Radboud University

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The ‘live’ life

The effect of engagement and parasocial interaction on the perceived closeness between viewers and streamers on Twitch.tv

Master Thesis Business Administration – Marketing

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Abstract

Live streaming over the internet is revolutionizing the way people consume media. The rise of live content is changing the online landscape. Live streaming also offers interesting opportunities for content marketing, but its workings are still unclear. The aim of this research is to investigate how viewer engagement and parasocial interaction affect emotional closeness between viewers and streamers on live streaming platform Twitch.tv. A quantitative research design was chosen and an online questionnaire was carried out. Based on 269 valid responses, we found that engagement has no significant effect on emotional closeness, while parasocial interaction does have a significant, positive effect. Furthermore, parasocial interaction also has a significant, positive effect on engagement. These effects hold when controlling for participants' age, gender, education level and the language in which they took the questionnaire. However, we note that existing conceptualizations of both viewer engagement and parasocial interaction do not appear to fully cover the nuances of the live streaming context. Thus, our most important finding is that live stream viewer engagement and parasocial interaction should be re-conceptualized and adapted to better match the intricacies of Twitch streams. Theoretical and practical implications of the results, along with avenues for further research, are discussed.

Keywords: Twitch.tv, live streaming, emotional closeness, engagement, parasocial interaction

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1. Introduction

1.1 Research context

Live streaming over the internet is revolutionizing the way people consume media. The rise of live content is changing the online landscape. Most major social media platforms, such as Facebook, YouTube, and Instagram, now offer live streaming functionality (Bous, 2021; Johnson & Woodcock, 2019). However, only one top social media platform was designed with live content at its core: *Twitch.tv*. While originally focused on providing live streams of video games, in recent years Twitch has expanded into other categories of entertainment as well, such as music and sports (Leith, 2021; Yaden, 2021). The platform allows anyone to broadcast themselves and what they are doing in real time, for free.

When Twitch is compared to other platforms like YouTube, it stands out by virtue of its high degree of closeness between content creators and viewers. Content creators who operate on Twitch, typically referred to as streamers, have indicated that this closeness is a key pull factor of the platform (Johnson & Woodcock, 2019). On Twitch, tightly knit communities form around individual streamers, creating intimacy and closeness between them and their viewers (Woodcock & Johnson, 2019; Hamilton et al., 2014; Wulf et al., 2018).

This closeness makes Twitch interesting from a marketing point of view. In digital marketing literature, it has been shown that closeness between content creators and their audience is beneficial for the effectiveness of influencer marketing (Hoos, 2019; Kim & Kim, 2021): closeness and trust are known to impact marketing outcomes such as brand attitude and purchase intention. This is likely because perceived closeness can positively affect source credibility (Phua, 2014), causing the influencer's recommendations to be taken more seriously.

Since influencer marketing is also being employed on Twitch (Woodcock & Johnson, 2019), it is desirable to understand what factors play a role in developing this closeness. However, research on this topic is still quite limited (Taillon et al., 2020; Taylor, 2020), especially when looking at Twitch, specifically. This research will attempt to uncover, at least partially, what factors influence the emotional closeness that Twitch viewers feel towards streamers. To do so, we will look at two mental processes which have been shown to be applicable to Twitch viewers: engagement (Jodén & Strandell, 2021; Storstein Spilker et al., 2018) and parasocial interaction (Wulf et al., 2018; Leith, 2021).

Engagement

Engagement is an important aspect of the Twitch viewing experience: the platform itself provides content creators with many tips on how to engage their viewers and build a community (Twitch.tv, n.d.-b), and content creators put effort in keeping viewers engaged, as this is crucial to growing their community and viewership numbers (Sjöblom et al., 2019, Jodén & Strandell, 2021). The social aspect of Twitch, which includes engaging with the streamers and the other viewers, is the strongest motivator to tune in for many people who watch live streams (Wulf et al., 2018; Jodén & Strandell, 2021). The Twitch platform facilitates this social element by offering numerous ways for viewers to interact with streamers (Sjöblom & Hamari, 2017; Johnson & Woodcock, 2017)

There is some research connecting engagement to the concept of social/emotional closeness. In education, the two concepts have been shown to be correlated, with some researchers hypothesizing that student-teacher closeness leads to increased student engagement (Archambault et al., 2017; Portilla et al., 2014). In a digital, non-educational setting that is perhaps more closely related to the current research, Pisoni et al. (2019) found that social closeness, engagement and enjoyment were positively correlated. The connection between viewer engagement and closeness in a live streaming context has not yet been studied, however.

Conceptually, a connection between viewer engagement and the development of close relationships on Twitch seems plausible. Being engaged with a stream means that a viewer is involved and interested in it (Oh et al., 2015; Kaminske, 2021) — being interested in the activities of a streamer could be an antecedent in developing emotional closeness to them. For these reasons, the concept of engagement is an interesting factor to consider.

Parasocial interaction

Examples from both research (Wulf et al., 2018; Wulf et al., 2021; Leith, 2021) and practice (Widomska, 2020; D'Anastasio, 2020) have shown that parasocial interactions, as well as long-term parasocial relationships, take place within the context of Twitch.
Like with engagement, parasocial interaction seems conceptually related to closeness. Parasocial interaction is the feeling of being addressed by media personae (Horton & Wohl, 1956; Schramm & Hartmann, 2008; Hartmann & Goldhoorn, 2011) — experiencing the viewing of media content as though an actual, face-to-face interaction took place. If a viewer were to experience parasocial interaction with a streamer, it seems reasonable to suggest that

this experience could lead to the development of closeness to the streamer: it has been shown that the frequency of interacting with people is predictive of the closeness of the relationship with them (Zhang, 2001).

1.2 Research question

So, viewer engagement and parasocial interaction both take place on Twitch, and both pertain to the social and psychological aspects of watching Twitch streams. The goal of this research is to investigate how engagement and parasocial interaction influence the emotional closeness that viewers feel towards streamers. As such, the main research question will be:

What effect do engagement and parasocial interaction have on the emotional closeness between viewers and broadcasters on Twitch.tv?

This question is relevant in numerous ways. For marketing practice, it is valuable because it would shed further light on the workings of Twitch streamers as social media influencers. Knowing how engagement and parasocial interaction are related to emotional closeness (which is known to enhance the effectiveness of influencer marketing) is useful for brands, as it will allow them to select more effective streamers to partner with. For streamers, it could offer opportunities to make themselves better social media influencers, increasing their attractiveness to potential sponsors and business partners.

From an academic point of view, the research is also relevant. Literature on Twitch is still relatively scarce, since the platform is still quite young and is still growing rapidly. Also, it would help close the gap between the relatively small pool of research related to influencer marketing and the large scale at which social media influencers are being used in practice. The relationship between influencers and viewers, in particular, is an element that is not yet well-documented (Taillon et al., 2020).

Finally, the research is also relevant to society at large. Since livestreaming through Twitch is increasingly popular, having more insight in its workings is beneficial because potential negative effects could be recognized. With the average Twitch viewer being quite young (Kavanagh, 2021), and the platform evolving to be increasingly commercialized, knowledge of the events and effects that take place there are necessary to ensure the wellbeing of all those involved.

2. Theoretical background

2.1 Existing research

There exists some research on close relationships via social media and the development thereof. Some of the earliest work on this concept is the idea of 'ambient intimacy' put forward by Reichelt (2007). Reichelt argued that social media allow people to stay in touch with others "with a level of regularity and intimacy" that would be otherwise impossible due to spatial and/or temporal constraints (2007, par. 3). This intimacy is 'ambient' in the sense that people may be exposed to others' posts without specifically looking for them; they are simply 'there' in their feed (Levordashka & Utz, 2016). Knowing details about somebody creates intimacy and could thus be one of the factors in developing closeness via social media (Reichelt, 2007; Lin et al., 2016).

Ambient intimacy has been compared to parasocial relationships because of its potential to be asymmetric or even one-sided (Lin et al., 2016; Thompson, 2008). The nature of (most) social media is such that it is possible to closely follow a person, without that person following you back or even knowing of your existence, similar to how media characters will typically be unaware of individual viewers (Lin et al., 2016). The link to parasocial effects is relevant to the current study, though the focus on parasocial *relationships* differs from the parasocial *interaction* we include.

Elements of ambient intimacy are present in the modern-day phenomenon of social media influencers. Influencers often show their daily lifestyle and activities (Taillon et al., 2020), making this information available to their followers. However, much like watching a Twitch streamer, this intimacy is less 'ambient' since users typically have to explicitly follow an influencer to be served their content. The rapidly growing body of research on influencer marketing (Vrontis et al., 2021) is relevant to the present study, since influencer marketing is also being employed on Twitch (Woodcock & Johnson, 2019). Studies in this field have shown that parasocial relationships have a strong effect on purchase intention (Farivar et al., 2021; Masuda et al., 2022). While highly relevant in the sense that social media influencers are involved, the fact that many of these studies focus on platforms like Instagram and YouTube (Vrontis et al., 2021) set them apart from the situation in the present study.

