Why am I watching? Capturing the interplay of social and technological aspects of online live streaming

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Abstract. Watching live streams of video games on the internet has become a popular leisure activity, which is accompanied by a remarkable social and economic meaningfulness. Different academic studies already captured the empirical phenomenon, but it remains unclear if the consumption of live streams of video games can be best described as a function of social or technological related variables in a single study. Our approach takes an initial step to answer this question. We conducted a survey collecting data from 210 participants to better understand live streaming. Affective Disposition Theory (ADT) was used to capture social and the Uses and Gratifications Theory (UGT) technology related variables. Using structural equation modelling, both theories showed their disjunctive usefulness to explain the individual use of streams. Additionally, we were able to derive a unified model capturing the interplay of social and technological aspects.

Keywords: Live Streaming, Video Games, Human-Computer Interaction

1　Introduction

Our everyday lives are characterized by a broad and rising dissemination of technology. As a result, new phenomena emerged through the interplay of social and technology related aspects. Looking at leisure behavior of individuals nowadays, new forms of activities can be detected, which include meaningful social and economic implications illustrating a disruptive and changing society [1]. One particular noteworthy class of technology are online platforms broadcasting live streaming of video games, which comprise the interplay of viewers, streamers (social aspects), and a broadcasting platform (technical aspect) [1]. Live streams of video games have been a topic of interest for researchers' in different disciplines, already exploring a significant amount of technological and social issues related to live streaming [1, 16]. Looking at contemporary research, a theoretical blind spot lies in the missing knowledge about the interplay of the perceptions of the (social affordances) streamer and the more general (technological) functionalities of the platform. Against this background, we use the Affective Disposition Theory (related to the streamer as an individual) and the Uses and Gratifications Theory (related to the effect of the broadcasting platform) to explain the consumption of streams. As a case, we use a survey focusing on Twitch.tv – the largest streaming

platform worldwide – to compare both approaches. Afterwards, we merge the results of both theories and propose a unified model explaining the consumption of live streaming of video games. Our study will help academia to better understand the interplay of technological and social aspects during the production of a live stream. In addition, we provide aid to developers in incorporating designs that will increase the experience of consuming live streaming. The paper is guided by the following research question:

- **RQ:** What (technological and social) variables best describe the motivation of users to consume online live streams of video games?

2   Related work

2.1   Streaming of video games

During the last decades, the phenomenon of online live streaming of video games emerged receiving public attention attracting millions of unique viewers daily all over the world [2]. As an example, Twitch.tv ranks under the top 40 visited websites worldwide. It has more than 7 billion visits, and over 429 billion watched minutes of video streaming as of June 2019, further illustrating the social and economic significance of live streaming of video games [1, 8]. The streaming phenomenon consists of two different groups of actors coming together on the streaming platforms. On the one hand, streamers live broadcast their game play and are producers of content. The group of viewers watch the broadcasts and are on the consumer side of the platforms. The creation of the live streams can be understood as a co-production between both groups of actors; streamers commenting on game play and interaction with the viewers explaining game style, strategies and giving advice to viewers is frequently provided using audio and chat functions [3, 4]. Apart from that, viewers have the opportunity to interact with each other and the streamer using chat functionalities as well. This two-way communication fosters a unique relationship between the streamers and their spectators.

From an academic perspective, two major streams of studies are suitable to investigate the streaming phenomenon. From a technological perspective, several studies examined live streaming platforms and services with regard to the (technological) systems of streaming. Variables like user satisfaction were the subject of interest including different approaches, such as reducing bandwidth cost [5–7], objective video quality [8], and hardware-based video encoding [9]. From a psychological perspective, research addressed motives that drive users (streamers and/or viewers) to engage in streaming. Research attempted to characterize different groups of users and personas [10], identified biometrics during streaming events [11], and explored identity related aspects [10, 12]. For our study, we choose a viewer's perspective to identify the explanatory power of the perceptions of the specific streamer and the more general broadcasting platform.

