of participation to incorporate massive audiences into gameplay, including voting games like *Quiplash*; games like *Choice Chamber* and *Legend of Dungeon: Masters* where audience participants influence mechanics and challenges; and games like *Twitch Plays Pokémon* and its offshoots where audience participants directly control play [22, 26, 27, 47]. Major streaming services are beginning to support and even develop APGs, from *Superfight* to *Breakaway*, to capture a segment of this rapidly growing market [36, 37, 45]. We are entering an era of widespread experimentation with the form of APGs and thus rich opportunities for research and design.

Related Literature

We draw on three areas of existing literature to inform our exploration of Audience Participation Games. First, we examine literature on motivations for play as a starting point for understanding potential motivations of audience participants. We next look at literature on game spectatorship, with the idea that motivations for audience participants might lie between motivations for direct play and motivations for spectatorship. Finally, we build on literature on agency in gameplay and theater to inform our investigations of audience participants’ feelings of engagement with this form of games and potential methods for addressing challenges related both to the structure of Twitch and to general aggregation of different goals.

Motivations for Play

Prior work has classified a number of motivations for participation in games. Yee identified six motivations that drive interest in different types of gameplay: Immersion, Creativity, Action, Social, Mastery, and Achievement [56, 57, 58]. Metrics of engagement offer a slightly different perspective

on player motivations by identifying factors associated with continued participation in a game. Engagement can result from persistent usage of particular features in a game [20], and in particular features that require some level of mastery of mechanics, but also from receipt of in-game rewards. Many games also make use of persistent avatars with which players identify to maintain engagement and motivate play [4]. The broader context for play is important both in shaping game features and in motivating particular categories of potential players [41]; for example, in Kinect games where players use their full bodies as game controllers, designers must consider players’ motivations with regard to exercise and physical activity [30].

In this paper we argue that motivations and contexts for participation in APGs differ from those in traditional games. In APGs, audience participants are separated from game mechanics in a way such that they often impact the game as a member of a crowd rather than as an individual.

Game Spectatorship

Game audiences are communities of diverse participants, each member of which may be invested in watching the game for a different reason. Members can be classified within spectator personas such as bystander, pupil, assistant, commentator, and griever, [6] which describe their relationship to other audience members and the players. Community-played games like Alternate Reality Games (ARGs) and esports communities often have a type of bystander called a “lurker” [18] who prefers to observe but still feels attached to the culture.

Spectators’ social engagement with a game includes a connection to the streamer/player of the game, a connection to the other audience members, and social status within the audience community [12]. Inside jokes and sublanguages are common in these communities [35], as are metanarratives about the game constructed discursively by the player and audience [38, 39]. Spectator communities can congregate on their own forums outside of the esports arena or livestreaming sites, such as the *Twitch Plays Pokémon* subreddit, and build on this metanarrative [27]. In the case of livestreamed games, socially engaged communities can in turn boost the popularity of a streamer or a play style [49, 51] and foster mechanical engagement with the game being played.

In short, game spectatorship is a diverse and socially engaged experience. Because audience participants have the option of becoming spectators at any time, we seek to understand what audience participation offers over and above spectatorship.

Agency

In APGs, audience participants have limited control over the game. Both the structural features of Twitch and methods for aggregating input from large numbers of viewers, which are discussed in the section on livestreamed APG mechanics, challenge existing approaches to fostering a sense of agency within games. Literature on agency in gameplay and in other types of performance present possibilities for addressing these challenges.

