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Understanding factors influencing viewers' intention to watch video game live streaming on Twitch: Combined use of PLS-SEM and NCA

by Kian Yeik Koay, Jian Yi Teoh, and Man Lai Cheung

Abstract

This study aims to propose and test an integrated model of the theory of planned behaviour (TPB) and uses and gratifications theory (U&G) to understand viewers' intention to watch video game live streaming on Twitch. Data are collected from 207 Twitch users and analysed using partial least squares structural equation modelling (PLS-SEM) and necessary condition analysis (NCA). Based on the PLS-SEM results, attitudes and subjective norm have a significant positive influence on intention. However, perceived behavioural control does not have a significant influence on intention. Furthermore, entertainment and information seeking have a significant positive influence on attitudes, but socialisation has no significant influence. According to the NCA results, attitudes and perceived behavioural control are the necessary conditions for intention. Moreover, entertainment and information seeking are identified to have necessary effects on attitudes. Subjective norm and socialisation are found to have no necessary effects on intention and attitudes, respectively. This study is the first to investigate the factors that influence viewers' intention to watch video game live streaming on Twitch based on an integrated perspective of the TPB and U&G theory using the sufficiency (PLS-SEM) and necessary (NCA) logics.

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1. Introduction

Since 2011, the popularity of live streaming has been growing rapidly worldwide as an interactive, Internet-based form of multimedia entertainment (Chen, *et al.*, 2020; Diwanji, *et al.*, 2020; Needleman, 2015). Advanced video streaming technologies have modernised how individuals consume broadcast media, empowering audiences from being passive receivers to serve as active participants in engaging with media content (Chen, *et al.*, 2020; Cheung, *et al.*, 2020; Wang and Wu, 2019). According to Spilker and Colbjørnsen (2020), consumer viewing behaviour is changing from satellite or cable television services to online streaming services. People are utilizing online streaming services through their personal mobile

devices connected to the Internet (Lim, *et al.*, 2015). Live streaming is considered conspicuously more popular among the younger generation, a fact that is demonstrated by the increasing number of young subscribers to video streaming services and online television channels (Panda and Pandey, 2017). Live streaming services account for 17 percent of all Internet traffic (Flynn, 2023). Since 2015, popular social media platforms such as YouTube, Twitter and Facebook have integrated live streaming services functions into their platforms (Xu and Ye, 2020).

According to Scheibe, *et al.* (2016), social live streaming services (SLSS) feature specific characteristics, including real-time broadcasting of user-generated content, two-way communications between streamers and viewers and a gratification system in the stream. Live streaming gives people the chance to create and show content relevant to their interests and reach out to viewers who share the same interests (Wulf, *et al.*, 2020). This means a wide variety of content is created for live streaming, such as art, cooking and music, as well as the specific topic of this research: gaming. Previous streaming services like television were unable to facilitate interaction between a streamer and viewers. However, during live streaming, there is two-way communication between the parties, facilitating information exchanges and experience sharing amongst streamers and viewers.

Turning to more in-depth aspects of the research topic, video game live streaming is a real-time video broadcasting system that integrates both traditional broadcasting elements with online gaming (Sjöblom and Hamari, 2017). In recent years, live-streaming platforms have emerged that integrate online video game live streams, such as Twitch, YouTube and even social media platforms like Facebook, which introduced Facebook Gaming (Facebook, 2021). As with live streaming, the user base of video game live streaming can be divided into streamers and viewers. The main difference between the two parties is that the former produces the content while the latter views, consumes or receives it (Zimmer, *et al.*, 2018). Streamers of video game live streams create content by displaying their proficiency in video game skills and mechanics. Viewers are then able to watch, learn or be entertained through the live streams. Furthermore, they also have the option to reward and support their favourite streamers through various actions such as subscriptions or donations (Chen, *et al.*, 2020). Some of the famous games on Twitch that are commonly watched by viewers include *League of Legends*, *Fortnite*, *Grand Theft Auto V*, *Counter-Strike: Global Offensive* and *Dota 2* (Statista, 2022).

Prior studies have investigated factors influencing streamers' intention to stream (*e.g.*, Chen and Chang, 2019; Johnson and Woodcock, 2019; Zhao, *et al.*, 2018). However, there is a paucity of studies examining factors influencing viewers' intention to watch video game live streaming on Twitch. Existing studies tend to utilise the uses and gratifications (U&G) theory as the theoretical base from which to understand the motivations of viewers to watch video game live streaming (*e.g.*, Li, *et al.*, 2020; Gros, *et al.*, 2017; Sjöblom, *et al.*, 2017; Sjöblom and Hamari, 2017). In brief, U&G theory provides a theoretical grounding from which to understand how users engage with media to fulfil specific psychological and social needs (Katz, *et al.*, 1973). However, U&G theory focuses only on understanding media use by individuals based on the perspective of psychological gratification but ignores the possible impacts of internal and external factors connected to the individual. For this reason, an integrated model of U&G theory and the theory of planned behaviour (TPB) is proposed to enable predictions about viewers' intention to watch video game live streaming on Twitch. This is because the TPB considers a person's attitudes towards a behaviour, subjective norm and perceived behavioural control in the context of predicting the behaviour of interest. This may compensate for the potential limitations of U&G theory. Furthermore, unlike previous studies focusing only on using a sufficiency logic for hypothesis testing (*e.g.*, Li, *et al.*, 2020; Gros, *et al.*, 2017; Sjöblom, *et al.*, 2017; Sjöblom and Hamari, 2017), this study utilises both sufficiency and necessary logics to examine the must-have and should-have factors of a viewer's intention to watch video game live streaming on Twitch using partial least squares structural equation modelling (PLS-SEM) and necessary condition analysis (NCA). The combination of both logics for hypothesis testing is an important aspect of theory building because it allows the necessary and significant conditions for an outcome, thereby providing more valuable and practical insights to streaming platforms and esports marketing practitioners.