The possible interactions between SMIs and viewers are very different on Twitch than they are on other, conventional platforms: Twitch focuses almost exclusively on live, real-time content (and thus real-time interaction), whereas 'traditional' social media are asynchronous:

the content is created and viewed at different times, not simultaneously. This difference between synchronous and asynchronous media creates differences in how viewers interact and engage with it (Hilvert-Bruce et al., 2018, Giertz et al., 2021). Additionally, the 'live' aspect of Twitch streaming allows for parasocial *interaction,* in addition to parasocial *relationships* to take place. The conceptual differentiation between parasocial relationships and parasocial interaction will be discussed in more detail later.

2.2 Key concepts

In this chapter, the central theoretical concepts discussed in the research will be further explored and defined. For a description of Twitch.tv as a platform, including 'streamers', please refer to Appendix A.

2.2.1 Engagement

Engagement in marketing

The concept of customer engagement has become a significant point of focus in both marketing practice and research (Brodie et al., 2013). As the social media marketing sector continues to grow (Statista, 2021), customer engagement grows with it, since the ability to interact and engage with brands is one of the major new opportunities that social media bring to the table (Brodie et al., 2013; Gummerus et al., 2012). Engagement is positively related to purchase intention (Toor et al., 2017; Rosetta, 2014, in Toor et al., 2017), which provides a clear explanation of why marketeers consider it to be so important. When engaged customers actively contribute, for example by creating user-generated content, this invites other users to contribute as well (Dolan et al., 2015). As such, companies want to encourage their followers to not just passively consume content, but actively contribute to it (Dolan et al., 2015; Baird & Parasnis, 2011; Gummerus et al., 2012).

Engagement on Twitch

For similar reasons, engagement is an important concept for Twitch streamers. Engaging the viewers is a crucial element of Twitch's appeal as a platform (Woodcock & Johnson, 2019). Engaged and active viewers contribute to the sense of community that surrounds streamers. They do this by sending messages in the chat, reacting to what the streamer says and does, and by having interactions with other audience members (Hamilton et al., 2014). Much like on other social media platforms (as mentioned above), seeing others interact and contribute invites Twitch viewers to participate as well, making the stream more interesting and engaging to new viewers (Jain et al., 2019; Hamilton et al., 2014). For Twitch streamers who wish to increase their viewership, the platform itself advises to create an engaging, active appearance to make viewers feel welcome (Twitch.tv, n.d.-b).

As described before, research in other fields of study have connected the concept of engagement to social/emotional closeness. In education, social closeness between teachers and their students is theorized to improve student engagement (Archambault et al., 2017; Portilla et al., 2014), and Pisoni et al. (2019) found a positive correlation between social closeness, engagement and enjoyment in an online exhibition setting. However, the two topics have not been studied in conjunction within a live streaming context.

Defining engagement

In research, many different fields of study have investigated engagement: education (Fitzgerald et al., 2012; Kahu, 2013), human-computer interaction (Kappelman, 1995; Oh et al., 2015), and (digital) marketing (Pentina et al., 2018; Calder et al., 2009), for example. The field of human-computer interaction appears particularly relevant to this research, since the present object of study is interactive digital media (Twitch streams) and the consequences of viewers' experiences with it. As such, definitions from this field of study will be explored. Since we are also interested in the potential marketing outcomes of engagement on Twitch, digital marketing literature will also be consulted.

In digital marketing, the definition of 'engagement' tends to be mostly quantitative, especially in practice. In this context, engagement is typically measured based on how many 'likes', comments, shares etc. an organization's posts and other content receive, as well as the amount and valence of user-generated content related to the brand (Marr, 2020; McGaw, 2019). Within social media marketing, customer engagement is often treated as a key performance indicator (Rahal, 2021); if customers are engaging with your content, you know that they are receiving and processing your message.
A distinction between 'passive' and 'active' engagement is sometimes made (Dolan et al., 2015), where reading or watching content is at the passive end of this continuum and creating original content is on the active end.
We can see that the understanding of engagement in digital marketing is mostly focused on behavioral outcomes which can be quantitatively measured.

In human-computer interaction research, engagement is treated more as an (emotional) process rather than a behavioral outcome. O'Brien (2017) defines (user) engagement as "a quality of user experience characterized by the depth of an actor's cognitive, temporal, and/or emotional investment in an interaction with a digital system" (p. 2809). Engaged experiences are facilitated by a combination of user attributes (e.g., attention, motivation, involvement) and system attributes such as novelty, usability and aesthetics (O'Brien & Toms, 2008; O'Brien, 2017). O'Brien and Toms (2008) suggest that user engagement is similar to the concept of 'flow' (Csikszentmihalyi, 1990), but that they are not the same: it is suggested that user engagement does not explicitly require intrinsic motivation (unlike flow) and that engagement can take place in short bursts (seconds or minutes), whereas flow is typically associated with sustained focus that lasts potentially hours. In a similar way, Oh et al. (2015) describe engagement as "a phenomenon where viewers or readers are completely invested in the unfolding of the media content, often oblivious to the surrounding environment" (p. 739). This complete investment, a sense of being 'drawn in' and losing sense of time, again shows similarities to 'flow'. However, Oh et al. propose that engagement can be seen as a continuum, and that the attraction to the content itself ('absorption') is a step that is much further along in it; earlier stages include users interacting with the content and evaluating the interface surrounding it. Their full model is presented in Figure 1. In this view of engagement, the 'flow'-like state is thus only part of a bigger process.

Both Oh et al. (2015) and O'Brien and Toms (2008; 2010) note that the visual appearance of an interface or system is an important aspect in the process of engagement. The framework that Oh and colleagues (2015) developed places 'interface assessment', being the user's perception of the aesthetics and usability of the interface, before the interest and investment in the content ('absorption'). Indeed, previous research has shown that the user's appraisal of the interface influences the degree of absorption (Sundar et al., 2014; O'Brien & Toms, 2010). As such, the visual appearance of a system appears to be an important antecedent for absorption, and thus deeper engagement, to take place.

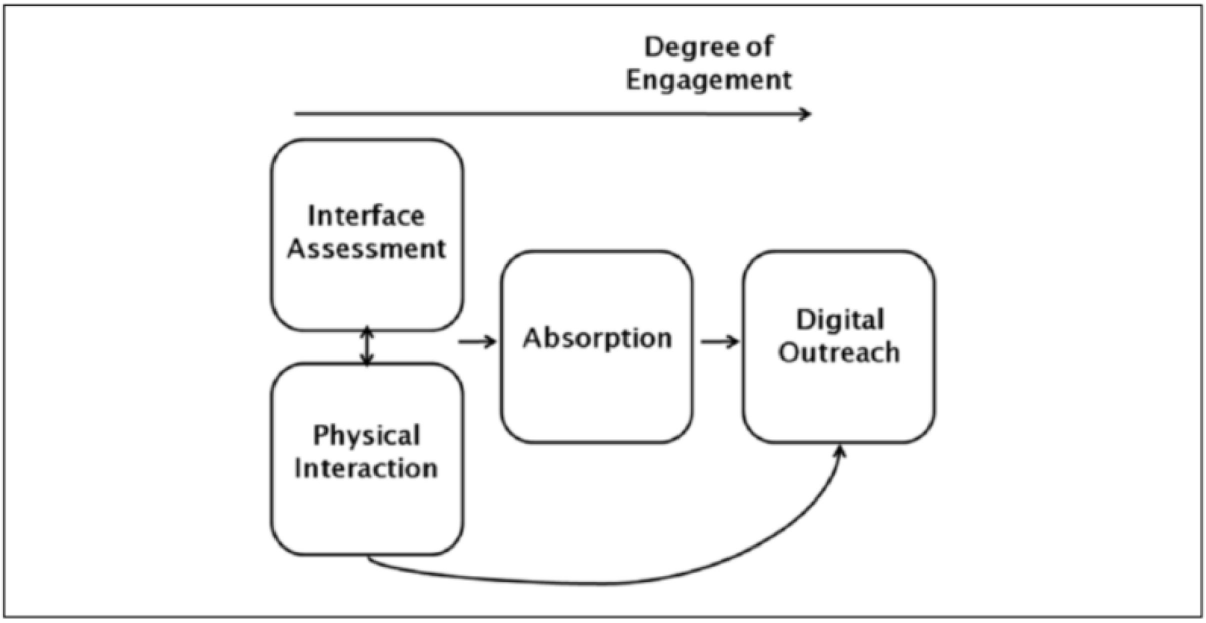

Figure 1: Oh et al.'s model of user engagement (2015)

The last ‘stage’ in the engagement model by Oh et al. (2015) is ‘digital outreach’. Oh and colleagues consider this to be “a heightened phase of engagement” (p. 744), characterized by behavioral indicators such as sharing content via social media or bookmarking a webpage for future access. These indicators are noticeably more quantitative than those in the other stages and are conceptually much closer to the definition of engagement seen in digital marketing.