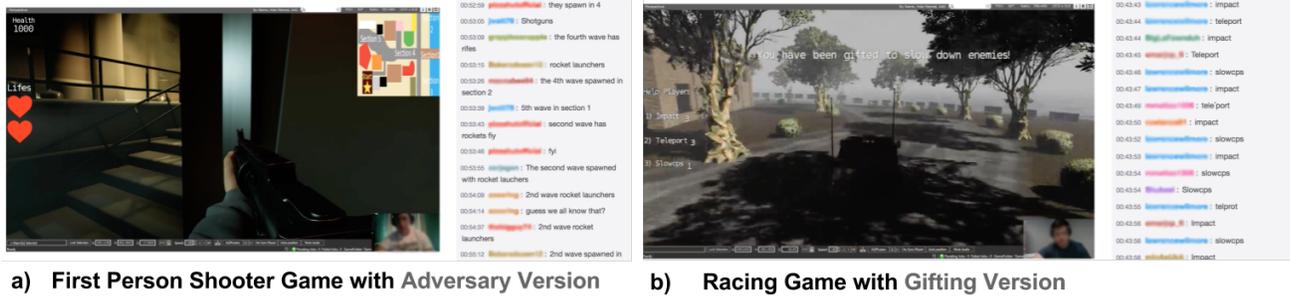


Figure 1. Examples of the two games we made, showcasing different design versions. a) In the FPS APG we designed, audience participants gave gifts to or hindered the streamer while he tried to stay alive against waves of enemies. b) In the racing APG, audience participants helped the streamer win a race or made driving harder for him.

In games, concepts of agency have been described broadly in terms of the relationship between players, mechanics, and narrative [13, 48]. Evans describes agency as a contrast between users’ control over a medium and a medium’s control over users [13]. This aligns with one framing of agency within HCI: as the degree to which an interface allows users to complete desired actions, and the sense of ownership they feel about the consequences of those actions [9, 32]. Interface decisions such as the mode of input can have a substantial impact on agency, as can receiving help from an external source [9].

In single-player games such as *Achievement Unlocked* and *Progress Quest*, players are given intentionally limited or even meaningless options for engaging with a narrative [14, 24]. These games are nonetheless played and enjoyed, suggesting that the ability to take in-game actions is not the only relevant metric for agency; to date, *Achievement Unlocked* has been played more than 4.6 million times [24]. This literature informs our examination of *individual agency*, which focuses on players’ relationship with controls.

Other scholars emphasize interpretation and experience, both individual and social, as core to agency. Tanenbaum and Tanenbaum discuss agency as choice-making, but suggest that commitment to meaning and responsibility in a particular narrative may be a more meaningful metric [48]. In literature and in theater, observing and interpreting can be understood as actions [2]. While authors and actors create a fictional reality, audiences have the power to question, monitor, watch, spy, or bring to light through communication and interconnection [53]. This type of agency builds on social connections between audience members and performers, informing our concept of *social agency* [54].

PREPARING GAME DESIGN PROBES

To explore the nature of APGs and how audience participants engage with them, we developed games that allowed audiences to participate in gameplay. Our designs were informed by concepts from the literature, such as allowing for both individual and social agency in gameplay. We then probed the designs in live playtest sessions on Twitch to study how audiences engaged with particular design elements.

Prototype Design

For our design probes, we developed eight prototypes: two different games with four variants each. The two games we developed were:

1. A **first-person-shooter (FPS) game**, where the streamer was tasked with killing as many computer-controlled opponents as possible before being killed three times himself (see Figure 1.a).
2. A **racing game**, where the player raced a vehicle around a course against three other computer-controlled opponents (see Figure 1.b).

A single round of each game took between three and five minutes on average to complete. We selected these two genres of games because they offered clear ways for the audience participants to engage with the player. The goals of the streamer were obvious, and there were well-established mechanics with which the audience could interact.

Once we had clear ways that audiences could affect gameplay, we created four variants of each game that allowed us to explore social relationships between game participants (including the streamer), and gave audience participants different types of control. See Figure 2 for game versions. The *voting* and *message count* mechanics referenced in 2 were methods for aggregating chat influence, and are described in our section on livestreamed APGs mechanics.

1. In the **“Gifting”** version, audience participants could give the streamer various gifts by typing the associated phrases into the channel’s chat.
2. The **“Adversary”** version allowed audience participants to vote to hinder the streamer by imposing various penalties.
3. The **“Combined”** version allowed audience participants to choose from all the options listed above, either giving the player gifts or imposing challenges or penalties. The audience could switch freely between gifting and penalizing.
4. The **“Oracle”** version involved a completely different mode of participation. Audience members were sent information that the streamer did not know about game conditions via Twitch direct message. They then chose whether

	Giftng	Adversary	Combined	Oracle
FPS Game (voting)	Ammo, health, speed boost	Slow motion, more enemies, forced knock-down	Choose from gifts and adversary options	Information about enemy locations and weapons
Racing Game (message count)	Teleport ahead, slow enemies, force enemies to crash	Shake screen, mix-up controls, slam brakes		Information about location of extra points

Figure 2. Matrix of game types vs conditions. In total, eight game versions were developed for audience participants to interact with - four modalities of interaction for each of two game types.

to truthfully convey that information in the chat, to lie or “troll” the player, or not to engage at all.