2.2   Theoretical framework

Affective Disposition Theory (ADT) stems from media psychology and proposes explanations for why and how an audience deals with various media entertainment narratives[13]. Its most basic premise is that users attach an emotion to relevant characters

while consuming narrative media [14]. ADT states that the use of a specific form of media is a function of the affects and dispositions of viewers towards (medial) characters. The assumptions of ADT have been widely tested in academia, with strong empirical support based on a variety of media narratives [15]. Within the ADT, the formation of affects can be illustrated by moral judgements assessing the moral appropriateness of a specific behavior, varying levels of liking or disliking, and the identification with medial characters, which influence the valence and intensity of affects and the use of specific media [14]. Research already explored different antecedents of affects like the general attitude towards the behavior the character performs and demographic variables. Results show that a more positive attitude increases the identification and the liking of the character. Furthermore, taking into account assumptions of developmental psychology and the fast changing self-concept of younger people becoming richer over time, a negative relation between age and affects can be found [14]. Additionally, researchers proposed different antecedents of moral judgements. One noteworthy variable is dispositional empathy, which showed effects on moral judgement prior [16].

To the best of our knowledge, no study has utilized the ADT to explain the use of live streaming. We assume that the ADT is especially suitable to describe our context of interest, because on live streaming platforms the audience can be understood as the group of viewers and the character as the respective streamer.

The Uses and Gratifications Theory (UGT) explains why individuals become involved in technology mediated communication and what kind of gratifications they receive from it [17]. On this occasion, related behavior can be understood as a gratification. Following these assumptions, the choice of media use is dependent on salient needs as well as the expectations of the individual towards the respective media [17]. Research already used UGT in different contexts like social media [18–20], consumer research [21], and technology use [22, 23]. The majority of UGT studies distinguished between two levels of predictors to explain media use. On a level of mediating variables, researchers tested variables like attitude [18] and interactivity [8, 6]. Both variables showed positive relationships to the subsequent levels of media use. On a level of independent variables, individual motives related to a behavior of interest were the most frequently exploited constructs looking at the application of the UGT, whereby they are understood as entities giving purpose and direction to a behavior of interest. Results of different studies indicated a consistent positive connection between motives and mediating variables [18]. Based on the aforementioned information and for the purpose of our study, we assume that the choice to use Twitch.tv is largely dependent on an individuals' own perception of how well a certain stream is able to satisfy their needs, mediated through the attitude towards streaming. Additionally, we suspect an outstanding meaningfulness of the perceived interactivity on the platform by design.

3 Methodology

3.1 Data analysis

To answer our research question, we used a cross-sectional approach to explain game related live streams. To derive our quantitative results, we make use of covariance-

based statistics. Since our work covers a wide range of content, we did not specify concrete hypotheses and framed our investigation as an explorative approach.

To analyze our data, we proceeded in five subsequent steps. First, we ran a preliminary analysis to make sure our data explaining continued use was not confounded with any unwanted effects controlling for demographic and control variables. Second, we explored relationships between the mediating (identification with the streamer, liking of the streamer, moral judgement, attitude towards streaming, perceived interactivity) and independent variables (age, attitude towards streaming, empathy) by using correlation calculations. Third, we used the information derived in the prior step and structural equation path modelling to test both theories. Fourth, we compared the results of the theories to find out which theory includes a richer explanation. Lastly, we proposed a unified model bringing together the information derived in our prior steps.
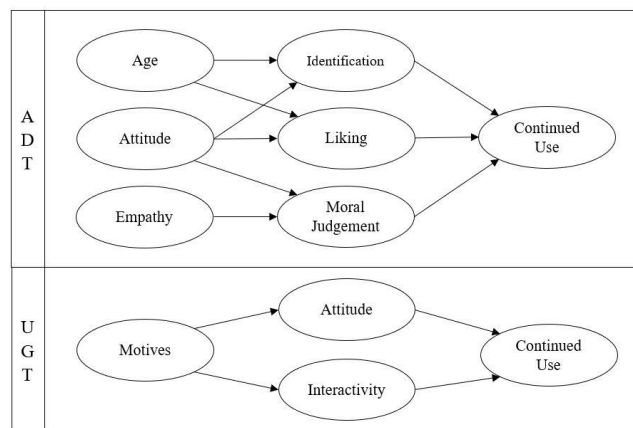

Fig. 1. Research Model

3.2   Data collection

We collected data from 224 participants supported by an online questionnaire. Since we wanted to apply covariate-based statistics, we had to exclude 14 cases because of missing data reducing the sample to 210 participants. The age of the participants ranged from 13 to 40 years and had an average of close to 22 years ($M = 22.20$, $SD = 4.85$). The vast majority of our sample were males (190) and the highest academic degree they achieved was either high school (108) or bachelors (62). Most participants came from Germany (72), the USA (30), Canada (18), and the UK (18).