This paper is organised as follows. The next section outlines the TPB and U&G theory and is followed by

the development of hypotheses. The next section discusses the sampling procedure and measures used in this research. Section three outlines a data analysis strategy and section four elucidates theoretical and managerial implications. The paper concludes with a discussion of the limitations and future recommendations.

2. Literature review

2.1. *The theory of planned behaviour*

As an offshoot of the theory of reasoned action (TRA), the theory of planned behaviour (TPB) was developed by Ajzen and Fishbein (Ajzen, 1991; Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975) to enable human behaviours to be understood and predicted based on the assumption that individuals make rational, reasoned decisions. Based on the TRA, individuals are expected to perform a particular behaviour that is positively evaluated and perceived as socially acceptable by people significant to the individual (Teoh, *et al.*, 2022). In other words, attitudes and subjective norm should be able to accurately predict an individual's intention to perform the behaviour in question (Ajzen, 1991). Later, the TRA was criticised for its failure to take into account and assess the relative control an individual has over his or her behaviour when predicting his or her intention. This is because individuals are unable to maintain constant and complete control over their behaviour. For this reason, perceived behavioural control was added to the TPB (Ajzen, 1991). Perceived behavioural control is defined as the individual perception of the relative ease or difficulty of performing a particular behaviour.

According to the TPB, an individual is more likely to develop positive attitudes towards behaviour that results in positive consequences and entails minimal risks, which is consistent with rational choice theory (Ajzen, 1991; Koay and Cheah, 2023). When the individual displays high levels of attitudes towards a behaviour, he or she tends to have a strong intention to perform the behaviour (Koay, *et al.*, 2022). In a qualitative study, Drayer, *et al.* (2010) discovered that fantasy sports participation is positively related to fans' attitudes towards the National Football League (NFL). Furthermore, Xiao (2020) reported that attitudes to watching esports have a significant positive influence on viewers' intentions to watch esports. In this study, attitudes refer to a viewer's overall evaluation of watching video game live streaming on Twitch. People are expected to have high levels of intention to watch video game live streaming on Twitch when they display high levels of attitudes towards the behaviour. Furthermore, we also propose that attitudes are a precondition for the intention to watch video game live streaming on Twitch. Accordingly, the following hypotheses were proposed:

H1a: Attitudes have a significant positive influence on the intention to watch video game live streaming on Twitch.

H1b: Attitudes are a necessary condition for the intention to watch video game live streaming on Twitch.

Subjective norm, another major pillar of the TPB, is defined as an individual's perception of social pressure to engage or not to engage in a behaviour (Ajzen, 1991). The influence of subjective norm on behavioural intention has been extensively investigated by scholars in other contexts. For instance, subjective norm was found to significantly influence a person's intention to play online games (Alzahrani, *et al.*, 2017), to continue using Facebook (Tariq, *et al.*, 2017), to share YouTube videos (Yang, *et al.*, 2010) and to post selfies on social networking sites (Kim, *et al.*, 2016). Subjective norm is usually shaped by people who are significant and relevant to the individual (Koay, *et al.*, 2020). The individual may change their significant ones who shape the subjective norm depending on the types of behaviour. To avoid being sanctioned, people will not perform a behaviour that would be criticised or perceived as unacceptable by others. In this research, subjective norm refers to social pressure that a viewer perceives when watching video game live streaming on Twitch. When individuals think that people significant to them agree to watch video game live

streaming on Twitch, those individuals are more likely to have high levels of intention to perform the behaviour. Lim, *et al.* (2020) found that viewers' intention to repeat viewing live-streaming games is driven by their attempts to build a one-sided relationship with streamers in a virtual world. Hence, it is proposed that subjective norm is required for the intention to watch video game live streaming on Twitch. Accordingly, the following hypotheses were proposed:

H2a: Subjective norm has a significant positive influence on the intention to watch video game live streaming on Twitch.

H2b: Subjective norm is a necessary condition for the intention to watch video game live streaming on Twitch.

Perceived behavioural control refers to the extent to which individuals think that they can successfully perform particular behaviours with ease. This concept is shaped by an individual's accessible control beliefs about specific behaviour. Subsequently, the presence or absence of control beliefs influences an individual's confidence to perform the behaviour of interest. People are less likely to have high levels of intention to perform a behaviour that is too strenuous. Various studies have reported that perceived behavioural control has a significant positive influence on behavioural intention regarding SNS use (*e.g.*, Baker and White, 2010; Chang and Zhu, 2011; Kim, *et al.*, 2016; Tariq, *et al.*, 2017). In the current context, control over an ability to watch video game live streaming on Twitch (such as having a computer with Internet access on which to watch the live streaming) will influence a decision to perform the behaviour. Based on the TPB and previous studies, it is proposed that one's perceived control in relation to watching video game live streaming on Twitch will have a significant positive influence on an individual's behavioural intention. Moreover, it is surmised that perceived behavioural control is an essential component of an intention to watch video game live streaming on Twitch. Accordingly, the following hypotheses are proposed:

H3a: Perceived behavioural control has a significant positive influence on an intention to watch video game live streaming on Twitch.

H3b: Perceived behavioural control is a necessary condition for an intention to watch video game live streaming on Twitch.

2.2. Uses and gratifications theory (U&G)

According to uses and gratification theory (U&G), people actively use, consume and participate in media to satisfy their personal needs and desires (Katz, *et al.*, 1973; Rubin, 1993). Gratifications drawn from media consumption vary and can be categorised into gratifications sought and gratifications obtained.