“Gifting” only allowed the audience to help the player, “Adversary” only allowed the audience to hurt the player, and the “Combined” version gave audiences the power to control their relationship to the streamer by choosing whether to help or hurt. These three modalities of interaction already exist in livestreamed APGs on Twitch [47, 26]. The “Oracle” version was developed as a contrast to the above types of games; voting and spamming phrases in chat are very common existing mechanics in Twitch APGs [22, 27], but our “Oracle” prototype allowed for an exploration of what happens when the audience can interact with the player in an open-ended way.

Prototype Development

The game prototypes tested in this study were developed in Amazon’s Lumberyard development environment, which allows for direct integration with Twitch. Lumberyard incorporates two programming languages, C++ and Lua, which work with a core feature called flow graphing. The primary Lumberyard engine uses C++, objects inside the engine are coded in Lua, and the flow graph system integrates directly with existing Twitch functionalities. This allows the connection of basic effects to keywords, as well as the incorporation of voting, scoring, and some Twitch API features. All connections to Twitch events developed for these games were incorporated within the flow graphs, with the exception of whispers which were sent via chatbot.

In addition to game development, data collection methods used two existing Twitch chatbots, one widely available and one developed for a previous study [59]. See Figure 3 for a visualization of the relationship between Lumberyard, Twitch, and the chatbots. Similar chatbots are already in use in existing APGs. *Choice Chamber* relies on a chatbot to broadcast polls to audience participants, mitigating issues associated with video feed delay [47].

Conducting Playtest Sessions

To study how the audience would engage with different game versions, we recruited audience participants to probe our game designs via emails to student lists, posts in public Facebook groups, and individual messages to interested gamers. Participants were assigned to one of four hour-long group sessions, which were scheduled at different times of the day and

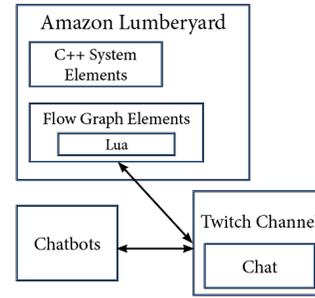


Figure 3. The games developed in Lumberyard were linked with the Twitch channel, while the chatbots collected data separately from chat.

week. Prior to the study, participants were asked to fill out a pre-survey about their demographics, Twitch history, and gameplay preferences. These participants then logged on to Twitch at the scheduled time and joined the channel designated for use in the study. A total of 35 audience members participated.

We used the same streamer in all four playtesting sessions. We chose the primary developer of the game prototypes because of his familiarity with their mechanics. We also wanted all audiences to be exposed to only one type of streamer. Messages sent to the chat were captured by chatbots, and video of the stream was also recorded to capture gameplay events.

At the start of the study, the streamer began the first game and informed participants of how they could participate. The order of the two games was randomized for each session. One round of the first game was played, lasting approximately three to five minutes. When this round finished, participants were asked to fill out a short survey about their experiences with the game, which included questions about whether they collaborated with other audience participants or the streamer and how much control they felt over the outcome of the game. When all surveys were completed the streamer began the second game, again explaining the mechanics and then playing another single round. When the game finished, participants were asked to fill out a second short survey about their experiences with the game, as well as a longer survey with questions comparing the two games and asking for feedback about their overall experiences.

This format of brief engagement with the games limited our ability to observe development of players over the course of the life cycle of a stream, but did facilitate comparisons across different game types. Our analysis focused on users’ initial reactions to a variety of mechanics, and as such was better served by multiple shorter sessions rather than a single longer-term observation. In addition, we elected to test these games as part of separate sessions run by a new streamer rather than through deployment in an established streaming community, but future tests in this area will certainly benefit from collaboration with such a community.

MOTIVATIONS AND MECHANICS

From data gathered during the playtests and experiences with prototype development, we developed a set of comparisons between traditional games and livestream-based synchronous

APGs. In this section we first compare audience participant motivations to traditional player motivations and define a new classification system for audience participant motivations that we derived from our survey data. Next, we explore mechanical differences between livestreamed APGs and traditional games and their potential impact on player agency.