Choosing a definition

The way Oh et al. (2015) conceptualize engagement seems to be a good fit for this research project. Since we want to investigate the relationship between engagement and emotional closeness, taking a more psychological and process-based view of engagement seems more appropriate than the quantitative, behavioral definition seen in digital marketing. Furthermore, we believe the viewing experience on Twitch to be relatively complex: not only the streamer, but also the game or activity they are participating in, the visual appearance of the stream and the influence of their community (e.g., through the chat window) shape the viewing experience. Because of this, we feel that constraining engagement only to behavioral factors would not encompass the full breadth of the concept.

As such, this research will interpret engagement in accordance with the model developed by Oh et al. (2015): as a process that takes place following exposure to media, with different phases which correspond to the degree of engagement. Early phases include the assessment of the media and its interface, and interaction with the media. Later phases include absorption in the material, and digital outreach (behavioral indicators).

2.2.2 Parasocial interaction

The concept of parasocial interaction was first put forth by Horton and Wohl (1956). As they conceptualized it, parasocial interaction is the phenomenon of perceiving a media persona as a conversational partner. For example, a person may feel as though they have had interaction, or even a conversation, with a television presenter after viewing a TV program. This feeling is an illusion, though, because (traditional) TV does not allow for interaction: the television presenter cannot see or hear the viewer, and as such does not react to them in any way. The communication is purely one-way (from the presenter to the viewer); any feeling of interaction is (presumably) only present in the viewer (Horton & Strauss, 1957).

Parasocial interaction and Twitch

Parasocial interaction as is, a concept, highly relevant to the Twitch platform. Practice has shown that parasocial effects take place on Twitch: there are documented instances of viewers asking streamers highly personal questions or even showing up on their doorstep unannounced, because they view them as friends (D’Anastasio, 2020; Lal, 2021). Multiple prominent Twitch streamers have addressed this problem (Atallah, 2020; Ludwig, 2020), including *Ludwig*, one of the most-watched streamers on Twitch (TwitchTracker, 2021a).

There has been some research into the parasocial processes taking place on Twitch. Wulf and colleagues (Wulf et al., 2018; Wulf et al., 2021) found that the social elements of watching Twitch streams (interaction with the streamer and other viewers) is an important motivator for viewers. Additionally, they note that the relationships between viewers and streamers do exhibit parasocial aspects — even though they are technically not ‘fully’ parasocial, as some degree of real interaction is possible.

Twitch has been recognized by researchers for providing television-like content (Woodcock & Johnson, 2019; Storstein Spilker et al., 2018; Pires & Simon, 2015) because of its immediacy and ‘live’ aspect. This could be part of the reason why Twitch is so well-suited for parasocial experiences, as this concept was first theorized within the context of television shows.

Defining parasocial interaction

Since its inception in the 1950s, parasocial interaction has suffered from confusion concerning its exact conceptualization (Dibble et al., 2016; Schramm & Hartmann, 2008). Horton and Wohl (1956) originally described parasocial interaction as the “illusion of a face-to-face

relationship" with a media persona (p. 215, emphasis added by the author). Later research continued to use the term parasocial interaction for the longer-term, one-sided relationship between viewers and personae (Rubin et al., 1985; Rubin & McHugh, 1987).
More recently, there has been a call to separate the concepts of parasocial *interaction* and parasocial *relationships* (Giles, 2002; Schramm & Hartmann, 2008), where the non-lasting experience of having a social interaction with a media character is classified as a parasocial interaction (PSI). As implied by Horton and Wohl (1956), PSI exists only for the duration of the viewing experience (Rubin et al., 1985). The one-sided (and illusionary) relationships with media characters that are developed across multiple viewing sessions are classified as parasocial relationships (PSR) (Schramm & Hartmann, 2008; Rubin & McHugh, 1987). Experiencing PSI can lead to the development of a PSR, but the two are distinct concepts (Dibble et al., 2016; Hartmann & Goldhoorn, 2011).

A few factors are known to induce PSI. The way the media character addresses the viewer, both through body language and with speech, appears to be an important aspect in invoking parasocial experiences: characters who face the camera and look directly into it (Hartmann & Goldhoorn, 2011; Dibble et al., 2016) and address the audience in their speech (Wulf et al., 2021, Horton & Wohl, 1956) have been shown to cause PSI. Examples of this type of addressing, such as using the word 'we' instead of 'I', are plentiful on Twitch (Leith, 2021). Other aspects which are hypothesized to cause PSI include the perceived attractiveness the media character (Hartmann & Goldhoorn, 2011; Dibble & Rosaen, 2011) and the cognitive empathy (the ability to take another person's perspective) of the viewer (Tsao, 1996; Hartmann & Goldhoorn, 2011).

The experience of parasocial interaction is characterized by a sense of social interaction, in many ways similar to what one would feel when having a face-to-face conversation (Chory-Assad & Yanen, 2005). Viewers get the impression that the media character is aware of them and pays attention to them, in the same way the viewer is paying attention to the character (Hartmann & Goldhoorn, 2011; Goffman, 1983). Additionally, people who experience PSI may also feel that there is mutual adjustment of posture, behavior, manner of speech, and other factors that people also adjust in 'real' interactions (Van Baaren et al., 2003; Malle et al., 2007). The viewer may not only adjust themselves to match the media character but may also feel that the character adjusts to match them as well (Hartmann & Goldhoorn, 2011) — even though this is unlikely to be the case, since the character cannot see or hear the viewer.

There are some further outcomes associated with parasocial interaction. PSI leads to an increased commitment to social norms (Wulf et al., 2021; Goffman, 1983): viewers feel an urge to adhere to social norms, in a similar way to how they would silently agree on expected and accepted behavior in a face-to-face interaction (Goffman, 1983).

Some studies have also found that experiencing parasocial interaction leads to an increased enjoyment of the media by the viewer (Wulf et al., 2021). This could partially explain why social motivations are among of the most prominent reasons for Twitch viewers to tune in to broadcasts (Jodén & Strandell, 2021; Hilvert-Bruce et al., 2018).

Choosing a definition

For the purpose of this research, the 'original' definition of parasocial interaction – the short-term experience – conceptualized by Horton and Wohl (1956) and, more recently, Hartmann and colleagues (Schramm & Hartmann, 2008; Hartmann & Goldhoorn, 2011) will be adopted. The reasoning for this is as follows: The longer-term phenomenon (PSR) would likely overlap with the outcome variable of this research, emotional closeness. Since this study attempts to find out how parasocial interaction impacts the relationship between engagement and the development of close relationships, using a definition for PSI that inherently describes interpersonal *relationships* would conflict with the outcome variable.

2.2.3 Emotional closeness

Emotional closeness, also called interpersonal closeness or social closeness, is a property of the social relationship between two persons. Closeness is a factor that helps differentiate between different types of relationships (Dunbar, 2011); people are more willing to disclose personal information about themselves to those they feel close to (Altman & Taylor, 1973), for example. Definitions of emotional closeness generally include a sense of connectedness and proximity to the other person (Gooch & Watts, 2014; Gino & Galinksy, 2012). The closeness of a relationship is experienced over a relatively long period of time, and does not typically change quickly (Gooch & Watts, 2014)

Emotional Closeness and Twitch

As mentioned in the introduction, Twitch.tv stands out from other social media platforms by virtue of the high degree of closeness in the communities found on the website (Woodcock & Johnson, 2019; Hamilton et al., 2014). Twitch is characterized by a notable "proximity between producers and consumers" and its "unique cultures and practices" (Johnson & Woodcock, 2019, p.2).

Definitions of emotional closeness

Early definitions of emotional closeness view the concept as a function of two people's interdependence. Kelley et al. (1983) proposed that this interdependence can be observed through the mutual activities that individuals partake in. The frequency, strength and diversity of these activities, taking place over a longer duration of time, indicate a high degree of interdependence and therefore emotional closeness (Kelley et al., 1983). This conceptualization was adapted by Berscheid et al. (1989) for the development of their influential Relationship Closeness Inventory (RCI), a survey that combines three subscales (measuring the frequency, diversity and strength of mutual activities) into one total RCI score. Berscheid et al. found the fourth aspect proposed by Kelley et al. (1983), the duration of the interdependence, difficult to measure and interpret and thus dropped it for the RCI scale.

Aron et al. (1992) proposed a different conceptualization (and measurement) of closeness. They proposed the unidimensional Inclusion of Other in the Self (IOS) scale, measuring how much ‘overlap’ exists between the respondent and the person in question. More recent interpretations of emotional closeness combine aspects of the ideas by Berscheid et al. and Aron et al. (Dibble et al., 2012; Dubois et al., 2016).

