

Understanding and Empowering Interactions Between Streamer and Audience in Game Live Streams

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For human-computer interaction, live streaming is a rich context in which to investigate not only one-to-many (streamer to audience) and many-to-many (audience members among themselves) interactions, but also how technology can facilitate both. Our research focuses on which interactive options viewers want to have in game live streams, and to what degree they want to be involved in a stream. In this article, we will elaborate on two of our approaches. Methodologically, the first one used a survey and the second one a proof-of-concept system called Helpstone, which aimed to enhance the interactive options of a popular live-streamed game. Before diving into these topics, we will first introduce the area of game live streaming.

Twitch.tv (<https://www.twitch.tv>) is an example of a platform primarily dedicated to this type of content. Everyone can become a streamer by registering and getting access to a personal page (“channel”) in which streamed video content can be shown. Content-wise, streamers show in their channels how they are playing analog or digital games (called “Let’s Play”), or demonstrate special skills such as beating a game quickly (called “Speedruns”). In the beginning, Twitch.tv required streamers to focus primarily on gaming or the gaming culture, but it has since relaxed this policy and today also allows creative content. According to the Influencer Marketing Hub [1], between July 2017 and June 2018, Twitch.tv had more than 15 million daily active users and between 2.2 million and 3.2 million monthly broadcasters. Underlining its popularity, during the same period, viewers watched 355 billion minutes of video content.

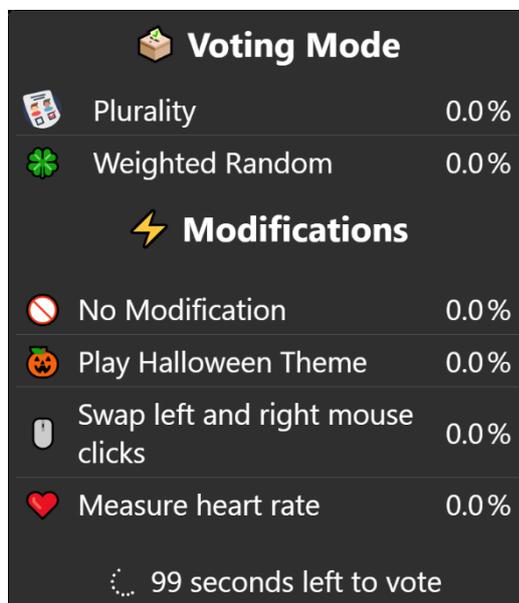


Figure 1. Example of a poll shown in one of our streams.

In contrast to uploaded Let’s Play or Speedrun videos on YouTube, on which viewers can post comments that the creator might read at a later point in time, a core characteristic of game live streams is that viewers can be directly involved in the stream. One typical example is a real-time chat feature alongside the streaming window that allows viewers to chat not only with each other but also with the streamer during a streaming session. Another example is the use of polls, in which viewers can cast their vote for one of several options provided by the streamer (Figure 1). The

streamer will then pick the one receiving the most votes. Occasions for using polls can vary; for example, a streamer may want their audience to select the next game to be played on the stream or which decision or path in the game the streamer should follow.

The possibility to involve viewers in streams has also led to new game experiences in which they are granted an even more active role. In so-called audience participation games [2], viewers are tightly connected to the game the streamer is playing. One popular commercial example is Choice Chamber (<http://choicechamber.com>). In this game, a streamer aims to beat the different levels, while viewers periodically receive polls (votes are cast through the chat) that aim at changing the game level or the underlying game mechanics (e.g., what type of enemies appear in the game or which abilities the streamer's avatar will have). The influence that the audience can exert can be seen as high. Another game genre that has appeared in the live-streaming context is Twitch Plays. Here, no streamer is present. Instead, the viewers themselves can control the game being streamed by entering chat commands. As all viewers provide inputs for the same game instance, a challenge is how to realize shared game control. The most prominent example is Twitch Plays Pokémon [3], in which the game Pokémon Red was streamed. More than 1.1 million viewers entered 122 million commands and, at the peak, 121,000 played simultaneously. Initially, every game command entered in the chat was carried out by the game's avatar; that is, no input aggregation of any kind happened. Later, a mode was added in which only commands in a fixed time interval were considered, and the most frequently entered one was carried out. The audience influence stayed high, as they could decide which aggregation mode should be active by an ongoing majority vote. The audience managed to beat the game within 17 days, and subsequently many more games were offered in a Twitch Plays style. Although we conducted research in the context of such games as well (e.g. [3]), in this article we focus on the typical case in which a streamer is present.