1. Audience Participant Motivations

There are a variety of motivations for play and engagement within traditional games [4, 20, 30, 41, 56, 57, 58], and a number of motivations for engaging with Twitch streams [19]. While Audience Participation Games can incorporate many of the same themes and concepts that other games use, audience participants themselves exist in a liminal space between spectating and playing. Players are “on stage” or “in the magic circle”, while audience participants are variably engaged but less central. Because of this distinction, we argue that the motivations of audience participants do not fit classification schemes traditionally used to group various types of players and require special investigation.

Method

In order to better understand the types of motivations for audience participants, we analyzed survey data gathered from post-surveys administered during playtesting sessions. One researcher began by coding categories of motivation from a set of randomly selected survey responses. Another researcher then analyzed and refined the list. Finally, the two researchers looked at a set of randomly selected responses and produced a final list of five mutually exclusive categories of motivations. Each audience member was coded into one of these categories based on their responses. We considered the hypothesis that these archetypes simply result from the limitations of the different affordances presented to players, but found that all of the types were represented in all conditions; players brought varying motivations to each of the game types.

Helpers

Regardless of whether the streamer’s goal was to collect points, to survive another wave of enemies, or simply to win overall, “Helpers” devised techniques to help the streamer achieve the goal. As one participant stated, “*I wanted to help the player win [...] there were too many enemies in the match!*”

In this study, the majority of the “helpers” felt that they got what they wanted out of the game. However, most of these individuals did not feel connected to other audience members. They primarily interacted with the streamer, and felt that they had less power than the streamer over gameplay.

Power Seekers

“Power seekers” participated with the sole focus of having impact on the game, whether the impact they had was helpful or harmful to the streamer. As one “Power Seeker” explained, “*My goal was to have my input change the course of the game.*”

In contrast to the “Helpers,” the majority of these audience participants felt more powerful than the streamer, though in

the end they still felt their influence was somewhat limited. Most of these participants focused on helping the streamer, not because they had an interest in seeing the streamer succeed, but rather because they felt they could have more impact through helping. These individuals also did not feel that they connected with others. They sought individual recognition, and felt that collaborating with others could diminish their individual impact on the game.

Collaborators

This user type had the highest proportion of individuals who stated that they collaborated with other audience participants and with the streamer. “Collaborators” also agreed most strongly that features of the game enabled them to do what they wanted; it is possible, however, that not having a clear goal in mind allowed them to be satisfied regardless of the outcome. Overall, these audience participants did not feel stronger than the streamer, nor did they feel they influenced the outcome of the game - “*...I didn’t want to get anything out of the game [...] I saw the majority of the community in chat was helping, so decided to be helpful also.*”

Solipsists

These participants focused on obtaining personal benefits from the game, such as learning how to use a new tool or meeting new people for networking opportunities: “*My goal was just to see the next generation of gaming [...] I also just wanted to be entertained*”. These individuals did not care about the player winning or losing, nor did they care about being entertaining to others or having impact on the game. They also felt they could influence the game and had more power than the streamer, but they did not choose to engage with the game to test this feeling and rarely collaborated with other audience participants or with the streamer.

Trolls

These audience participants focused on bullying and playfully harassing the streamer. In contrast to Helpers or Power Seekers, these participants assumed the role of Trolls mainly out of boredom - “*...then I kind of got sick of typing the same three things [to help the streamer]. I found it boring, so then i just wanted the game to end, so I switched to enemy mode...*”. While these participants seemed to get the most entertainment out of seeing the streamer suffer and provoking responses from other participants, they were able to switch back and forth between helping and hindering.

“Trolls” also felt more powerful than the streamer; while most did state that they wanted the streamer to succeed, they focused more on deriving enjoyment from any given situation regardless of whether their methods helped or hurt the streamer. One core characteristic that separated these participants from the others was that they were much more conscious about different roles they could take. This led them to devise more complex ways to collaborate and work with others. The majority of these participants felt more powerful than the streamer and also that they had substantial influence over the outcome.

In these categories, we see that audience participant motivations vary along two axes: the desire to engage with game me-

chanics, and the desire to engage with other audience members. First, player goals implied different levels of engagement with game mechanics, which some players wanted to use to affect the game’s outcome. For example, Power Seekers wanted to use game mechanics to influence the game, regardless of the outcome. Second, there was a range of levels of engagement with the rest of the audience. For example, Collaborators cared a lot about other audience members and their behavior, while Solipsists did not.