"Gratifications sought refers to users' expectations of the types of gratifications they would get from using media, whereas gratifications obtained refers to the needs satisfied by media use" [1]. People are aware of their choices and motives for media consumption. In the last decade, scholars have examined the reasons why people use different media platforms through the perspective of the uses and gratification theory. Social media platforms investigated include Facebook (Ferris and Hollenbaugh, 2018; Menon and Meghana, 2021), Twitter (Chen, 2011), YouTube (Khan, 2017), Pinterest (Sashittal and Jassawalla, 2015), TikTok (Bucknell Bossen and Kottasz, 2020), LinkedIn (Smith and Watkins, 2023), Snapchat (Chang, 2017), Weibo (Gan and Wang, 2014) and live blogs (Pantic, 2020). In brief, different types of media will satisfy various psychological needs of different users.

A systematic literature study by Li, *et al.* (2020) summarised previous studies of viewers' motivations to use Twitch. For instance, Gros, *et al.* (2017) found that the types of gratification obtained by viewers from using Twitch were entertainment, socialisation and information seeking. In other words, viewers were more likely to use Twitch when the streams were entertaining and viewers could interact with others and learn useful skills and knowledge from the streams. Another study by Sjöblom and Hamari (2017) reported that the length of time viewers spent on Twitch could be predicted by five types of gratification, namely cognitive, affective, personal integrative, social integrative and tension release. In addition, Sjöblom, *et al.*

(2017) examined how the genres and content types of games on Twitch affected various types of viewers' gratifications, including affective, information seeking, learning to play, personal integrative, social integrative and tension release.

This study aims to investigate the influence of three gratifications, namely entertainment, socialisation and information seeking, on viewers' attitudes to watching video game live streaming on Twitch. As other studies have claimed, entertainment is a primary type of gratification for media usage (*e.g.*, Cheung and Huang, 2011; Hamilton, *et al.*, 2014; Papacharissi and Mendelson, 2010). Entertainment refers to the feelings of relaxation, fun and enjoyment that arise due to watching video game live streaming on Twitch. Watching this form of live streaming entertains people and allows them to avoid boredom during their free time. Hence, it is proposed that entertainment not only has a significant positive influence on the intention to watch video game live streaming on Twitch but is also a necessary condition for it. Thus, the following hypotheses were developed:

H4a: Entertainment has a significant positive influence on the intention to watch video game live streaming on Twitch.

H4b: Entertainment is a necessary condition for attitudes.

Based on U&G theory, people use certain forms of media for communication purposes in order to attain a sense of belonging (Rubin, 1986). With the advancement of social media platforms, individuals can easily connect with their like-minded peers in various forms (*e.g.*, direct message, liking posts and sharing content) on social media platforms (Cheung, *et al.*, 2021). For instance, in a qualitative study, Gan and Wang (2014) found that social interaction was one of the primary reasons people use Weibo. In addition, Bulduklu (2019) discovered that people play mobile games to satisfy a need for social interaction. Similarly, Gros, *et al.* (2017) reported that viewers watched live streaming on Twitch for socialisation purposes. In this study, socialisation involves communicating with others with the aim of forming and maintaining relationships while watching video game live streaming on Twitch. Sjöblom and Hamari (2017) reported that social integrative motivations, composed of companionship and shared emotional connection, were positively related to the number of hours spent on Twitch. Moreover, viewers enjoyed participating in video game live streaming in order to build parasocial relationships with their favourite streamers (Wulf, *et al.*, 2020). As a result, it was postulated that socialisation was both a desirable and an essential factor behind the intention to watch video game live streaming on Twitch. Accordingly, the following hypotheses were proposed:

H5a: Socialisation has a significant positive influence on the intention to watch video game live streaming on Twitch.

H5b: Socialisation is a necessary condition for attitudes.

Information seeking is another important factor that motivates people to use media in general. For instance, Kircaburun, *et al.* (2020) found that people used social media mainly for informational and educational purposes. Apart from entertainment and socialisation gratifications, some viewers were motivated to watch video game live streaming on Twitch to learn new strategies and techniques to improve their own gaming performance. To determine why viewers preferred to watch a video game stream instead of actually playing a game themselves, Vosmeer, *et al.* (2016) conducted interviews with nine viewers. It was discovered that they watched video game streams intending to learn from professional streamers so that they could become better players. Gros, *et al.* (2017) also found that information seeking was positively related to the length of time spent on Twitch weekly. Based on the evidence of previous studies, it was posited that higher levels of information seeking will lead to higher levels of intention to watch video game live streaming on Twitch. Moreover, information seeking was also suggested as a required condition for the intention to watch video game live streaming on Twitch. Accordingly, the following hypotheses were proposed:

H6a: Information seeking has a significant positive influence on the intention to watch video game live streaming on Twitch.

H6b: Information seeking is a necessary condition for attitudes.

The full research model is presented in [Figure 1](#).

