

E-Sports and Audience

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Abstract. That video and computer games have reached the masses is a well known fact. However, also game streaming and watching other people play video games is a phenomenon that has outgrown its small beginnings by far, and game streams, be it live or recorded, are viewed by millions. E-sports is the result of organized leagues and tournaments in which players can compete in controlled environments and viewers can experience the matches, discuss and criticize, just like in physical sports. In this paper we look into the challenges for multimedia research and the question to be answered by focusing on a specific relevant game, Counter-Strike: Global Offensive, and investigate how the audience consumes game streams from competitive tournaments.

1 Introduction

All in all, e-sports and game streaming are big business. Already in 2013, the number of concurrent users for a single event exceeded eight million for a League of Legends Championship¹. In 2016, approximately 162 million viewers accessed e-sports streams frequently². In 2018, the biggest DOTA 2 tournament, a game similar to League of Legends, had more than 14 million concurrent viewers at peak times³. Also in 2018, Tyler “Ninja” Blevins was the first person to reach ten million followers with a single game streaming channel. With the beginning of 2019, Ninja already exceeded 13 million followers⁴.

From a consumers point of view the rich bouquet of data including multiple audio and video streams from different players in multiplayer games, commentaries, game data and statistics, interaction traces, viewer-to-viewer communication, and many more channels makes it hard to stay on top of more than a handful selected games, tournaments or streamers.

Why would people watch game streams? From an observational point of view, it has been argued that the interactivity of participating in a game affects the narrative of the game through the player's choices. That's what viewers experience along with the (i) unique personality of the streamers, who comments on her/his actions and conveys the emotional undertone while playing the game, (ii) the interaction with the streamer via chat or other means, and (iii) the interaction in between viewers. While this may be the case for single player games or watching streams of single players, the case of

¹ <https://associate.vc/esports-millions-of-viewers-millions-of-dollars-e7b411b57ba6>, accessed 2018-02-28

² <https://www.statista.com/statistics/490480/global-esports-audience-size-viewer-type>, accessed 2018-02-28

³ <https://esc.watch/blog/stats-international-2018>, accessed 2019-01-17

⁴ <https://socialblade.com/twitch/user/ninja/monthly>, accessed 2019-01-17

e-sports matches and tournaments is more complex. The game provides a sandbox with a limited toolkit and two groups of people are competing over a virtual prize. Arguably, this might be a new version of the medieval jousting or the Roman gladiators, but the new aspect is that everyone, everywhere can offer or enter an arena and share a view of the game to everyone else. This has become so popular that it is even integrated in the current hardware generation of game consoles. Gamers can stream to Twitch, YouTube, or Mixer (popular platforms for game streaming) at the press of a button from Xbox One, Playstation 4, PC and Nintendo Switch.

While consuming video game streams is similar to watching TV or consuming any other live stream on the internet, there are characteristics that set game streaming and streaming of e-sports apart.

- **Interactivity is extremely high.** The increased interactivity through chats from viewers to viewers as well as from audience to players encourages intense discussions, but also trolling, the use of bots, hate speech, toxic behavior, etc.
- **The footage is multi-view content.** In multiplayer games many concurrent players interact in the same game world instance, and each of them has her/his own view. Viewers have to choose which players to follow or rely on a commentator or director to make that decision for them.
- **The user group is well-informed.** This is very similar to core sports fans who know every piece of history from their soccer, hockey, football, or baseball team, but the e-sports stars are within reach and there's always the possibility to encounter one and play and/or compete with an idol.

One of the key challenges of the industry today is to render the results of e-sports events more promotable. It is notoriously difficult to search, e.g., for exciting highlights, because of the huge amounts of video recorded for each match, and their homogeneity, e.g., every match of League of Legends roughly looks the same.

Analyzing the vast amount of data created by players of games to recognize patterns and learn about players has recently been identified as research are named game analytics (El-Nasr et al. 2016). However, the interconnection between playing the game, game streaming and consuming streamed game content has not yet been researched in detail. In this paper we focus on Counter-Strike: Global Offensive (CS:GO), a rather settled game with a long history, but with a solid player and viewers base serving more than 10,000 matches for more than 300,000 user concurrently⁵. We particularly investigate the challenges for summarizing competitive CS:GO matches in a way that allows viewers to grasp the essence of a match in short time.