We observed that the categories of participants who focused on working with or helping others felt they had the least ability to engage meaningfully with gameplay. People who focused on trolling or on entertaining their own personal goals felt that they had the most ability to attain their own personal goals in the game, but they also had less ability to connect with other audience participants. These differences suggest that audience participants’ game satisfaction is not just about their personal motivation, but also about the degree to which there is a *fit* between their goals and the agency they experience. We therefore next consider the different types of agency available to players within APGs.

Though these categories emerged from limited playing time and a small subset of possible mechanical framings, they present a starting point from which game features can be linked to specific types of audience engagement or experiences. They also intersect in some ways with existing frameworks previously discussed. For example, within frameworks for spectatorship, Solipsists can be compared to a more engaged version of the ‘bystander’ archetype, while Trolls are similar to ‘griefers’ [6]. Engagement with meta-narratives [38, 39] emerged in the “Oracle” and “Combined” conditions across multiple player types. In individual motivations for play, these meta-narratives relate to both the ‘immersion’ and ‘creativity’ motivations [56, 57, 58]. Collaborators and Helpers fit with Yee’s ‘social’ motivation, and Trolls and Power-seekers relate somewhat loosely to ‘mastery’. These connections indicate that audience participant motivations relate both to motivations for spectatorship and motivations for play, but do not cleanly align with either. More work will be needed to clarify the nature of these relationships.

2. Livestreamed APG Mechanics

In exploring their role in the liminal space between spectatorship and play, audience participants in this study varied in the extent to which they sought control over game conditions and desired connection with other users. In our analysis, we divide agency into its individual and social components. Trolls and Power-Seekers wanted a high level of individual agency, where they could directly and personally control play. Collaborators, and to a lesser degree Helpers, sought social agency, which would allow them to build connections with other players and cooperate to achieve goals. Finally, Solipsists’ goals rarely involved either manipulating gameplay or building relationships.

The distinction between individually-focused agency and socially-focused agency is important for APGs. While individual agency is core to many traditional games, where the

player feels in control of game mechanics, this concept encounters significant problems when there are thousands of audience participants vying for control. Designers may consider granting participants social agency as an alternative or supplementary form of engagement, where collaboration leads to collective power and collective rewards. In this section we highlight factors in our playtest sessions that affected individual agency and social agency.

Individual Agency in Livestreamed APGs

In our study, we explored four types of audience-streamer interaction, ranging from “Adversary” to “Oracle”. Among these, the two conditions that allowed audience participants to decide between helping and hindering the streamer, the “Combined” and “Oracle” conditions, led to qualitatively richer gameplay dynamics, matching observations in [19] where Twitch audience members desired both a positive connection with the streamer and impact on the progression of the stream. Audience participants in the “Combined” condition voted to help the streamer when he was behind in the racing game, but voted to hinder him when he got ahead. In the Oracle condition, users moved from conveying the information they had received to creating playful lies to tell the streamer. The narratives built from such interactions could, over time, help audience participants feel that they have agency in affecting the progression of the game [48].

Twitch incorporates a delay into streams in order to accommodate users with different internet connection speeds, the length of which varies across different users. This means that when the streamer responds to audience participants on stream, the response is seen between six and more than twenty seconds later. Both this delay and its variability across users are a challenge to mechanical responsiveness of games and to communication between audience participants and the streamer. In our study, this delay resulted in a time gap between when audience participants voted for particular options and when they saw their votes counted. For example, if an audience member voted to disrupt the streamer’s controls in the racing game, they usually would not see their vote counted on screen until at least ten seconds later. This made it difficult to know whether their vote was important. The delay was even more impactful during the first-person shooter game, where votes were only totaled every thirty seconds. Due to variable delay, it was almost impossible for viewers to know whether their vote would count in the current thirty second cycle or the next one, directly reducing feelings of individual agency via control [9, 46]. Over time users might have adapted to this, as in the case of Twitch Plays Pokémon, but this did not occur in our playtests.

The presence of delay affects individual agency through separation of audience participants from the results of their actions, making it difficult for them to increase engagement and position themselves closer to the stage of play. Existing games have come up with novel methods for dealing with this, from Choice Chamber’s use of chatbots to Quiplash’s use of external browser pages [22, 47], but it remains a challenge that designers must contend with.