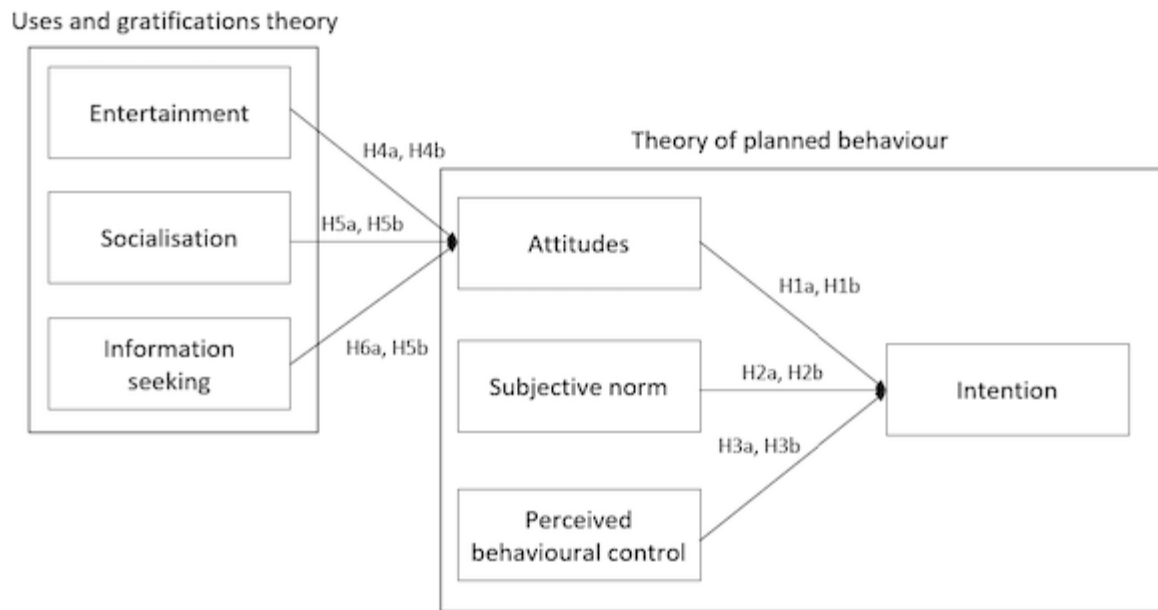


Figure 1: Research model.

3. Methodology

3.1. Sample and procedure

This study employed a survey method for data collection to achieve the research objectives. Prior to distributing a questionnaire to our target respondents, the questionnaire was pre-tested on 15 Twitch users and revised according to their feedback. Only minor modifications to the formatting and instructions were made for greater clarity. The target population of this study was viewers who had the experience of watching video game live streaming on Twitch, to ensure that the respondents had the knowledge required to provide the necessary information for this research. Hence, a purposive sampling method was used to collect data. After creating the survey using Google forms, we distributed the online survey link to viewers who were watching video game live streaming on Twitch. Specifically, we searched for popular Malaysian streamers on Twitch and then posted the survey link on their stream chats. To increase the response rate, we also privately sent the survey link to viewers who were watching video game live streaming on Twitch.

According to the G^* power analysis (effect size = 0.15 (medium), alpha (α) = 0.05, and the number of predictors = 3, and the power was set at 80 percent), the minimum sample size needed for this research was 77. A total of 207 data were collected for this research. This sample consisted of more males (75.8 percent) than females (24.2 percent), and most respondents were between the ages of 20 and 29 (81.6 percent). In addition, the majority of the respondents (62.3 percent) reported that they watched video game live streaming on Twitch daily.

3.2. Measures

Intention: The intention to watch video game live streaming on Twitch was measured by a three-item scale adapted from Ajzen (1991) and Hou, *et al.* (2020). A sample item was “It is likely that I will spend time watching video game live streaming on Twitch in the future”. All the responses were rated on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

The TPB constructs: Attitudes were measured by a five-item scale adapted from Ajzen (1991). A sample item was “Watching video game live streaming on Twitch is interesting”. A three-item scale adapted from Ajzen (1991) was used to assess subjective norm. A sample item was “People who influence my behaviour think that I should watch video game live streaming on Twitch”. Lastly, perceived behavioural control was assessed using a two-item scale adapted from Ajzen (1991). A sample item was “I am confident that I can watch video game live streaming on Twitch”. All responses were measured on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

Uses and gratifications: The scales to measure entertainment, socialisation and information seeking were first developed by Gros, *et al.* (2017). Respondents were requested to read statements that expressed various motivations for watching video game live streaming on Twitch and rate their agreement with the statements on a five-point Likert scale (strongly disagree — 1 to strongly agree — 5). Sample items were “I watch video game live streaming on Twitch to be entertained” for entertainment; “I watch video game live streaming on Twitch to be part of a community” for socialisation; and “I watch video game live streaming on Twitch to learn new gaming strategies and techniques” for information seeking.

4. Data analysis

Partial least square structural equation modelling (PLS-SEM) was the main analytical tool used to verify the proposed theoretical hypotheses in this study. As suggested by Hair, *et al.* (2019), PLS-SEM is preferred over co-variance-based SEM under certain conditions. First, theory testing was not the main objective of this study as the aim was to test an integrated model of the TPB and U&G theory and to understand viewers' intentions to watch video game live streaming on Twitch. Second, PLS-SEM performs effectively with non-normal data and small sample sizes. Third, the latent variable scores can be used for necessary condition analysis (NCA) in order to identify the necessary conditions of an outcome. Smart PLS (v 3.3.3) and Rstudio were used for PLS-SEM and NCA, respectively.

4.1. Common method variance

To ensure that the data were not contaminated by common method variance (CMV), we conducted two statistical tests which were Harman's single factor test and a full-collinearity test. For Harman's single factor test, exploratory factor analysis was performed to ensure that the first factor does not explain more than 50 percent of the variance, as outlined by Podsakoff, *et al.* (2003). The results showed that the first factor explained only 38.194 percent of the variance, indicating that CMV is not a problem. Next, the full-collinearity test, developed by Kock (2015), required a dummy variable to be regressed on all the variables under investigation, from which the variance inflation factor values should not be greater than 3.3. The results passed the test. In conclusion, it can be safely concluded that CMV should not be considered a serious concern.