2. Counter-Strike: Global Offensive

CS:GO⁶ is a first person shooter with a focus on tactics and a common e-sports game. Figure 1 shows a screenshot with the view from a single player on the game. CS:GO is the result of an evolution of the original Counter-Strike game, which has been first released in 1999. After Counter-Strike has been developed as a modification of the popular game Half-Life as a hobby project, the developers have been hired by Valve, the producers and publishers of Half-Life, and Counter-Strike has been developed

⁵ <https://csgo-stats.com/>, accessed 2019-01-17

⁶ https://store.steampowered.com/app/730/CounterStrike_Global_Offensive/, accessed 2019-01-18

further and further. It has been among the most popular e-sports games for years and is still being played despite the somewhat outdated graphics.

The game is played by two teams of five players. While the overall rules can change with the server settings, a common rule set for e-sports tournaments is that the game is played in a *best of 30* fashion, meaning that each of the teams tries to score 15 rounds before the other does. If the final score is 15:15 points, then teams go into overtime. Depending on the tournament rules this can be a *best of six* or *best of ten* system.



Figure 1. Screenshot from the game Counter-Strike: Global Offensive (CS:GO) showing the default view of the players. In the left top corner the mini map indicates the position of the player as well as the positions of the team mates.

In each CS:GO round, there are two sides. The *terrorists* and the *counter-terrorists*. Teams change side after 15 rounds and in overtime they change again after three (or respectively five if it's best of ten) rounds. A crucial part of the game is the outfitting of the players. In case of avatar death, one has to buy new weapons, armour, ammo, grenades and items. If a round is survived, what remains can be taken to the next round. In-game money is awarded for achievements in the game, including kills, bomb plantings and bomb defusing, as well as winning a round or losing consecutive ones. The most common game type played is the bomb planting / bomb defusal game. Terrorists try to plant a bomb, while counter-terrorists work against that. If the bomb is successfully planted, counter-terrorists try to defuse the bomb and terrorists are in the role of working against defusal. Other game modes include hostage scenarios, VIP protection, deathmatches and battle royale.

Typically, CS:GO games show common patterns, especially if the competing teams have comparable skills. A common scheme is that teams win or loose rounds consecutively and, especially for the teams losing rounds, economy management is crucial. For instance, players awarded with money need to buy

equipment for the players, who have no money left and sometimes. Often, rounds are intentionally played with minimum equipment (e.g. pistol rounds) to save money for a fully equipped round to turn the tides in the game. Common tipping points and interesting rounds are when teams are both fully equipped.

3. CS:GO Streams and Summarization

Professional tournaments in CS:GO are organized by companies like the ESL Gaming Network⁷. ESL organizes games in leagues from hobbyist leagues (ESL Play) to amateurs and pro gamers (ESL Pro). For streaming these tournaments there are several approaches. On the one hand streaming platforms like Twitch TV, a game streaming platform owned by Amazon, show a cut and commented version of the game, where a director cuts between scenes, replays them and one or more commentators explain the ongoings, add background information and comment on the game. This stream typically also includes real world footage, showing the players, their emotions and expressions as well as the trainer directing and supporting the team. On the other hand specialized streaming platforms like ZNIPE.TV⁸ provide access to all the streams including the commentators stream, the players views and the map overview showing the players positions in the map as they advance.