Social Agency in Livestreamed APGs

The development of feelings of social agency requires users to understand their role in the social network described by Copier [7, 8] and to strengthen bonds with other users. We encountered several core challenges to development of social agency both on Twitch and in our game designs.

We tested two different chat participation mechanics in each of the four interaction type conditions. We found that the different participation mechanics affected audience participants' ability and motivation to build social bonds. In the *message count* mechanism used in the racing game, a given effect occurred if the corresponding phrase was typed in chat a number of times equal to half of the number of active audience participants. This could include messages sent from one user or from multiple users working together. The *voting* mechanism used in the FPS game counted total votes every thirty seconds and imposed the single effect that had the most votes. In this condition, audience participants could have gained an advantage by trying to build blocs of users who voted in the same way. In theory, this meant that the mechanic encouraged strengthening of social bonds, but in practice this result was not achieved; they found it more advantageous to simply spam their vote instead. The *message count* condition also encouraged individual spam but did not in any way privilege the emergence of voting blocs- a single user with enough persistence could cause any effect to be achieved.

While the participatory game mechanics we built into these games allowed collaboration toward achieving certain effects, the games we created were not structured to allow social victories. The only possible outcomes were a victory or a loss for the streamer, for which audience participants might feel responsible. Mechanics that truly build social agency would provide incentives for users to collaborate and would formally scaffold the development of network bonds.

In the current state of Twitch, a scaffold for strengthening bonds must come from game design rather than the platform itself because identity signals are limited and formal mechanisms for social connections are limited. Absent in Twitch chat are identity markers common in games, such as avatars, character level, and guild tag. The linear presentation of participation (chat messages) on Twitch also makes it difficult to identify groups of users who are working together or who have established social connections because their messages are not separated out from the general flow of chat.

In our study, we directly observed this difficulty in forming social bonds. Users rarely conversed directly with each other; prior to and after games, a total of 10 conversational messages were sent between users, while during games no participants ever conversed with each other. Some participants in our study were familiar with the channel due to a pre-existing personal connection with the streamer, but we did not find any evidence that the display of this connection caused other users to treat them with any more deference.

Other possibilities outside the formal mechanics of the Twitch platform exist for developing identity signals. Some existing Twitch chat bots keep records of point totals associated

with each audience member, which persist across streaming sessions [59]. These points indicate success in previous minigames or total time spent in the channel, and ranking users by points could help clarify social roles and encourage interaction. Some games also allow streamers to designate specific temporary or permanent social roles; in *Choice Chamber*, the game randomly selects a user from active audience participants to have extra powers [47]. Broadly, social identity tags that might enrich group dynamics and sense of social agency are sparse in Twitch chat, and additional tags can currently only be added through games, bots, and other external services.

The Twitch platform offers various. The most basic form is intra-chat text communication, where audience members send messages to each other in real time. While text-based messages have the advantage of simplicity, and many can be accommodated simultaneously, they can be insufficient to convey complex instructions or plan courses of action. Streamers can also communicate with individual viewers or the audience as a whole via speaking in stream, and while this medium can be significantly richer than text it suffers from asynchronicity due to stream delay. A third option for communication is private messaging, or "whispering" between individual users. In our study we used whispers to convey pieces of secret information about the games to audience participants. These modes of communication, while situationally effective, make it a challenge to work collaboratively toward a goal; feedback from the streamer is substantially delayed, individual messages in the chat can get lost in a sea of text, and whispers can be cumbersome and feel disconnected from gameplay.

While Twitch as a platform currently only offers interactions through chat, outside services have sprung up to fill this gap. For example, Discord is an external voice and text chat service that integrates with Twitch; it offers additional features such as multiple chatrooms and different tags for different user types. Development of new, richer modes of communication, both within games and on the Twitch platform itself, could substantially boost the development of feelings of social agency in gameplay both through ability to collaborate to achieve a goal and through feelings of commitment to the group [9, 48].

DISCUSSION: INFORMING DESIGN OF APGS

In the above sections we have focused primarily on Live-streamed APGs. Here we describe potential design spaces within APGs more generally and provide context for possible approaches based on our experiences in this study. We also touch briefly on additional areas that suggest interesting possibilities for design, but which were not explored in depth in this study.