Feelings of emotional closeness can be caused by many different things. In addition to the interdependence and mutual activities that Kelley et al. (1983) and Berscheid et al. (1989) focus on, similarities between people appear to be a strong antecedent of perceived emotional closeness. Sharing membership to a group (Tajfel, 1974) or belonging to an interdependent culture (Gunia et al., 2009) can lead to feelings of closeness. Even seemingly minor similarities or simple physical proximity to somebody else can elicit feelings of emotional closeness (Sedikides et al., 1999). For example, sharing the same birthday (Miller et al., 1998) or having a similar name (Pelham et al., 2005) can cause feelings of emotional closeness.

Known consequences of emotional closeness include behaviors that individuals would not display to people with whom they do not feel close. Examples of this include their choice of words (Brown & Gilman, 1960, in Dubois et al., 2016), their willingness to disclose personal information (Altman & Taylor, 1973), cooperate (Batson et al., 2002) or provide financial support (Aron et al., 1991).
Cognitive effects have been shown to take place, as well. People tend to consider opinions from peers they feel close to more strongly than others’ views (Brown & Reingen, 1987; Dubois et al., 2016). Additionally, feeling close to someone causes people to justify the

other's actions (Gunia et al., 2009) and influences their judgments of the other's behavior (Gino & Galinsky, 2012).

Choosing a definition

For the purpose of this research, emotional closeness will be defined as the perceived cognitive, affective and behavioral overlap between two individuals (Aron et al., 1992). Though closely related to interdependence, the term 'overlap' is more applicable for our use case since true 'interdependence' seems infeasible for the relationship with a character whom one (typically) only has digital interactions with.

2.3 Hypotheses and conceptual model

From the literature analysis, it is clear that engagement, parasocial interaction and emotional closeness are highly relevant to Twitch.tv as a platform. The aim of this research is to investigate the effect of engagement and parasocial interaction on perceived emotional closeness from Twitch viewers towards streamers.

In accordance with the analyzed literature, a viewer who is engaged with a Twitch stream feels invested and interested in it (Kaminske, 2021). Twitch allows for viewers to interact with the stream in a number of ways (Woodcock & Johnson, 2019), and interaction can be linked to both engagement (Hilvert-Bruce et al., 2018; Dolan et al., 2015) and feelings of emotional closeness (Zhang, 2001; Aron et al., 1997). Adding to this that emotional closeness to others can be elicited by seemingly minor factors such as belonging to the same group or (sub-)culture (Tajfel, 1974; Gunia et al., 2009), it appears logical that highly engaged Twitch viewers would have strong feelings of emotional closeness towards the streamer. Hence, the first hypothesis will be:

H1: A high degree of engagement in viewers has a positive effect on their feelings of emotional closeness towards the streamer.

When experiencing parasocial interaction, viewers feel as though they have had a real, personal interaction with a Twitch streamer while this is not the case. As interaction with other people has been shown to induce feelings of emotional closeness towards them (Zhang, 2001), it is expected that viewers who experience strong parasocial interaction will have greater feelings of emotional closeness towards the streamer.

H2: A strong experience of parasocial interaction in viewers has a positive effect on the emotional closeness they feel towards the streamer.

As touched on before, interaction is regularly seen as an element that is important to engagement (Dolan et al., 2015; Hilvert-Bruce et al., 2018). Since Twitch viewers who experience parasocial interaction feel as though they have ‘real’ interactions with the streamer, it appears likely that they would also feel more engagement with the streamer (and the stream as a whole). As such, it is expected that parasocial interaction has a positive effect on engagement.

H3: A strong experience of parasocial interaction in viewers has a positive effect on how engaged they are.

Combining these hypotheses results in the following conceptual model:

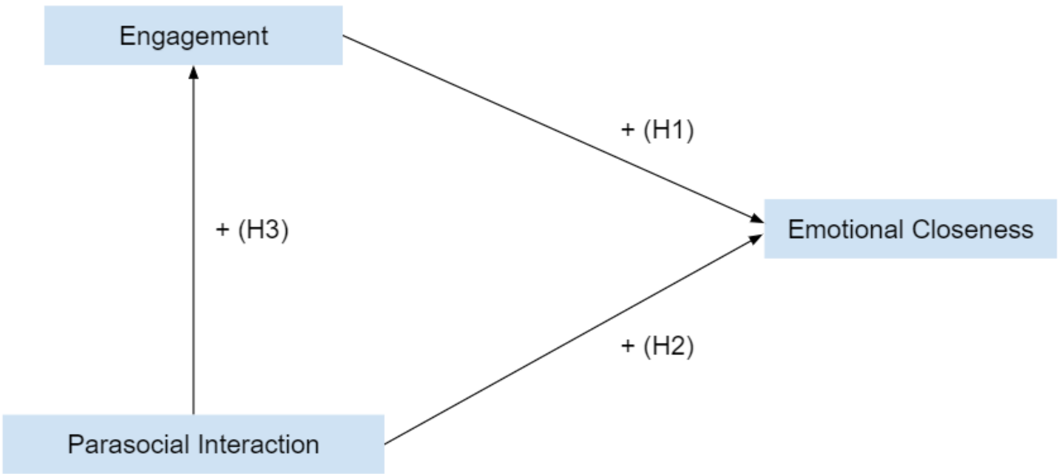

Figure 2: Conceptual model.

3. Methodology

3.1 Research design

To test the hypotheses, a quantitative research design was chosen. Data was collected through an online questionnaire, in which respondents were asked to name a Twitch streamer whose stream they had recently watched. Any respondents who indicated that they were not familiar with Twitch.tv or had not watched a stream for 10 or more minutes in the past month were prevented from participating further and thanked for their time.

After naming a streamer, respondents were asked questions about their experience when watching that streamer's stream. Once they had completed these questions, they were asked if there were any other streamers they watched, and if so, whether they would be willing to complete the questionnaire for a second streamer as well. An option to decline and proceed to the end of the survey was offered as well. Lastly, demographic information was asked, and the respondents were thanked for their participation.

The target audience and population for the survey was Twitch.tv viewers. Responses were gathered through multiple channels: Twitch streamers partnered with the Dutch branch of Cooler Master Europe B.V. (a manufacturer of computer hardware and accessories) were asked to distribute the questionnaire among their viewers. Furthermore, the researcher asked friends and acquaintances to participate and/or spread the questionnaire to others who are part of the target audience. This second approach employs snowball sampling, which can be considered to be a form of convenience sampling (Parker et al., 2019). Additionally, the survey was shared on multiple discussion boards on Reddit.com, including the (unofficial) Twitch forum. This approach was chosen due to the large number of potential respondents (the Twitch forum on Reddit has 1.2 million members) and the assumption that the userbase would be a good representation of the population. Finally, a short description of the research and a link to the survey were posted as a news item on the Dutch-language consumer electronics news website Hardware Info.

3.2 Pilot study & translation

After the initial development of the operationalization, a pilot study was conducted to test the clarity of the questions and the correct functioning of the display logic in the questionnaire. Pilot studies, or pre-testing, are an important way of reducing errors and non-response (Grimm, 2010; Van Teijlingen & Hundley, 2002). Eight participants completed the survey and had the opportunity to add comments regarding the clarity of the questions and prompts on each page in the questionnaire. A post-participation debrief was (digitally) held with one participant. Numerous small improvements to spelling, phrasing and clarity were made based on the feedback. Additionally, based on the debrief, an additional question was added to the survey.

The pilot study was conducted in Dutch. In order to validate the researcher's translation of the original English-language measurements, the back-translation method was employed. Though not without its issues, back-translation is useful for judging the quality of a translation and for ensuring the tone and meaning of different versions are consistent (Brislin & Freimanis, 2001). The back-translated version showed no significant deviations from the original meanings of the measurement items, indicating that the translation to Dutch was mostly accurate. Exceptions to this were examined and amended when a better translation was found.

3.3 Operationalization of variables

3.3.1 Engagement

Engagement was measured through three dimensions based on the framework by Oh et al. (2015). These dimensions and the indicators within them have been adapted to better suit Twitch.tv. The resulting indicators differ from those used by Oh and colleagues (2015) but are conceptually similar. In Appendix B, a more complete description of the changes and the reasoning for them is provided.

One dimension from the original model, *Physical Interaction*, has been removed entirely. The reasoning for this is that interaction with a Twitch stream, for the most part, takes the form of interacting with the streamer and/or their audience. The stream window has little to no features aimed at local, non-social interaction. Social interaction with the stream is conceptually much closer to the *Digital Outreach* dimension than it is to *Physical Interaction*, and since the researcher did not see any suitable replacement, the latter dimension was removed from the operationalization.