4.2. Measurement model

Prior to assessing the structural model, the measurement model was examined to ensure that an adequate level of reliability, convergent validity and discriminant validity was achieved (Hair, *et al.*, 2019). As illustrated in [Table 1](#), the values of Cronbach's alpha and composite reliability for all constructs exceeded

0.7, suggesting that internal consistency of measures had been obtained. Next, all constructs demonstrated good convergent validity as all the values of average variance extracted (AVE) for all constructs exceeded 0.5. Although some factor loadings were lower than 0.7, they were still acceptable (>0.4). Lastly, discriminant validity was not a cause for concern as the square root of AVE for each construct was lower than the correlations of the construct with other constructs ([Table 2](#)) (Fornell and Larcker, 1981). In addition, all the heterotrait-monotrait ratio of correlation (HTMT) values were lower than 0.85 ([Table 3](#)) (Henseler, *et al.*, 2015).

| Table 1: Measurement model. | | | | | |
|------------------------------------|-------------------|------------------------|-------------------------|------------------------------|---|
| Constructs | Indicators | Factor loadings | Cronbach's alpha | Composite reliability | Average variance extracted (AVE) |
| Attitudes | ATT1 | 0.847 | 0.897 | 0.923 | 0.707 |
| | ATT2 | 0.877 | | | |
| | ATT3 | 0.823 | | | |
| | ATT4 | 0.798 | | | |
| | ATT5 | 0.856 | | | |
| Entertainment | ENT1 | 0.757 | 0.784 | 0.853 | 0.546 |
| | ENT2 | 0.587 | | | |
| | ENT3 | 0.875 | | | |
| | ENT4 | 0.872 | | | |
| | ENT5 | 0.534 | | | |
| Information seeking | INF1 | 0.699 | 0.815 | 0.870 | 0.573 |
| | INF2 | 0.774 | | | |
| | INF3 | 0.758 | | | |
| | INF4 | 0.771 | | | |
| | INF5 | 0.781 | | | |
| Intention | INT1 | 0.935 | 0.933 | 0.957 | 0.882 |
| | INT2 | 0.953 | | | |
| | INT3 | 0.930 | | | |
| Perceived behavioural control | PBC1 | 0.909 | 0.782 | 0.902 | 0.821 |
| | PBC2 | 0.903 | | | |
| Subjective norm | SI1 | 0.880 | 0.874 | 0.922 | 0.797 |
| | SI2 | 0.930 | | | |
| | SI3 | 0.867 | | | |
| | SO1 | 0.824 | 0.849 | 0.888 | 0.570 |
| | SO2 | 0.779 | | | |

| | | |
|---------------|-----|-------|
| Socialisation | SO3 | 0.674 |
| | SO4 | 0.709 |
| | SO5 | 0.821 |
| | SO6 | 0.711 |

| Table 2: Fornell-Larcker criterion. | | | | | | | |
|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Note: Values on the diagonal (italicised) represent the square root of the average variance extracted while the off-diagonals are correlations. | | | | | | | |
| Constructs | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1. Attitudes | <i>0.841</i> | | | | | | |
| 2. Entertainment | 0.556 | <i>0.739</i> | | | | | |
| 3. Information seeking | 0.498 | 0.657 | <i>0.757</i> | | | | |
| 4. Intention | 0.387 | 0.695 | 0.651 | <i>0.939</i> | | | |
| 5. Perceived behavioural control | -0.182 | 0.004 | -0.006 | 0.039 | <i>0.906</i> | | |
| 6. Socialisation | 0.414 | 0.548 | 0.689 | 0.616 | -0.044 | <i>0.755</i> | |
| 7. Subjective norm | 0.135 | 0.219 | 0.315 | 0.296 | -0.007 | 0.317 | <i>0.893</i> |

| Table 3: HTMT criterion. | | | | | | | |
|---------------------------------|----------|----------|----------|----------|----------|----------|----------|
| Constructs | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1. Attitudes | | | | | | | |
| 2. Entertainment | 0.635 | | | | | | |
| 3. Information seeking | 0.568 | 0.843 | | | | | |
| 4. Intention | 0.413 | 0.818 | 0.744 | | | | |
| 5. Perceived behavioural | 0.220 | 0.085 | 0.138 | 0.081 | | | |

| | | | | | | |
|--------------------|-------|-------|-------|-------|-------|-------|
| control | | | | | | |
| 6. Socialisation | 0.458 | 0.709 | 0.805 | 0.690 | 0.097 | |
| 7. Subjective norm | 0.166 | 0.287 | 0.357 | 0.316 | 0.055 | 0.357 |

4.3. Structural model

The full structural model results, including the path coefficients, t values, p values and effect sizes, are provided in [Table 4](#). Attitudes ($\beta = 0.373$, $p < 0.001$) and subjective norm ($\beta = 0.246$, $p < 0.01$) were found to have a significant positive influence on intention, supporting *H1a* and *H2a*. However, perceived behavioural control ($\beta = 0.108$, $p > 0.05$) was found to have no significant influence on intention. Thus, *H3a* was not supported. Next, it was found that entertainment ($\beta = 0.392$, $p < 0.001$) and information seeking ($\beta = 0.197$, $p < 0.01$) were significant predictors of attitudes, supporting *H4a* and *H6a*. Lastly, *H5a* was not supported as socialisation ($\beta = 0.063$, $p > 0.05$) was found to have no significant influence on attitudes. The research model's explanatory power was also assessed in terms of the coefficient of determination (R^2) (Hair, *et al.*, 2019). The R^2 values for attitudes and intention were 0.343 and 0.210, respectively. Furthermore, the predictive relevance of the research model was examined based on blindfolding-based Q^2 and Q^2 predict (Geisser, 1974; Shmueli, *et al.*, 2019; Stone, 1974). The blindfolding-based Q^2 values for attitudes and intention were 0.229 and 0.171, respectively, while the Q^2 predict values for attitudes and intention were 0.208 and 0.243, respectively. Given that the values of blindfolding-based Q^2 and Q^2 predict were greater than 0, it can be concluded the research model has predictive relevance.