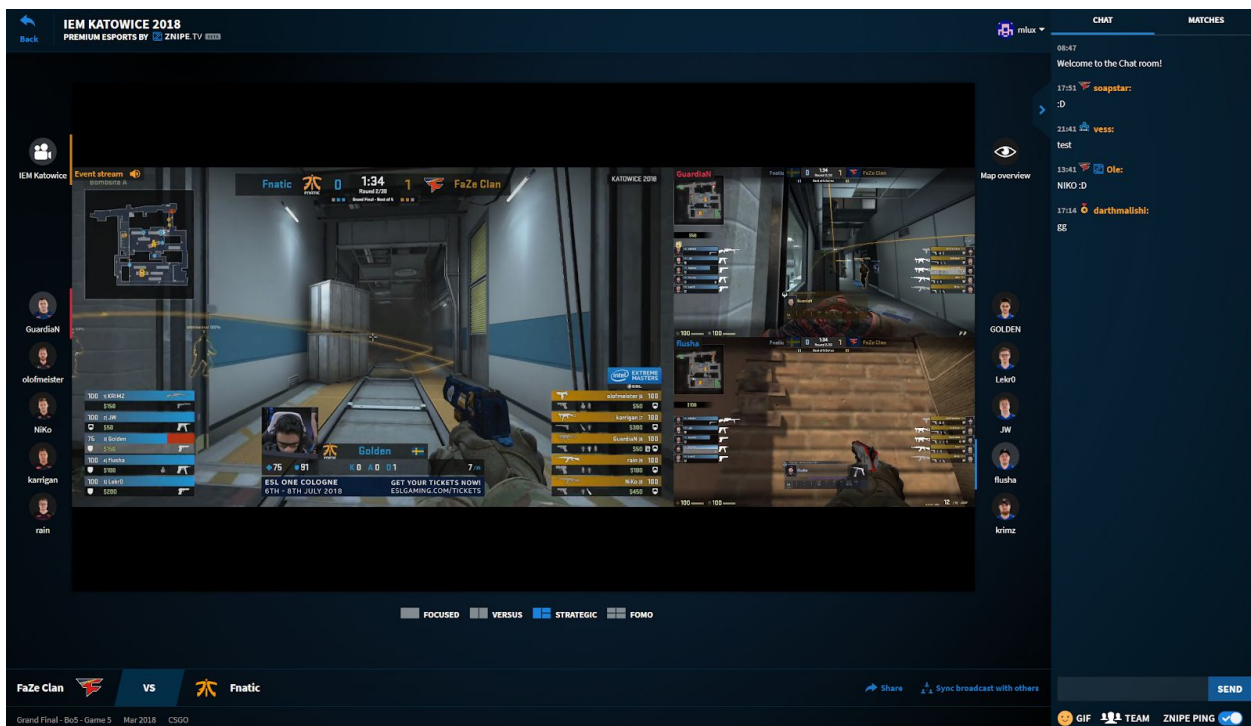


Figure 2. Interface from ZNIPE.TV showing three video streams at once from the finals of the ESL One tournament in Katowice, 2018.

In Figure 2 a screenshot from ZNIPE.TV shows the interface. Below the videos viewers can switch between four options allowing them to view 1-4 streams at the same time. From left and right sides of

⁷ <https://www.eslgaming.com>, accessed 2017-01-18

⁸ <https://beta.znipe.tv>, accessed 2017-01-18

the main video view player streams as well as the map and commentator stream can be dragged to the view to compose one's own personalized view on the game. So instead of following the commentator, viewers can be their own directors and can follow their favourite players through their eyes.

While for high profile matches and professional leagues people can consume the commentator streams, many matches that are played, e.g. in the ESL Play league for hobbyists, have no summary or can only be viewed through the eyes of one single player streaming the match on Twitch.tv or similar platforms. A lot of content is created, and while some of it is potentially interesting for viewers, it's hard for them to skim through the vast amount of played matches and player views to get the information and entertainment they want.

4. Challenges

Taking the ESL Play league as an example, the ESL Gaming Network manages to set up the rules, to organize the tournaments, to prevent cheating to a certain degree, and to compile the results of the tournament and provide overall score boards. Streaming of the ESL Play leagues is not supported by the ESL Gaming Network. While there might be a market for viewers, companies struggle to provide ready to consume videos featuring highlights of the matches, and summaries of tournaments. Hence, most of the game streaming content in these matches and tournaments is discarded and despite potential interest, never consumed by viewers.

Looking at the vast amount of video data ready to be published through the lens of a multimedia researcher opportunities but also challenges can be identified. From a multimedia research point of view, automated highlight identification and summarization of e-sports matches is a challenging and novel research area posing new problems due to the high interactivity and multiple views on the arena, or virtual world. Based on the example of CS:GO we can identify the following challenges:

Classification of intra-round strategy. In CS:GO teams employ different strategies for a single round, like buying all heavy equipment they need and rushing in, saving money for a fully equipped round, waiting for the other team to make a move towards strategic positions, or a general strategy of disruption. For summarization it is useful to analyze and display which team employed which strategy for a given round.