Audience Impact on Gameplay

Traditional audiences are static, uniform, and often passive, but APGs give designers opportunities to subvert traditional roles by allowing audiences to impact gameplay both individually and as a collective. In this study we explored three

modalities of impact: helping, hindering, or choosing between the two. We also looked at two modes of engagement with the game: spamming keywords in the chat, and posting open-ended descriptions of information in the chat. In both cases, players were more engaged when offered more complex interactions, whether by selecting their stance toward the player, or by posting open-ended information rather than a simple keyword.

One approach to this finding is to make modalities of communication more complex and open-ended. Built-in mechanics such as map pings, and emergent mechanics such as jumping as a way of gaining attention, allow players to cooperate without explicit spoken or written discussion. Without these mechanics, audiences cannot, for example, easily refer to map positions or signify differences among apparently identical objects [52]. While our team was able to develop workarounds, such as making in-game objects different colors, workarounds come with their own sets of limitations.

Our findings also suggest that audience participants found open-ended interaction more satisfying because it gave them a deeper way to engage with play. This suggests that richer channels for interaction may not automatically meet audience participants' needs. To create a satisfying impact on gameplay, audience participants must be able to understand the game situation, how they might influence it, and how their actions affected the outcome. Richer communication channels, if not paired with careful design for accessibility, may increase the complexity of player interactions while decreasing their sense of impact. Designers must carefully balance audience impact on game conditions and outcomes with the technical affordances of different modes for engagement.

Creating Performable Gameplay

The success of Twitch streamers in large part depends on their ability to entertain the audience through narration and emotional expressiveness [19]. While it might seem that simply playing a game on stream is a performance, in our study we found that audience participation can directly impact streamers' ability to create a compelling narrative. The streamer chose to frame his relationship with the audience as an ongoing story, and to treat his interactions with the audience as narratively significant. For example, in the "Adversary" condition the streamer portrayed himself as at the mercy of the audience participants, and jokingly begged for leniency when they caused too many negative effects in a row. Audience members could participate in the narrative by causing negative effects; these effects became "performable moments," or game situations that allowed the streamer to advance the narrative and perform in emotionally expressive ways.

We observed that the streamer had increased flexibility in generating an engaging narrative when audience participants had the choice to help or hinder him. This effect was partly driven by audiences choosing to create dramatic tension in gameplay. For example, in the "Combined" condition's racing game, the streamer constantly narrated his position in the course relative to his opponents. When he talked about the game being easy because he was so far ahead, audience participants imposed penalties on him to make the race closer.

When he fell behind as a result of these penalties, audience participants responded to the frustrations he expressed by giving him gifts to help him catch up. In other words, audience participants played a role usually taken by game systems: balancing player performance against that of opponents.

As this example illustrates, it is important to distinguish between how streamers perform through their *gameplay*, and how they perform through *narration*. Designers can enable both types of performance by allowing audiences to influence key game systems, and by ensuring that streamers can easily understand and summarize audience contributions.

Conveying Asymmetric Information

Asymmetric information can give streamers access to a wider repertoire of dramatic techniques, and can make the experiences of audience members more variable and individual [6]. Traditional audience members in a theater or sports game see more or less the same show, but this need not be the case in APGs; seeing only part of the show can add to the experience as other audience members and the streamer try to explain the parts that are missing.

In our study, we explored information asymmetries as a way of generating interactions between players and streamer that were more complex than simply spamming keywords. In the "Oracle" condition, different audience participants had different pieces of information needed by the streamer. Because no one player had all the information, multiple audience members needed to contribute to the streamer's success; because the information was private, individuals could choose how truthful to be about the hidden information.

First, we discovered that audience participation rates affect this type of information asymmetry. Critical pieces of information can be left out of conversations, not because no one knows them, but because nobody who received them is participating. This problem is amplified in the Twitch context, which has a high rate of drop-in and drop-out, but applies to any scenario where audiences can participate at a range of levels of engagement.

Second, we found that the streamer identified individual participants and developed an evolving narrative about their honesty based on the information they shared. However, audience members did not collaborate with one another, even though they had mutually useful information. One difference between the two groups is that the streamer could test whether a piece of information was true by incorporating it in his gameplay, while audience participants could not. We conclude that engaging collaboration based on information sharing requires some method for discerning whether a piece of information is truthful; these interactions are not engaging if there is no way to differentiate between truth and lies.