| Table 4: Structural model results. | | | | | | | |
|--|-------------------|-------|-----------------|----------|----------|---------------|-------|
| Relationships | Path coefficients | STDEV | [5.0%. 95%] | T-values | p-values | Decision | f^2 |
| <i>H1a</i> Attitudes → Intention | 0.373 | 0.092 | [0.234, 0.526] | 4.077 | 0.000 | Supported | 0.170 |
| <i>H2a</i> Subjective norm → Intention | 0.246 | 0.084 | [0.108, 0.366] | 2.934 | 0.002 | Supported | 0.076 |
| <i>H3a</i> Perceived behavioural control → Intention | 0.108 | 0.104 | [-0.117, 0.230] | 1.040 | 0.149 | Not supported | 0.015 |
| <i>H4a</i> Entertainment → Attitudes | 0.392 | 0.079 | [0.256, 0.514] | 4.984 | 0.000 | Supported | 0.129 |
| <i>H5a</i> Socialisation → Attitudes | 0.063 | 0.082 | [-0.068, 0.200] | 0.768 | 0.221 | Not supported | 0.003 |
| <i>H6a</i> | | | | | | | |

| | | | | | | | |
|---------------------------------|-------|-------|----------------|-------|-------|-----------|-------|
| Information seeking → Attitudes | 0.197 | 0.082 | [0.053, 0.324] | 2.407 | 0.008 | Supported | 0.025 |
|---------------------------------|-------|-------|----------------|-------|-------|-----------|-------|

4.4. Necessary condition analysis

Unlike PLS-SEM that follows a sufficient logic for hypothesis testing, necessary condition analysis (NCA) relies on a necessity logic (Dul, *et al.*, 2020). Combining both PLS-SEM and NCA allows researchers to identify essential and desirable factors for an outcome, which can be valuable in theory testing. To conduct NCA, the analytical procedure developed by Richter, *et al.* (2020) was followed. First, latent variable scores were obtained from the Smart PLS and then exported as a CSV file as the input in Rstudio for NCA. [Figure 2](#) demonstrates the scatter plots for all hypothesised relationships and [Table 5](#) reports the NCA effect sizes. The ceiling envelopment-free disposal hull (CE-FDH) line was used to generate the effect sizes, so 100 percent accuracy was achieved (Richter, *et al.*, 2020). As [Table 5](#) suggests, attitudes ($d = 0.194$, $p < 0.001$) and perceived behavioural control ($d = 0.245$, $p < 0.01$) were necessary conditions for intention, supporting *H1b* and *H3b*. However, subjective norm ($d = 0.049$, $p < 0.01$) was found not significant because the d value was less than 1 although the p -value was less than 0.01. Hence, *H2b* was not supported. Next, it was found that entertainment ($d = 0.476$, $p < 0.001$) and information seeking ($d = 0.283$, $p < 0.001$) were necessary conditions for attitudes, supporting *H4b* and *H6b*. In addition, socialisation ($d = 0.077$, $p < 0.01$) was found not to be a significant necessary condition for attitudes. Thus, *H5b* was not supported.

Although the results of PLS-SEM revealed that perceived behavioural control had no significant impact on intention, it was required for the occurrence of intention. According to the bottleneck tables ([Table 6](#) and [Table 7](#)), in order to achieve a 90 percent level of intention, the attitudes, subjective norm and perceived behavioural control should be at least at 55.9 percent, 25 percent and 34 percent, respectively. Similarly, entertainment, socialisation and information seeking must reach 66 percent, 12.6 percent and 35.5 percent, respectively, in order to attain a 90 percent attitude level.

| Table 5: NCA effect sizes. | | | | | | |
|--|-----------------------------|-------------|---------------|-----------------------------|-------------|-----------|
| Note: Necessity effect size (d) must be greater than 0.1 to be meaningful (supported). | | | | | | |
| Construct | Intention | | | Attitudes | | |
| | CE-FDH effect sizes (d) | p -values | Decision | CE-FDH effect sizes (d) | p -values | Decision |
| <i>H1b</i> Attitudes | 0.194 | 0.000 | Supported | | | |
| <i>H2b</i> Subjective norm | 0.049 | 0.004 | Not supported | | | |
| <i>H3b</i> Perceived behavioural control | 0.245 | 0.002 | Supported | | | |
| <i>H4b</i> Entertainment | | | | 0.476 | 0.000 | Supported |

| | | | |
|-----------------------------------|-------|-------|---------------|
| <i>H5b</i> Socialisation | 0.077 | 0.011 | Not supported |
| <i>H6b</i> Information seeking | 0.283 | 0.000 | Supported |

Table 6: Bottleneck table (percentages) — intention.

| Y (Intention) | Attitudes | Subjective norm | Perceived behavioural control |
|---------------|-----------|-----------------|-------------------------------|
| 0 | NN | NN | NN |
| 10 | 4.5 | NN | NN |
| 20 | 4.5 | NN | NN |
| 30 | 4.5 | NN | 34 |
| 40 | 4.5 | NN | 34 |
| 50 | 4.5 | NN | 34 |
| 60 | 4.5 | NN | 34 |
| 70 | 49.4 | NN | 34 |
| 80 | 49.4 | NN | 34 |
| 90 | 55.9 | 25 | 34 |
| 100 | 55.9 | 25 | 34 |