3.3.2 Parasocial interaction

To measure the parasocial experience of Twitch viewers, the Experience of Parasocial Interaction (EPSI) scale by Hartmann and Goldhoorn (2011) was used. This scale consists of six items which are rated on a seven-point Likert-type scale, ranging from “Fully disagree” (1) to “Fully agree” (7). This measurement was selected because of its short form and simplicity, because it has been found to measure parasocial interaction better than common alternatives (Dibble et al., 2016), and because it has been successfully used in recent work researching parasocial effects on Twitch.tv (Wulf et al., 2021).

3.3.3 Emotional closeness

A combination of three extant measurement tools was used to measure emotional closeness. The Relationship Closeness Inventory (RCI) by Berscheid et al. (1989), the 10-item scale used by Lee et al. (1990) and the Unidimensional Relationship Closeness Scale (URCS) by Dibble et al. (2012), to construct an instrument that is suitable for the type of relationships and interactions that are found on Twitch. Dimensions and corresponding items were adapted only where deemed necessary, in an effort to preserve the original, proven measures.

Based on existing measurement scales and literature, five dimensions were selected: trust, enjoyment, frequency, strength and caring. Items for these dimensions were sourced from the aforementioned scales where realistically possible and adjusted to be applicable to the Twitch environment. For the Trust, Enjoyment and Caring dimensions, additional original items were added.

3.3.4 Overview of final operationalization

In Table 1 below, the final operationalization of the research variables is shown. The full questionnaire can be found in Appendix C.

Construct	Dimension	Item	Source/Notes
Engagement	Interface Assessment	[Streamer]'s stream looks good.	own
		I can clearly distinguish the different visual elements that are visible in [Streamer]'s stream.	own
		I understand what the different visual elements in [Streamer]'s stream mean.	own
	Absorption	I understand what's happening in [Streamer]'s stream.	own
		Watching [Streamer]'s stream is immersive.	Oh et al. (2015)*
		While watching [Streamer]'s stream, I don't get distracted by other things.	Oh et al. (2015)*
		While watching [Streamer]'s stream, I'm doing other things or am not paying attention.	own [reverse-scored]
	Digital Outreach	I actively participate in the live chat in [Streamer]'s stream.	own
		I plan to watch [Streamer]'s stream again in the future.	Oh et al. (2015)*

Parasocial Interaction	Parasocial Interaction	***When watching [Streamer]'s stream, I get the feeling that [Streamer]...***	Hartmann & Goldhoorn (2011)* [instruction]
		... is aware of me.	Hartmann & Goldhoorn (2011)
		… knows I am there.	Hartmann & Goldhoorn (2011)
		… knows that I am aware of him/her.	Hartmann & Goldhoorn (2011)
		… knows that I am paying attention to him/her.	Hartmann & Goldhoorn (2011)
		… knows that I am reacting to him/her.	Hartmann & Goldhoorn (2011)
		… reacts to what I say or do.	Hartmann & Goldhoorn (2011)
Emotional Closeness	Trust	I feel [Streamer] is honest.	own
		I feel like I can trust [Streamer].	own
		[Streamer] and I share a mutual trust.	Lee et al. (1990)
	Enjoyment	I enjoy watching [Streamer]'s stream.	own
		I enjoy my connection with [Streamer].	Lee et al. (1990)*
		I have the feeling that [Streamer] and I enjoy each other's presence.	own
	Frequency	When I have free time, I choose to spend it watching [Streamer]'s stream.	Dibble et al. (2012)*
		I want to spend time watching [Streamer]'s stream.	Dibble et al. (2012)*
	Strength	I have a close relationship with [Streamer].	Dibble et al. (2012)
		Me and [Streamer] have a strong connection.	Dibble et al. (2012)
		[Streamer] influences how I spend my free time.	Berscheid et al. (1989)
	Caring	I care about [Streamer].	own
		I feel that [Streamer] and I care about each other's feelings.	Lee et al. (1990)*
** Item was adapted to better suit the context of this research (Twitch.tv) but is conceptually similar.*			

Table 1: Operationalization of variables. Note that many questions/prompts in the questionnaire include a streamer name. In the online survey, the participant is asked to name a streamer they have recently watched; this name is consequently used in the questions and prompts. For the purpose of this table, '[Streamer]' has been inserted where the actual name would be displayed.

3.4 Research Ethics

Ethical concerns were taken into account during the design and execution of this study. Questionnaire participants' information, such as their IP addresses, e-mail or name were not collected. Participants were informed that their participation in the research was wholly voluntary, that their response would be anonymous and that they could withdraw at any point. Furthermore, they were advised that the survey did not have any 'right' or 'wrong' answers and were asked to answer based on their own experiences and feelings. Additionally, the dataset resulting from the survey was not made available to anyone except the researcher, and the participants were made aware of this.

4. Results

4.1 Missing data

The online questionnaire gathered a total of 510 respondents. However, many responses were incomplete. 55 respondents were purposely directed to the end of the survey before answering all questions, because they either did not agree to the terms of the questionnaire (5), were not familiar with Twitch.tv (19) or had not watched a Twitch stream within the last month (31). Since these represent system-missing values, they are no cause for concern.

However, there was also significant non-response. Of the 455 respondents who were not deliberately directed out of the survey, only 273 filled out all questions. As all questions were mandatory, we could determine some points in the survey where many respondents quit:

- 73 respondents reached the point where they were asked to enter the name of a Twitch streamer they had recently watched, but did not enter anything;
- 48 respondents reached the first page of Likert scales, but did not fill them out.

Losing approximately 40 percent of participants due to incomplete responses is quite noteworthy, and introduces a significant risk of non-response bias (Berg, 2005, in Kempf-Leonard, 2005). Unfortunately, since the questions pertaining to respondent demographics were placed at the end of the questionnaire, our ability to analyze the incomplete responses is limited. However, we are able to compare how the weekly viewing time is distributed for complete responses and some of the incomplete responses (only those that answered this question). This (Figure 3) shows us that the distribution of viewing time appears to be extremely similar between complete and incomplete responses. Based on this information, viewing time does not appear to explain why respondents prematurely quit from the survey. Since the viewing time item was the only descriptive item before the main Likert-type items, this is the only meaningful analysis we can perform to gather information about the incomplete responses. The non-response still has several implications for the generalizability of our findings, which will be discussed in section 5.5.

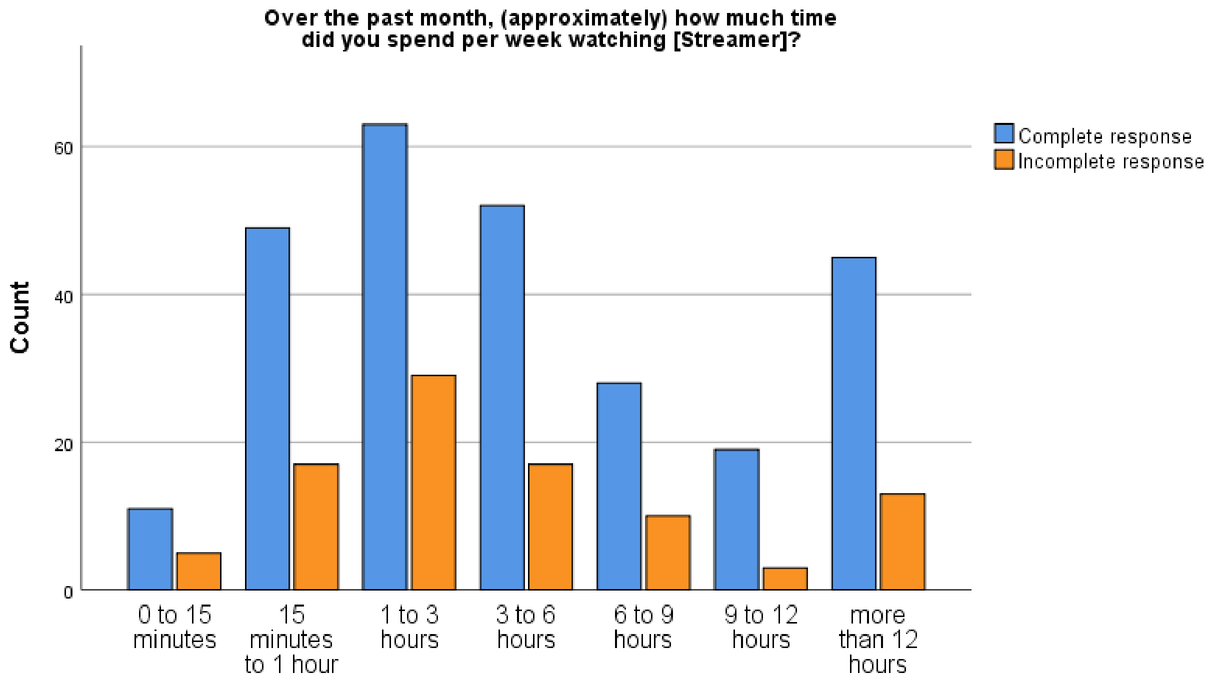

Figure 3: Histogram of indicated weekly viewing time, comparing incomplete to complete responses.