Another consideration for testing the accuracy of information is the ability to predict outcomes. Can one determine whether a player is lying with greater than random chance? Existing designs on other platforms use systems for attaching a persistent reputation to a user that develops over time. They may also allow users to attach a social signal to their contribution that serves as evidence for its veracity [11]. The highly fluid

nature of Twitch chat makes the former difficult, while the latter depends entirely on the structure of the game.

Future Design Explorations

Several other sources for design decisions that were not explored in this study are worth noting. First, in this study we defined five categories of audience participant motivations. Given that these categories emerged from playtesting, we did not design the games with the intention of accommodating these types of motivations. There is potential for designers to explore what it means to target games toward these different types of motivations, either individually or in combination. For example, games could be designed specifically to manage trolls - or to enable them.

Second, future designs could explore making more nuanced actions available to the audience. In our research prototypes, helpful actions were always helpful and harmful ones were always harmful. However, audience actions might use scarce resources, include both helpful and harmful consequences, or have a variable effect based on what the player is doing at the time. We can explore design spaces for APGs that incorporate richer choices, and we can examine how to make these choices accessible at a range of levels of engagement.

Third, while playtests performed for this study included between five and fifteen audience participants, which is a typical size for Twitch channels, audiences can also number in the thousands. It is important for designers to consider a variety of questions about how gameplay scales across different sized audiences. For example, is it possible to design an APG that is entertaining regardless of audience size? Should APGs be designed for a specific number of participants?

Finally, APGs allow innovation in financial models of game development and distribution. For example, if streamers expect to play a game with thousands of viewers on a consistent basis in a way that might generate revenue through donations, sponsorships, or increased ad viewership, they can justify spending a much larger amount of money on the game than most individual users would normally spend. This opens up possibilities for the development of games targeted toward a very small group of consumers (streamers) which make use of expensive peripherals, are site-specific, or are otherwise not accessible at mass scale. APGs allow for mass access to scarce real-world resources in play.

INFORMING FUTURE RESEARCH

This paper framed the context for APGs, the space of associated mechanics, and the motivations for contributing as an audience participant. A variety of research directions emerge from these frameworks.

First, while the motivation categories described here cover the motivations of participants in our playtests, work remains to be done to refine these categories to cover the motivations of participants across a wider variety of APGs. Research can explore the characteristics of members of these categories in greater depth and analyze the types of people that are likely to fall into each category.

Second, much of this study focused on the ways participants could impact gameplay. In traditional gameplay, much research has been done on the ways players respond to different types of mechanics, and on which types of mechanics contribute to different types of experiences. There is potential for a parallel arc of research for APGs that explores how different mechanics for engagement are differently satisfying for audience participants, and how different types of impact are more or less comprehensible to players. We suggest that mechanics that show clear evidence of an individual's contribution will be more likely to capture that individual's interest.

Third, we can explore the role of commitment to a community in feelings of agency. Our study explored a transient community of audience participants, and even in this situation some players demonstrated an agentic commitment to the group. Engaging players over weeks or months would allow us to investigate the different roles of control, choice, and commitment in agentic experiences during play.

Finally, while this study explored how audience participants impact gameplay, there remain many open questions about how gameplay impacts audience participants. Much literature exists on how games can teach players skills, increase bonds between players, and help to define players' identities [50, 51]. Corresponding research could explore how these effects translate to APGs. Can a skill be taught to ten thousand audience participants simultaneously via an APG? Can such games build solidarity within a community or increase participants' tolerance and empathy toward others?

CONCLUSION

In this paper we have defined APGs as games that have a *mutually-aware* group of audience members who participate in a way that has a *meaningful impact* on the game. They incorporate mechanics and deal with challenges to create feelings of social and individual agency that are not prevalent in other types of games.

We developed two prototype games and four different methods of audience-game interaction and collected data about audience engagement and agency. We identified five categories of audience participants: "Helpers", "Power-seekers", "Collaborators", "Solipsists", and "Trolls". The motivations for audience participants depended on their goals and on their individual and social agency. A distinction between individual and social agency emerged from playtest results and were further explored through an analysis of APG mechanics.

We highlighted several areas for future exploration in design including defining audience impact on gameplay, creating performable gameplay, and conveying asymmetric information. Study of APGs will further our understanding of player motivations, identify mechanisms affecting impact and visibility of mechanics, improve our understanding of agency, and define the ways in which games impact audiences.

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