Table 7: Bottleneck table (percentages) — attitudes.

| Y (Attitudes) | Entertainment | Socialisation | Information seeking |
|---------------|---------------|---------------|---------------------|
| 0 | NN | NN | NN |
| 10 | NN | 4.1 | 19.1 |
| 20 | 36.6 | 4.1 | 19.1 |
| 30 | 44.8 | 4.1 | 25.6 |
| 40 | 44.8 | 4.1 | 25.6 |
| 50 | 44.8 | 4.1 | 30 |
| 60 | 65.9 | 12.6 | 35.5 |
| 70 | 65.9 | 12.6 | 35.5 |

| | | | |
|-----|----|------|------|
| 80 | 66 | 12.6 | 35.5 |
| 90 | 66 | 12.6 | 35.5 |
| 100 | 66 | 12.6 | 35.5 |

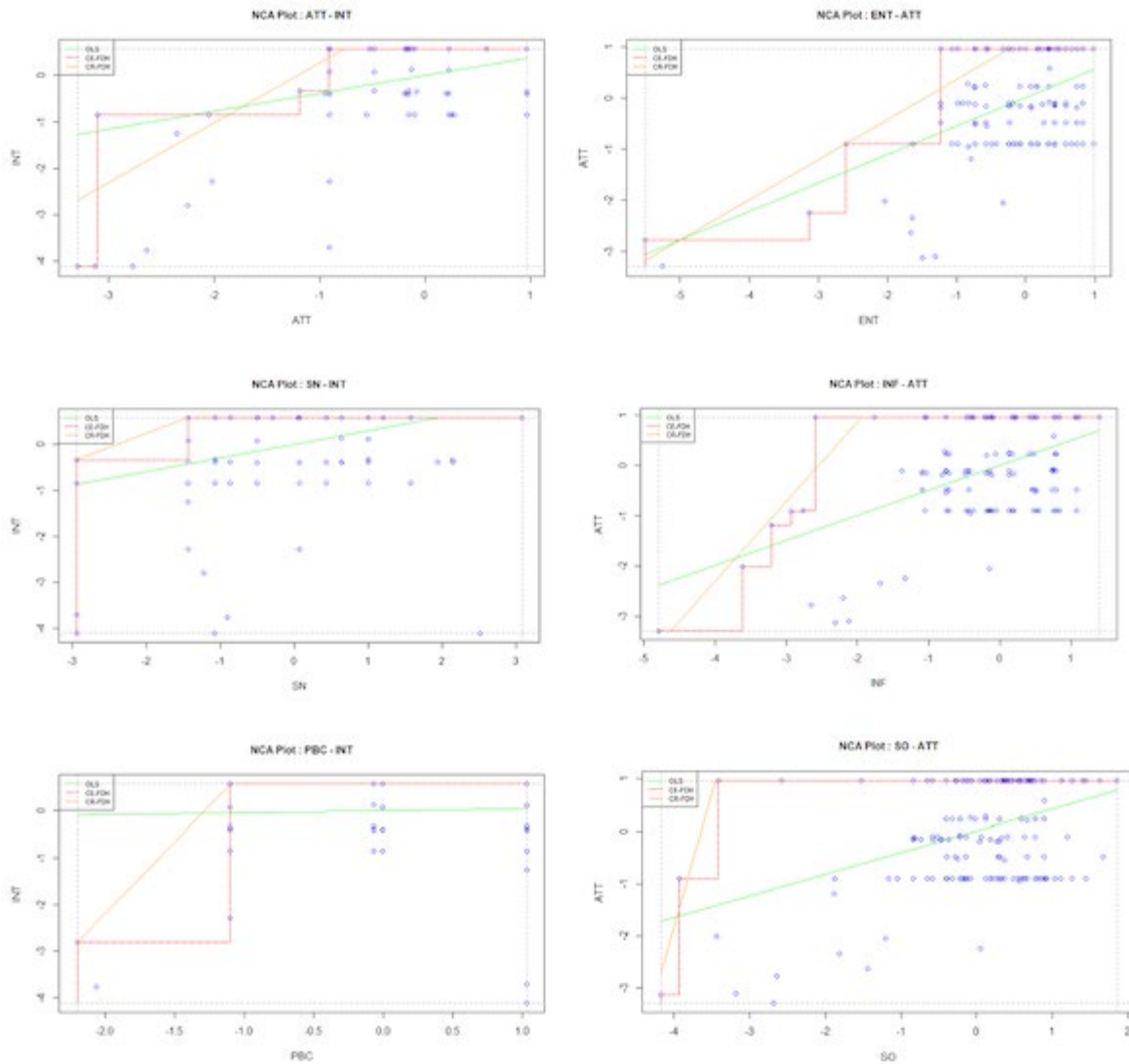


Figure 2: Scatter plots.

Note: Larger version of Figure 2 available [here](#).