After cleaning the data and removing a few responses that were deemed unrepresentative (due to suspected response set, very short completion time and/or nonsensical answers to open questions), 269 valid and complete responses remained.

4.2 Description of sample

Our final sample consists of 269 Twitch.tv users who indicated they had watched at least one Twitch stream in the month prior to filling out the questionnaire. Their ages ranged from 15 to 67 years old (mean: 31.14; std. dev: 9.7 years). Participants were predominantly male (221 cases, 82.2%). 33 participants were female (12.3%), while 6 respondents identified as 'other'. 9 respondents chose not to disclose their gender.

Most respondents live in the Netherlands (66.5%), with the United States (9.7%) and Belgium (8.6%) being other frequently observed locales. Higher vocational education (Dutch 'HBO') and university Bachelor degrees were the most recorded completed levels of education among the sample, with each of those categories representing 69 respondents (25.7%). Associate degrees (Dutch 'MBO 3-4'; 16.4%), university Master degrees (14.5%) and high school/secondary school (11.5%) were other frequent responses.

Within the sample, 23.8 percent of respondents watched their indicated Twitch streamer for one to three hours per week. The distribution of weekly viewing time can be seen in Figure 3 (specifically, the blue bars). 46 participants (17.1%) indicated that they watched the Twitch streamer they selected for the questionnaire for more than twelve hours per week.

4.3 Factor analysis

To assess the validity of the questionnaire items, a confirmatory factor analysis is carried out. For this analysis, a set number of factors is specified: 3, corresponding to the three constructs present in our conceptual model.

For all iterations of the factor analysis, Bartlett's test of sphericity is significant ($p < 0.001$). Similarly, the Kaiser-Meyer-Olkin measure of sampling adequacy has a value equal to or greater than 0.900 in all steps of the analysis. This is well clear of the minimum acceptable value of 0.5 (Field, 2013). Together, these tests confirm that our data is suitable for factor analysis.

The factor analysis shows that some indicators did not properly measure their intended construct. Items ENG_6 and ENG_7 are examples of this. These items pertain to remaining focused on the Twitch stream while watching, and not allowing oneself to be distracted. The reverse-scored ENG_7 does not load on any of the three factors, whereas ENG_6 loads significantly on all factors. One by one, they are both eliminated from the analysis.

A number of items for Closeness suffer similar issues. Items CLO_2 and CLO_6 cross-load on both Engagement and Closeness. CLO_1 and CLO_4 load more strongly on Engagement than on Closeness, but are not cross-loaders. CLO_2 and CLO_6 are removed from the analysis due to cross-loading. CLO_1 pertains to the perceived honesty of the streamer, and does not appear conceptually related to Engagement. For this reason, it is removed. In contrast, CLO_4 ("I enjoy watching [Streamer]'s stream") can be conceptually linked to Engagement via the Absorption dimension (Oh et al., 2015). As such, this item is retained, even though it does not appear to measure the construct we initially meant for it to measure.

After removing ENG_6, ENG_7, CLO_1, CLO_2 and CLO_6, a suitable model is reached. The KMO-measure for this model has a value of 0.901, and Bartlett's test of sphericity is significant (χ^2=4879.481, $p < 0.001$). All items have a communality value greater than the minimum of 0.2 (Field, 2013). The initial eigenvalues of the three extracted items explain 65.31 percent of the variance in the model, and the 'elbow criterion' (Rahn, 2012) in the scree plot is also satisfied.

Factors extracted from final model

Factor 1: Engagement	ENG_1, ENG_2, ENG_3, ENG_4, ENG_5, ENG_9, *CLO_4*
Factor 2: Parasocial Interaction	PSI_1, PSI_2, PSI_3, PSI_4, PSI_5, PSI_6, *ENG_8**
Factor 3: Closeness	CLO_3, CLO_5, CLO_7, CLO_8, CLO_9, CLO_10, CLO_11, CLO_12, CLO_13

Table 2: The factors extracted from the final factor analysis model, and their indicators.
** Indicator ENG_8 did load significantly on this factor, but was not used in later analyses on theoretical grounds.*

As can be seen in Table 2, two items remain which load on a construct they were not intended for (CLO_4 and ENG_8). CLO_4 loading on Engagement can be explained by theory, as we have done above. For ENG_8 loading on PSI, this is not the case. ENG_8 ("I actively participate in the live chat in [Streamer]'s stream") is quite antithetical to the concept of parasocial interaction, which assumes no interaction is possible between the viewer and the media persona. While being very active in the live chat *could* potentially be an indicator of forming a parasocial *relationship* with a streamer, that is explicitly not something we want to measure (see section 2.2.2). As such, ENG_8 was not used in further analyses.

4.3.1 Construct reliability

In Table 3, the Cronbach's alpha for each of the latent variables is given. The values for each item far exceed the threshold of 0.7 which is considered good (Hair et al., 2019; Glen, 2022), indicating strong construct validity. Since we use existing measurement tools as a basis, though, such high values are to be expected.
For Engagement, removing item ENG_5 ("Watching [Streamer]'s stream is immersive") would not cause a decrease in Cronbach's α. However, for the sake of content validity the item was not deleted.

Reliability of factors

Factor	**Cronbach's α**
Engagement	0.900
Parasocial Interaction	0.942
Closeness	0.906

Table 3: Cronbach's α for all factors.

4.4 Variable distribution

Using the factors that were determined during the factor analyses (see Table 3), summated and then averaged scores for each variable are calculated. Subsequently, the distribution of these variables is assessed. To do this, the skewness, kurtosis and P-P plot for each variable is used.

For PSI and Closeness, the P-P plots match the diagonal line indicating normally distributed values reasonably well. For Engagement, however, more substantial deviation can be observed; refer to Appendix D for the data and plots. The skewness and kurtosis statistics reinforce this finding: for both PSI and Closeness, all skewness and kurtosis values are smaller than |1|. Engagement, on the other hand, shows noticeable negative skew (skewness = -2.408) and high kurtosis (7.790).

Transforming variables can aid with non-normality (Field, 2013). Multiple transformation methods (square root, square, natural logarithm, inverting) are performed for our Engagement score — see Appendix D. Out of these, squaring the score yields the best results (skewness: -1.445, kurtosis: 2.581). While an improvement, these values are still not ideal: the kurtosis remains greater than the acceptable value of |2| suggested by George and Mallery (2010).

To assess whether squaring Engagement yields substantial improvements, two multiple regression model analyses are performed: one with the regular Engagement score and one with the squared score. The results with the transformed Engagement variable are not substantially different than when using the untransformed variable.

Furthermore, Field (2013, p.172) argues that normality is unimportant when the goal of an analysis is to estimate parameters and when the sample size is sufficiently large. Both are the case for this study. Combining this with the observation that transforming Engagement does not yield substantially changed results, we choose to not transform Engagement in the further analyses.

4.5 Assumptions of regression

Before conducting a (multiple) regression analysis, we must assess whether our data adheres to the assumptions associated with this analysis. As such, the linearity, homoscedasticity, multicollinearity of the variate and the normality and independence of the error terms are reviewed. In this section, only the values for Model 1b (see Figure 4) are discussed at length, however the assumptions were also checked for the later models.

To check if our independent variables have a linear relationship with the dependent variable (Closeness), the partial regression plots are consulted. These are displayed in Appendix E. For Engagement, no nonlinear patterns are visible, and thus the assumption of linearity appears to be met. The plot for PSI, however, appears to show a slight curve in the distribution of the residuals. This could imply a non-linear relationship. To check whether this is the case, the PSI score is centered and subsequently squared and cubed. A multiple regression with both of these polynomial terms showed that the squared PSI score has a significant effect, in addition to the significant effect found for the regular PSI score. As such, the quadratic term for PSI is included in the regression analysis.

Homoscedasticity is also assessed using the partial regression plots, wherein an equal distribution of residuals across the different values of each independent variable indicates that the assumption is met. For PSI and its quadratic term, this is the case: the spread of residuals is constant. In the plot for Engagement, a noticeable funnel shape can be observed: for lower values of Engagement, the residuals are closer together than for higher values. This signals that the assumption of homoscedasticity is possibly violated. This is noteworthy because it limits our ability to draw strong conclusions from the regression analysis.

Multicollinearity, the degree to which the independent variables correlate with each other, is tested using the variance inflation factor (VIF) values. Field (2013) proposes that VIF values greater than 10 are cause for concern; Hair et al. (2019) suggest values greater than 3 indicate the presence of multicollinearity. Furthermore, the average VIF should not be substantially greater than 1 (Field, 2013) because this could indicate a biased regression.
Out of our 3 predictors, the untransformed PSI score has the highest VIF, with a value of 1.075 (see Appendix E). The Engagement score has a VIF of 1.059 and PSI's quadratic term has a VIF of 1.017. As such, the average VIF value (1.050) was also not substantially greater than 1. Based on these statistics, multicollinearity does not appear to be an issue in our dataset.