From a technological perspective, there are several ways to involve the audience. The platforms offer built-in options, such as the above-mentioned real-time chat. For more sophisticated options, Twitch.tv offers so-called Extensions: Streamers can choose these from a marketplace to integrate them (e.g., an interactive overlay on the video stream) into their channels or can realize their own ideas by implementing a new extension (using Web technology and the API Twitch offers). In addition, third-party tools exist that can be integrated into the channel (e.g., chat bots, a tool that periodically posts information in the chat or reacts to specific viewer chat messages) or the stream (e.g., donation alerts, messages popping up when a viewer donates money). Finally, streamers may integrate Twitch's video stream and the real-time chat into their own webpages, allowing for even more customization (which we also did in the case of Helpstone; see below).

We administered an online survey in 2017 that was aimed at viewers of game live streams [4]. We investigated which elements they found interesting and to what degree they actually wanted to be involved. A total of 417 German-speaking participants completed the questionnaire. Among the top-rated elements (rated as somewhat interesting or interesting by more than 80 percent of the participants) were anti-trolling mechanics, polls made by the streamer, the streamer reacting to chat messages, and the streamer playing with or against the community. It became obvious that the best-rated features (15 of the top 20) had an interactivity-related aspect to them, underscoring the importance of this factor. We learned that involvement starts with simple interactions, such as the audience being able to decide whether to keep on streaming a certain game. We also found an interesting effect: Only 294 participants claimed to like being involved, although many of the

interactive elements were rated as interesting by more than 294 participants. This was supported by statements that participants provided in free text areas (e.g., “For me, the most important feature is the involvement of the community, even though I would not participate myself”) and seems to be true for many participants: 335 participants would characterize themselves as passive viewers who would, for example, not use the chat actively; 357 stated that they are not really interested in communicating/interacting with other viewers; and 291 stated that they also do not want to communicate/interact with the streamer. By comparing those who agreed with at least one of these statements to those who disagreed with all three, we found that the majority of participants in both groups (64 percent / 88 percent) agreed that they wanted to be involved. This shows that although passive viewers are unlikely to use the options offered, they appreciate having them in a stream. Thus, investigating and improving interactive options is worthwhile for a large viewer base.

It also became clear that the audience did not want unrestricted interactive options to interfere with a streamer’s intentions for their stream. Elements in which the streamer can act as a moderator received higher ratings than those that would affect the channel or stream unconditionally. As an example, polls the streamer can set up were among the top-rated features, but elements such as changing the background music in the stream or manipulating the streaming setup while playing (e.g., exchanging keyboard bindings while playing) are examples of elements interfering with the stream directly, and were rated lower. Trolling behavior by other viewers (i.e., the tendency to exploit the offered features to disturb the stream or streamer) and contextual factors, such as which game genre is streamed and how often interactive options are of relevance during a stream, were also aspects that affected the viewer’s perception of interactivity. These were also exemplified through comments such as “I find features that manipulate the stream uninteresting. There are too many trolls and spammers” and “Please do not overuse interactivity. Too much of it is not good—when used discreetly it helps to enhance the entertainment value and the stream, but if it is omnipresent, I lose interest.” In addition, we found differences in the element perceptions, based on viewers’ motivations for consuming game live streams (e.g., being entertained, being interested in the game streamed, wanting to assist the streamer, etc.). Considering all these aspects together, we feel research and development on viewer types and the derivation of guidelines for the different contextual factors is needed, to get a holistic picture of how proper interactivity can be achieved.

Conceptualizing and providing interactive solutions for live streams also entails confronting several issues that have not yet been discussed. One is scalability: For example, the interactive real-time chat changes considerably depending on the number of viewers who are using it [5]. Hamilton et al. [6] compared the influx of messages in the chat sections of popular channels with the roar of a crowd in a stadium. If the chat is intended to convey information, this also needs to be considered with regard to information overload (especially for the streamer). Thus, when considering new interactive options for viewers, we need to consider that there are channels with more than 10,000 viewers. Another issue is, depending on the live-streaming platform used, the video delay due to technical limitations, which makes real-time interaction a challenge. Practically, this means that while the real-time chat has nearly no delay and a streamer can read what viewers are writing, it can take eight seconds or more until reactions on the stream are shown to the viewers. Platforms such as Mixer (<https://mixer.com>) advertise that they offer lag-free streaming, and Twitch.tv has also done a lot to improve the situation, but this issue has not yet been overcome completely.