3.3   Variables and measurement

Wherever possible we utilized empirically validated scales adjusted to the context of our study. The majority of scales used a five-point Likert scale (1 = "strongly disagree", 5 = "strongly agree") evaluating self-reports of participants. Subsequently, we present the dependent, mediating, independent, and control variables of our study.

Dependent variable. *Continued Use (ADT, UGT).* We adapted a validated scale measuring continued use consisting of three items (e.g. "Compared to other digital media, I intend to use Twitch continuously"; $M = 3.72$, $SD = .81$, $\alpha = .73$) [24].

Mediating variables. *Identification with the streamer (ADT).* We measured it with three items adapted to the context of our study (e.g. "I tend to understand the reasons why the streamer does what he does"; $M = 3.52$, $SD = .73$, $\alpha = .64$) [25]. For *Liking of the streamer (ADT) w*e adapted a single item from previous literature (e.g. "I like the streamer a lot"; $M = 4.12$, $SD = .79$) [14]. To measure *Moral Judgement (ADT) w*e adapted a semantic differential comprised of five statements (e.g. "honest - dishonest"; $M = 3.73$, $SD = .62$, $\alpha = .68$) [26]. The *Perceived Interaction (UGT).* includes fifteen items, following prior literature (e.g. "I can easily promote and extend my social networks"; $M = 2.97$, $SD = .75$, $\alpha = .90$) [27].

Independent variables. *Age*. To measure *Age (ADT)* we asked for it ("How old are you"; $M = 22.20$, $SD = 4.85$) and invited participants to use an open text field to give us their response. *Attitude towards Streaming (ADT)* was a semantic differential with five points consisting of seven statements from previous literature (e.g. "boring - interesting"; $M = 3.89$, $SD = .62$, $\alpha = .79$) [28]. *Empathy (ADT)* was explained by an existing four item scale (e.g. "I often tender, concerned feelings for people less fortunate than me"; $M = 3.44$, $SD = .81$, $\alpha = .71$) [29]. *Motives (UGT)* included an already validated scale from previous literature consisting of sixteen different statements (e.g. "…to be entertained"; $M = 2.58$, $SD = .56$, $\alpha = .86$) [30].

Control variable. *Media Consume.* We measured the construct asking participants how often they use social media. The majority (91%) used social media daily.

4　Results

4.1　Model tests

Initially, we ran multiple regressions to check for potential confounds by using the main dependent variable (continued use) and tested demographic (age, gender, education, origin) and control variables (digital media consume) as predictors. The regression equation was significant (F $(5,204) = 2.42$, $p < .05$) and explained 3 % of the variance of continued use. All regression weights were non-significant ($p \geq .06$), so we had to consider none of those variables.

To check for additional relationships between mediating and independent variables in the ADT, we carried out correlation calculations. All three variables correlated significantly ($r \geq 19$, $p < .01$). Additionally, we calculated correlations between the independent variables (age, attitude towards streaming, empathy). One more time all correlation coefficients indicated meaningful results ($r \geq 23$, $p < .01$). We used this information and specified a path model to test the ADT. The path model illustrates a desired non-significant result (F $(7,210) = 8.51$, $p = .29$, SRMR = .03, CFI = .99) and good additional fit indices. Identification with ($\beta = .27$, $p < .001$) and liking of the streamer ($\beta = .26$, $p < .001$) showed positive relationships explaining continued use. The path coefficient of moral judgement did not show a significant relationship explaining continued use ($\beta = -.10$, $p = .15$). Additionally, attitude predicted identification ($\beta = .24$, p