The normality of the error terms can be visually checked by plotting the standardized residuals in a P-P plot and a histogram; these can be found in Appendix E (figure 4). The histogram shows no residuals with a value greater than |3|, and adheres to the normal curve rather nicely. In the P-P plot, the residuals similarly remain quite close to the diagonal. Therefore, normality of the error terms can be assumed.

Lastly, the independence of the error terms is assessed. This is done using the Durbin-Watson statistic, which tests for autocorrelation in the residuals. The statistic produces results between 0 and 4, where values smaller than 1 and greater than 3 are cause for concern (Field, 2013). Our model produces a Durbin-Watson statistic of 1.967, which is sufficiently close to 2 to not be alarming.

4.6 Regression analyses

4.6.1 Model 1

To test the hypotheses posed in section 2.3, multiple regression analysis is used. The first model, Model 1, follows a hierarchical approach. First, a number of control variables is added to the regression model, and subsequently the predictors (Engagement, PSI and the squared transformation of PSI) are entered. This results in sub-model 1a, containing only the control variables, and model 1b with the control variables and hypothesized predictors. A visual representation of these models is given in Figure 4.

The control variables used are:

- Gender (dummified to females; reference category is males)
- Age (in years)
- Education level, categorized to low, middle and high based on a distribution by Statistics Netherlands (CBS, 2019) (dummified to low and middle levels; reference category is highly educated)
- Language of the survey (Dutch or English; dummified to English; reference category is Dutch)

The multiple regression results for Model 1a can be found in Table 4. Full SPSS output for model 1a and 1b can be found in Appendix F.

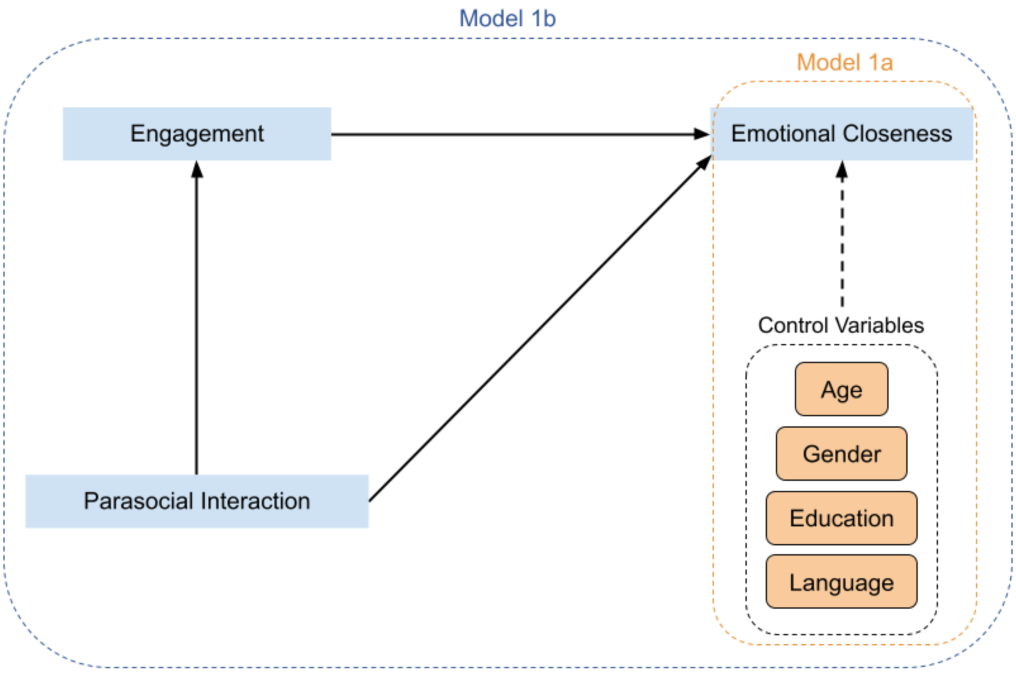

Figure 4: Visual representation of regression models 1a and 1b.

	B	***SE B***	***β***	***p***
Constant	3.668	0.341		0.000
Age	-0.009	0.009	-.064	0.347
Gender_Female	0.026	0.266	.006	0.922
Edu_Mid	0.358	0.229	.102	0.119
Edu_Low	0.153	0.229	.043	0.504
Language_EN	0.156	0.190	.058	0.412

Table 4: Results of multiple regression analysis using Model 1a, which includes only control variables.

The regression with Model 1a does not produce statistically significant results: F (5, 258) = 1.038, p = 0.396. The model has an adjusted R^2 of 0.001, indicating that it explains only 0.1% of the variance in emotional closeness. None of the control variables appear to predict emotional closeness.

	B	*SE B*	*β*	*p*
Constant	0.959	0.494		*0.053*
Age	-0.009	0.006	-.0647	0.162
Gender_Female	-0.002	0.189	.000	0.992
Edu_Mid	-0.003	0.164	-.001	0.985
Edu_Low	0.145	0.163	.041	0.375
Language_EN	0.125	0.136	.046	0.361
PSI	*0.494*	*0.033*	*.690*	*0.000*
PSI_square	*0.076*	*0.017*	*.192*	*0.000*
Engagement	*0.096*	*0.068*	*.064*	*0.163*

Table 5: Results of hierarchical multiple regression analysis using Model 1b, which includes both the control variables and our theorized predictors (in italics).

Table 5 shows the results for Model 1b, which includes our theorized predictors. This model is significant ($F(8, 255) = 33.714$, $p < 0.001$). Adjusted R^2 is 0.499 and thus the model explains 49,9% of the variance in emotional closeness.

The first hypothesis for this research was as follows:
H1: A high degree of engagement in viewers has a positive effect on their feelings of emotional closeness towards the streamer.

From the multiple regression results for Model 1b, we can determine that Engagement does not have a significant effect on Closeness: $B = 0.089$, $p = 0.155$. Based on this information, Hypothesis 1 can be rejected.

The second hypothesis was:
H2: A strong experience of parasocial interaction in viewers has a positive effect on the emotional closeness they feel towards the streamer.

The results of the multiple regression analysis show that PSI does have a significant, positive effect on Closeness ($B = 0.499$, $p < 0.001$). Thus, every 1 unit increase on the PSI score is expected to lead to an increase of 0.499 in Closeness, assuming all other factors remain constant. Additionally, the quadratic polynomial of PSI also has a significant positive effect: $B = 0.074$, $p < 0.001$. Using the standardized coefficients, we can see that this effect is less strong than that of the untransformed PSI score ($\beta = 0.187 < \beta = 0.693$). Based on these statistics, Hypothesis 2 can be accepted.

4.6.2 Model 2

The third and final hypothesis in this research was:

H3: A strong experience of parasocial interaction in viewers has a positive effect on how engaged they are.

To test Hypothesis 3, a second, simple regression model in which Engagement acts as the dependent variable is used. PSI serves as the sole predictor in this Model 2. Before conducting the analysis, the relevant assumptions are checked: the corresponding SPSS outputs can be found in Appendix G. In short, the assumptions of heteroscedasticity and linearity are met (and as such no polynomial terms of the PSI score are included). The Durbin-Watson statistic for autocorrelation has a value of 1.805, which is further removed from 2 than Model 1b but still no cause for concern. Normality of the error terms cannot be assumed, since the histogram of the standardized residuals shows substantial negative skew. To account for this, bootstrapping (with 2000 samples) is used to calculate confidence intervals.

	B	***SE B***	***p***
Constant	0.772 [5.237, 5.906]	0.165	*0.044*
PSI	0.121 [0.060, 0.185]	0.035	0.000

Table 6: Results of regression analysis using Model 2, with 95% bias-corrected and accelerated (BCa) confidence intervals reported in brackets. Standard errors and confidence intervals are based on 2000 bootstrap samples.

The results of the regression analysis using Model 2 are displayed in Table 6. Based on this analysis, PSI has a significant positive effect on Engagement ($B = 0.121$, $p = 0.001$, 95% BCa-CI [0.060, 0.185]). Thus, Hypothesis 3 is accepted.

4.6.3 Model 3: Mediation using PROCESS 3.4

To test whether the positive effect of PSI on Closeness is (partially) mediated by Engagement, a mediation model was run using PROCESS 3.4 (Hayes, 2022). Using the mediation model in PROCESS, only one independent variable can be specified. As such, it is not possible to include the quadratic term for PSI to compensate for its possibly nonlinear relationship with Closeness. However, as PROCESS is a bootstrapping-based procedure and is thus robust (Field, 2013), this is not a major concern.