5. Discussion

5.1. Theoretical implications

Consistent with the TPB, attitudes were a significant predictor of intention. In other words, the tendency of viewers to watch video game live streaming on Twitch was higher when they had positive attitudes to the behaviour. In support of this, Xiao (2020) found that attitudes to watching esports were strongly related to intention. Furthermore, this study found that attitudes were also a necessary condition for intention. That is, in order for viewers to be driven to watch video game live streaming on Twitch, they must first form positive attitudes towards this form of behaviour. Furthermore, it was discovered that subjective norm has a significant positive influence on intention, suggesting that forming the intention to watch video game live streaming on Twitch was influenced by how viewers' significant others perceived the behaviour. If watching video game live streaming was deemed inappropriate by viewers' significant others — family members, spouse, friends or those in wider society — the viewers would be less likely to engage in this form of behaviour (Xiao, 2020). This finding is consistent with that of Kinnally and Bolduc (2020), which indicated that subjective norm was positively related to intention to use digital music streaming services. However, subjective norm was found not to be an essential factor for the formation of intention. That is, in the absence of subjective norm, the intention to watch video game live streaming on Twitch could still occur as long as other necessary factors were present. Next, despite perceived behavioural control having no significant influence on intention, it remains a necessary condition for intention. In other words, an increase in perceived behavioural control will not increase levels of intention. However, the presence of perceived behavioural control was a precondition for intention. Possessing a certain level of perceived behavioural control was critical for viewers to watch video game live streaming on Twitch.

The findings also revealed that attitudes towards watching video game live streaming on Twitch could be predicted by entertainment and information seeking but not socialisation. That is, when viewers found it pleasant and informative to watch video game live streaming on Twitch, they were more likely to develop positive attitudes towards the behaviour, which might subsequently affect their intention. The insignificant effect of socialisation on attitudes was unexpected, as previous studies (*e.g.*, Chen and Lin, 2018; Gros, *et al.*, 2017; Sjöblom and Hamari, 2017) reported that social gratification was an important predictor of Twitch usage. In addition, entertainment and information seeking had necessary effects on attitudes, implying that in order for viewers to develop positive attitudes, the two gratifications must attain a certain level. Besides, socialisation was found not to be an essential factor for the formation of intention.

This research makes two major contributions to the live streaming literature. First, this study is the first to investigate the factors that influence viewers' intention to watch video game live streaming on Twitch based on an integrated perspective of the TPB and U&G theory. The majority of previous studies mainly focused on understanding viewers' live-stream usage only through the lens of U&G theory. Combining the TPB and U&G theory into an integrated model will arguably enable holistic predictions to be made of viewers' intention to watch video game live streaming on Twitch. Another important contribution of this research is the use of both sufficiency and necessary logics for hypothesis testing. Previous studies (*e.g.*, Chen and Lin, 2018; Gros, *et al.*, 2017; Sjöblom and Hamari, 2017) mainly relied on using regression analysis to verify the theoretical effects following a sufficiency logic which may not be possible to identify the necessary effect of a determinant. Furthermore, the combined use of PLS-SEM and NCA for hypothesis testing in this study provided useful information with which to understand the proposed theoretical relationships, based on two distinctive views on causality (Richter, *et al.*, 2020).

5.2. Managerial implications

From this study, it is possible to suggest several important managerial implications to video game streamers, streaming platforms and esports marketing practitioners. If streaming platforms wish to attract more viewers to watch video game live streaming, they must ensure that their platforms are positively evaluated. That is, viewers should benefit from watching video game live streaming. Furthermore, through advertising and other campaigns, sports marketing practitioners must actively deliver the message to the public that watching video game live streaming is a socially common and acceptable behaviour, especially to the elderly, who are often concerned about video games (Ferguson, *et al.*, 2017). In addition, streaming


platforms must ensure that their platforms are easy to use and that the server is stable so that viewers will not experience technical issues.

Entertainment and information seeking were the two necessary conditions for the development of positive attitudes to watching video game live streaming. Although socialisation was not a necessary factor, increasing it could lead to higher levels of attitudes. The entire live streaming consumption process could be made more entertaining, interactive and informational. Based on these findings, we offer several suggestions. First, the personality of streamers plays a significant role because viewers do not enjoy watching dull, boring streams. While playing games, streamers could tell funny jokes and interact with viewers through direct communication and stream chat. Furthermore, to make the live streaming more entertaining, streamers could be reactive to viewers' suggestions by modifying their play to fit requests. Wulf, *et al.* (2020) showed that building a parasocial relationship with viewers is essential for their media enjoyment.

Second, apart from the streamers' personalities, the games themselves must be entertaining and trendy to encourage more viewers to watch. As of May 2023, the top three most popular games on Twitch were *Just Chatting*, *Grand Theft Auto V* and *League of Legends*, according to TwitchMetrics (2023). Streaming such popular games would certainly draw more viewers who want to see how their favourite streamers play certain games from their perspectives.

Third, as previously mentioned, viewers watch video game live streaming not simply for entertainment purposes but also to learn how to be better players themselves (Wulf, *et al.*, 2020). For instance, a famous streamer known as SingSing, who used to be a professional *Dota2* player, attracts an average viewership of 3,365 because of his hilarious personality and gaming skills (TopTwitchStreamers, 2021). Streamers are recommended to discuss the rationale behind their decision-making processes and the way they approach a game so that viewers can also improve as players. This will certainly encourage more viewers, who are mainly watching video game live streaming for educational purposes.

6. Conclusion, limitations and future recommendations

This study confirmed that the integrated model was useful in explaining viewers' intention to watch video game live streaming on Twitch. These findings should be interpreted in light of some limitations of this study. First, this cross-sectional study has the inherent weakness of drawing causal inferences. Thus, future studies should use longitudinal data for further investigation. Second, only three gratifications were investigated after being obtained from watching video game live streaming on Twitch. Other possible unsolicited gratifications could be further explored by conducting a qualitative study. Third, Twitch is a platform that allows viewers to watch different types of live streams, apart from video game-related live streams. Hence, future studies should consider replicating the research model but focus on other types of live streams, such as only chatting. Lastly, data were collected only from Twitch users. Other platforms like Facebook, Youtube and DouYu also allow streaming services. It would be interesting to ascertain whether these results would differ if users of different platforms were investigated. 

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Note

1. Kircaburun, *et al.*, 2020, p. 529.

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