Figure 2. Helpstone Viewers' View. A streamer is currently playing the game *Hearthstone* (Blizzard Entertainment, 2014) enhanced with *Overwolf* overlays, while his viewers provide hints by directly interacting with the video stream.

With Helpstone [7], we wanted to investigate how we could improve viewers' options in respect to these challenges. We decided to focus on one popular streamed game to see what we could achieve in this case (instead of creating a general, but potentially limited, solution). We selected *Hearthstone*, a digital trading-card game released by Blizzard Entertainment in 2014. When we created Helpstone, the Twitch.tv Extensions concept was under development and would not yet provide the set of options we would have needed; hence, we decided not to use it. Instead, we embedded the video stream on a webpage we developed, where we could offer more features (Figure 2). We selected *Hearthstone* not only because of its popularity in game live streams (even in October 2019, it was still the 14th most-watched game on Twitch.tv [8]), but also because many streamers already involve their audience: For example, streamers frequently ask for the community's opinion on which cards they should play next, showing that *Hearthstone* is a suitable game to investigate ways to overcome the challenges mentioned earlier.

Helpstone used real-time game-log data (containing information such as which cards were played) to offer context information on our Web page (e.g., a played card and move history). This allowed viewers to not only get an overview of the current state when joining the stream late, but also to allow them to write comments directly to these turns/moves. In addition, they could provide a thumbs up or thumbs down to easily express what they think about them, when not interested in writing text. To reduce information overload, we implemented several aggregation options. Streamers would play the game as usual, but by using the *Overwolf* (<https://www.overwolf.com>) overlay concept, we were able to display overlays in the game even when using it in full-screen mode (which can be seen in the streamed video in Figure 2). A streamer could make overlays visible when interested in the aggregated results, and for example would then see the highest-rated comment, the best- and worst-rated actions, and a selection of top comments. A core feature of Helpstone was the viewer's option to propose move suggestions by simply drawing them on the video stream, instead of writing them out in the chat. This interaction is similar to playing the game by oneself. Identical suggestions coming from different viewers (e.g., attacking card X with card Y) would be automatically aggregated: A streamer would then see visual indications in *Hearthstone* and an

indication showing the number of viewers that approve this move. Again, we were guided by providing new discussion options for the streamer while avoiding information overload. Finally, to account for the lag issue, viewers could adjust a clock on the webpage to a clock that was shown in the video stream. This helped to prevent viewers seeing something (from the real-time game log) that they would not have seen in the stream yet. We evaluated Helpstone in an in-the-wild scenario with a Hearthstone streamer who used Helpstone with his community. On the day of the study, 23 viewers were active, of whom 10 filled out a closing questionnaire. We learned that the direct interaction to suggest hints was the most often used feature and was perceived as a reasonable metaphor for giving hints. The viewers enjoyed Helpstone and reported being more active when using it. The number of game-related interactions rose considerably; they also had the feeling that they could exert influence on the streamer. In addition, the streamer stated that he was influenced by it. We also saw that some viewers who were not particularly active still enjoyed Helpstone. This highlights the result that those who do not want to take part in the extended interactive options still see benefits to them in the live-streaming context.

In sum, through the presented survey, we could show the relevance of interactive options in live streams that are interesting even for those who would not use them actively. Additionally, it became obvious that there are contextual factors that moderate the perception of these options. We see it as highly relevant to investigate and understand these factors, and use the insights to provide tailored experiences for the viewers. In addition, with Helpstone, we developed a system offering more interactivity and overcoming existing challenges. Nonetheless, this was just an approach for one specific game genre; it will be an interesting next step to investigate how concepts can be generalized for completely different genres. Ultimately, both the theoretical and practical research aspects in the domain of game live streams will potentially lead to new, interactive forms of the experience.

Endnotes

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Insights

- Game live streaming is a popular new form of entertainment.
- Streamers offer interactive options to integrate viewers in their live stream.
- Viewers value interactivity—even those who would never use interactive options still appreciate that these are available in game live streams.