< .001), liking (β = .41, p < .001), and moral judgement (β = .53, p < .001). However, age was neither a meaningful predictor of identification (β = -.12, p = .08) nor liking (β = -.06, p = .019), and empathy did not predict moral judgement (β = .01, p = .81).
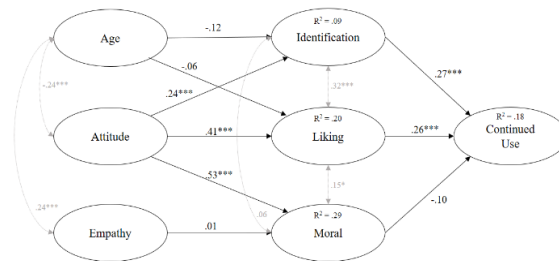

Fig. 2. ADT SEM results

For our UGT results, we tested the correlation between the two mediating variables attitude towards streaming and interactivity. The correlation weight indicated a significant relationship between the two variables ($r \geq .33$, p < .001). Using this information, we specified a corresponding path model. The model illustrated a desired non-significant result (F (1,210) = 0.01, p = .98, SRMR = .01, CFI = .99) and good additional fit indices. Attitude towards the streamer (β = .11, p = .08) showed a non-significant and interactivity (β = .44, p < .001) a significant relationship explaining continued use. Additionally, the tests of the predictor variable motives on the two mediating variables indicated a consistent picture in which motives predicted attitude (β = .27, p < .001) and interactivity (β = .58, p < .001) in a positive manner.
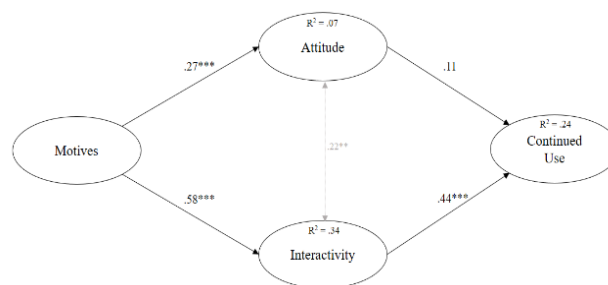

Fig. 3. UGT results

The results indicated a better fit for UGT (χ2diff = -8.50, CFI = .99, SRMR=.01) compared to the ADT (χ2diff = 8.50, CFI = .99, SRMR = .03). Thus, we reasoned that, UGT delivers better quantitative indices, although the ADT showed a good fit between the theoretical and the derived empirical data model.

4.2 Unified model proposal

Building on the previously explored empirical information using ADT and UGT, we developed a unified model. First, we calculated a correlation to see if the independent variables of attitude and motives needed to be considered. It showed a significant result

(r = 27, p < .01) and the specified path model (see figure 4) showed a good fit between the theoretical model and data (F (5,210) = 1.032, p = .96, SMR = .01, CFI = .99). Looking at predictors of continued use, the UGT variable interactivity (β = .40, p < .001) was the most meaningful predictor compared to the two ADT variables identification with (β = .17, p < .05) and liking of the streamer (β = .20, p < .01). Furthermore, attitude towards streaming explained all three mediating variables (β ≥ .18, p < .01) and the variable motives explained identification with the streamer (β = .33, p < .001) and interactivity (β = .53, p < .001).
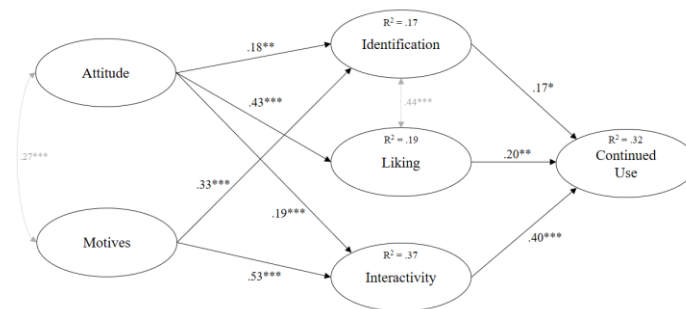