Classification of inter-round strategy. Teams also have an overall strategy spanning multiple rounds, like wait and see to wait for action of the other team or rush in and try to win the match as soon as possible.

Tipping points and events. Beside the knowledge of who won the match, viewers also appreciate to reflect on the most critical time points in the game, like for instance the goals, fouls, or corner throws in a soccer game (Bayat et al. 2014, Min et al. 2003). For CS:GO this includes events when players fail to implement a strategy, when teams turn around the game after consecutive losses, etc.

Ranking of player importance. A team can only be as good as its weakest player. For summarization we need to identify the relevance of contribution to winning or losing for each player. This goes far beyond elimination count and includes team play, communication, skill and much more.

Player positions. Tactics within the rounds heavily rely on where players are within the map. For CS:GO and many other games, the position of players in the map is not given in the meta data stream,

but can only be inferred visually from an overview map. Moreover, the map is not flat, but often has multiple floors and points of interest may lie on the same x and y coordinates, but at a different z.

Detecting scenes of high importance. Within rounds there are scenes that are of special interest to viewers, including when a single remaining player fights off a whole team of enemies, or a bad decision of a single player destroys the overall strategy of a team. Moreover, the overtime, if any, has been identified as highly interesting to players as well as viewers.

Analyzing economy management of teams. As economy management is a crucial part of the game, for summaries this needs to be analyzed and properly visualized to the viewers. We hypothesize that economy management is -- along with player positions -- highly correlated to inter- and intra-round strategy.

View composition and visualization. Having at least ten streams in CS:GO, i.e. one for each player, viewers might be interested in seeing multiple streams at once. Options include featuring 1-4 streams at the same time, and which option and how to choose remains an open question.

Stream synchronisation. For analyzing multiple video streams from the same event it is a common problem that the streams are not aligned properly timewise. Due to technical issues resulting from small differences in hard- and software the same event, e.g. the defusal of a bomb in CS:GO can be found at different time points in different streams. Difference can add up to multiple seconds, which calls for synchronization of streams before creating a summary.

Applicability to other games. While it is a plausible approach to analyze games and find heuristics for them, one needs to differentiate between approaches that are independent from the game or even the genre and approaches that can be applied for other games or games of the same genre. Finding positions of players and strategy classification might be of similar importance in DOTA, League of Legends, or FIFA Soccer, but economy management and inter round strategy might be less relevant.

6. Summary & Outlook

Game streaming and in particular streaming of e-sports events is on the rise. Even Netflix, itself hugely popular, thinks Fortnite, and, therefore, a video game and video game streaming, is a bigger competitor than Netflix-like streaming services⁹. Ultimately, interactive entertainment seems to lead to a kind of meta-entertainment, where viewers interactively watch others play interactive games. Main change compared to traditional interactive entertainment and broadcasting is, that content can be generated without expensive equipment, everywhere and anytime. Furthermore, broadcasting platforms provide means to send out your video live to millions of people and -- in a few cases -- to make a living from it. This of course leads much more content, which is typically raw and unfiltered and rarely edited in a professional way.

Multimedia research can focus on major challenges regarding the analysis, filtering and summarization of this content. A first step has been taken by the *MultimediaEval GameStory* task (Lux et al. 2018), from which the authors have extracted challenges and hypotheses. The three submissions to the task in

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<https://www.cnn.com/2019/01/17/netflix-more-scared-of-fortnite-and-youtube-than-disney-and-amazon.html>, accessed 2019-01-18

2018 (Lux et al. 2018, Wutti 2018, Ninh et al. 2018) have helped to identify what's important and challenging and will help to redefine the GameStory task in 2019.

Acknowledgements

We'd like to thank all the people from MultimediaEval for the fruitful discussions, the support and all the comments and interesting views on the problem of e-sports analysis and summarization. Special thanks go to Martha Larson and Steven Hicks. A lot of thanks also go to the CS:GO players and game stream consumers who helped us from a consumer point of view: Manoj Kesavulu, Jonas Markussen, and Hakon Stensland. We also thank ZNIPE.TV and in particular Marcus Larson for providing us and helping us with the data.

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