Fig. 2. Unified SEM model

5   Discussion

In light of our findings, we can address our research question - What (technological and social) variables best describe the motivation of users to consume online live streams of video games? On the one hand, we found empirical support that identification, liking, and interactivity directly predicted the use of game related live video streams. This finding can be interpreted as an empirical hint that watching live video game streams can be best predicted through a dichotomous approach using technological and social variables simultaneously. Streamer related variables as well as platform specific components seem to be important to holistically capture the phenomenon of streaming. Additionally, we expanded the external validity of findings from other domains to the context of live video game streaming. Viewers who perceive higher levels of interactivity as well as identify with and like their chosen streamers tend to use game related streams more frequently. Opposed to this, we were not able to find empirical evidence for all relationships found in neighboring disciplines. For example, moral judgement and attitude did not explain the dependent variable more frequently than random. We interpret this finding as a suggestion that moral judgements are not as meaningful in the streaming context as they are in other forms of media use (e.g. music, movies) [15]. Additionally, attitude had no direct effect on the consumption of online video streams. Instead, it was a highly significant predictor of identification and liking. We understand this as a validation of ADT assumptions, which postulate indirect effects of attitude on the dependent variable of interest [14]. Furthermore, we were able to confirm existing findings from previous research that are in line with explanations of identification, liking,

moral judgement and interactivity through positive attitudes towards streaming and a higher chance to fulfill individual motives [14, 18].

5.1   Theoretical and practical implications

Previous research showed that ADT and UGT can be useful theories to explain different forms of media usage [15, 17, 24]. First, we enriched the external validity of both theories and showed that streamer related variables (identification, liking) as well as platform specific variables (interactivity) explain online live streaming. Additionally, we proposed a unified model explaining the use of game related live streams on Twitch.tv illustrating references to the uniqueness of online live streams as a context. Second, we illustrated that interactivity is the most meaningful predictor of the use of game related live video streams. In specific cases, interactivity plays a particularly important role for creating a good streaming experience. Higher levels of interactivity might lead to more active processing of consumers. This finding is in line with literature on interactivity and media consuming [27, 31, 32]. Third, we illustrated a way of using and integrating findings from two theoretical approaches and illustrated opportunities to derive richer empirical statements by combining them. This is noteworthy since it provides new opportunities to better understand the use of live streaming of video games. Therefore, our findings can be a good starting point for future research.

From a practical point of view, we are now able to recommend different actions. Based on our finding that interactivity explains large parts of game related live streams it seems worthwhile to stimulate players' opportunities to present themselves and broaden the portfolio of interactive elements for the group of streamers (e.g., games played with the consumers of a specific stream). Our findings that identification with and liking of the streamer are relevant predictors of streaming use, offers additional starting points with practical relevance. Accordingly, streamers could use existing marketing tools to advertise themselves and actively shape their career paths as part of their communication strategies and (as a consequence) increase their popularity and revenue.

5.2   Limitations and future research

On the level of explanatory power and external validity, we only looked at a single context. It would be useful to revise the robustness of the contributions of our study attempting to replicate our findings in neighboring contexts to explore commonalities and differences to our findings. On the level of measurements and the internal validity, we had to deal with a balancing act between efficiently and using preferably detailed measures. Future studies could use more elaborated and granular scales differentiating between different forms of interactivity, motives, attitude, identification, and liking. On a level of research design, our study had some weaknesses. Since our study used a convenience sample, an undesired effect of selection could have occurred. Future studies can try to explore differences and similarities between different clusters of players, which was not the primary interest of our study. Since we used a survey, we do not have the chance to identify causal connections between each construct. Using experiments as complementary might be a promising avenue for further research. Our unified

model explained one third of the variance of the dependent variable. This indicates that predictors not included might play a meaningful role explaining video streams.

6 Conclusion

The world of streaming has become a major leisure activity for individuals and a revenue source for the industry. Our study takes a quantitative approach to better understand different aspects of motivation of consumers to online live watch streams. Accordingly, we investigated the market leader of streaming platforms Twitch.tv and explored the impact of variables that were informed by theory exploring the interplay of two theories explaining media use (ADT, UGT). Our data suggests that the mechanisms involved can be best described combining both theories. The study identified different variables directly related to the use of game related streams on Twitch.tv from a viewer's perspective. Interactivity, identification with and liking of the streamer directly explained the consumption of streams. This finding illustrates the potential to combine content from more than one theoretical approach to derive more granular insights.

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