Effect	***B***	***SE B***	***95% CI***	***p***
PSI → CLO (direct)	0.4832	0.330	[0.4174, 1.8615]	0.0000
PSI → ENG	0.1210	0.032	[0.0609, 0.1810]	0.0001
ENG → CLO	0.0858	0.0643	[-0.0408, 0.2125]	0.1832
PSI → CLO (indirect)	0.0104	0.0086	[-0.0048, 0.0283]	

Table 7: Results of multiple regression analysis for Model 3, using PROCESS 3.4. Standard errors and confidence intervals are based on 2000 bootstrap samples.

Table 7 shows the results of the PROCESS analysis for Model 3; full output is available in Appendix H. In line with our findings from Model 1, PSI has a significant positive direct effect on Closeness (B = 0.4823, p < 0.001, 95% CI [0.4174, 0.5473]), while Engagement does not have a significant effect (B = 0.0858, p = 0.1832, 95% CI [-0.0408, 0.2125]). The significant positive effect of PSI on Engagement, as found using Model 2, is reflected here as well: B = 0.1210, p < 0.001, 95% CI [0.0609, 0.1810].

The indirect effect of PSI on Closeness is not significant: B = 0.0104, 95% CI [-0.0048, 0.0283]. Furthermore, the indirect effect only accounts for 2.11% of the total effect (0.4927/0.0104 = 0.0211). As such, there is no substantial mediation effect.

4.7 Additional analyses

In addition to the main effects theorized in our conceptual model, our questionnaire yielded a lot of data that could provide interesting insights on our sample (and Twitch viewers as a whole). The effect that the control variables have is a good example of this. While we noted that the control variables age, level of education, participants' gender, and language of the survey did not prove to be significant regression predictors for emotional closeness, this does not mean that these variables do not provide interesting information. By assessing the effects of our control variables, we can learn more about our sample. The full SPSS outputs for the findings discussed below are given in Appendix I.

For example, the language in which a respondent completed the questionnaire appears to influence the level of viewer engagement they reported. In an independent-samples t-test, English-language participants scored significantly lower on engagement (M = 5.87, SD = 1.02) than Dutch-language participants (M = 6.21, SD = 0.86): $t(196.92) = 2.788$, p = 0.006. This could be an indication that Dutch-language viewers are more engaged with the streamers they watch. However, it could also point at a difference in how the items measuring engagement are interpreted between the two languages. In any case, it is an interesting observation.

Additionally, respondents who indicated that they watch more than one Twitch streamer showed significantly higher engagement (M = 6.81, SD = 0.79) than respondents who did not: t(51.52) = 3.037, p = 0.004. On average, respondents who watched multiple streamers scored 0.625 points higher on Engagement than those who did not. This group likely represents the more dedicated, core Twitch viewers (Wohn & Freeman, 2020). An explanation for their higher engagement could be these users are more embedded in Twitch culture and thus understand the medium better, which raises their interest and engagement.
Interestingly, though, participants who watched more than one streamer did not score higher in terms of parasocial interaction and emotional closeness (in fact, their mean scores for both were slightly lower than viewers' who watch only one streamer). Perhaps their increased experience with and understanding of Twitch also makes these viewers more aware of the parasocial aspect of live stream culture. One respondent made a remark that implies this as well, noting that they feel engaged with the streamers they watch but do not "have any illusions of having a special connection with them". The respondent went on to indicate that the questions measuring parasocial interaction and emotional closeness were somewhat awkward to them, because they recognized this behavior in other viewers. Parasocial interaction and parasocial relationships have had relatively significant attention in live streaming culture (Ludwig, 2020; D'Anastasio, 2020), which could explain why dedicated Twitch viewers are (self-)aware about it.

Similarly, viewers who watched a single Twitch streamer for more than three hours per week reported significantly higher levels of engagement (*M* = 6.34, *SD* = 0.74) than those who watched less than 3 hours per week, *t*(216.68) = 5.11, *p* < 0.01. The average engagement score for viewers who watched more than 3 hour per week was 0.573 points higher than for viewers who watched less than 3 hours per week. However, these viewers also scored significantly higher on PSI (*M* = 4.24; *p* = 0.018) and emotional closeness (*M* = 3.76, *p* = 0.005) than those who watched less than three hours per week. Why PSI and emotional closeness do significantly differ here, while they do not differ when comparing viewers who watch only one or more than one streamer, is unclear. Perhaps the viewing time of one streamer is more closely related to how dedicated the viewer is to that particular streamer, and watching multiple streamers is more indicative of being a heavy Twitch user in general. This finding reinforces the idea that retaining viewers is important for their engagement.

Respondents’ gender did not appear to impact their viewer engagement, experience of parasocial interaction, or perceived emotional closeness. Independent samples t-tests did not indicate statistically significant differences between male and female viewers. Participants who indicated to identify as ‘other’ gender were too small in number to meaningfully compare (6 cases).

5. Discussion and conclusion

5.1 General discussion

The aim of this research was to investigate the emotional closeness between viewers and broadcasters on the Twitch.tv live streaming platform. During the process of conducting the study and processing its results, it has become increasingly clear that the academic understanding of Twitch streaming is in need of further development. The existing conceptualizations of parasocial interaction and viewer engagement on Twitch, both central elements of this study, appear to be insufficiently applicable to the interactive live streaming context. The definitions and operationalizations of these variables used in this research were derived from extant theory, mainly from fields and papers that were not specifically aimed at Twitch.tv. While these conceptualizations remain valid in their respective fields, it has become apparent that they do not fully cover the intricacies of the live stream viewing experience. We will expand upon this below.

5.1.1 Viewer engagement

The definition of viewer engagement used in this research was based on the framework developed by Oh et al. (2015). Oh and colleagues developed their framework in the context of human-computer interaction, and their process-based approach with multiple stages and elements of engagement appeared to be a good fit for the relatively complex viewing experience on Twitch. However, our results show that viewer engagement on Twitch does not quite match their conceptualization. For example, interaction with the live chat does not appear to play a large role in viewer engagement, contrary to the theory and our expectations. Similarly, focused attention on the live stream does not correlate strongly with engagement, despite it being an advanced element of the construct (Oh et al., 2015). Clearly, live stream viewer engagement differs from engagement with ‘regular’ websites and digital systems. However, the more quantitative views on engagement that social media typically adopt also do not seem appropriate. We suspect that the social aspect of watching a Twitch stream is the leading cause for this. While platforms like Facebook or Instagram obviously also provide the user with content from other human beings, the fact that Twitch content is happening in real time gives the experience a lot more depth. By engaging with a live stream, users can help shape the stream itself, in a much more immediate and visible way than leaving a comment on a Facebook post or Instagram video. Users have multiple ways of engaging and interacting with a stream, and they can still be a part of it without being very visible. Furthermore, Twitch channels and communities are known to develop specific (sub-)cultures (Woodcock &

Johnson, 2019; Hamilton et al., 2014), which could further complicate how interaction with them is perceived and experienced.
Watching Twitch streams involves interaction with other human beings (parasocial or otherwise), giving the concept of engagement an additional dimension that is absent when simply interacting with a piece of software.

The ambiguity surrounding the exact definition of viewer engagement on Twitch is also clear when looking at how the term is used in practice. In the field, elements traditionally considered to be part of parasocial interaction are included in the concept of viewer engagement. Twitch (the organization) even recommends that streamers employ typical PSI-inducing behaviors such as directly verbally addressing viewers (Wulf et al., 2021; Horton & Wohl, 1956) in order to stimulate viewer engagement (Twitch.tv, n.d.-c). Evidently, the exact boundaries of what entails viewer engagement on Twitch.tv — and what does not — are unclear in academic literature. Considering how important this concept is generally agreed to be for live streaming as a form of entertainment, more clarity how engagement works on Twitch.tv is sorely needed. Avenues for further research in this direction will be discussed in section 5.3.

5.1.2 Parasocial interaction

In addition to viewer engagement, the phenomenon of parasocial interaction also requires adaptation to better suit the live streaming context. While practical examples of parasocial processes occurring on Twitch typically refer to parasocial *relationships* (Ludwig, 2020; D'Anastasio, 2020), our results indicate that parasocial *interaction* also takes place on the platform. This aligns with the idea posed by Wulf and colleagues (Wulf et al., 2018; Wulf et al., 2021) that parasocial interaction can take place in new media contexts despite these media platforms offering methods for actual interaction. PSI is typically defined as a feeling of interaction in non-interactive media exposures (Horton & Wohl, 1956; Hartmann & Goldhoorn, 2011; Schramm & Hartmann, 2008) — but since it also occurs on Twitch, which is considered to be highly interactive (Hamilton et al., 2014; Johnson & Woodcock, 2019), this conceptualization appears to be outdated. Evidently, parasocial interaction can occur even when actual interaction takes place. This observation yields some interesting follow-up questions, such as what causes PSI to take place when regular interaction is also possible. We suggest that the asymmetry in media formats used to communicate (audiovisual from the streamer to the viewer, textual from the viewer to the streamer) could be an important aspect herein. Similarly, the fact that one broadcaster is simultaneously communicating with many viewers could possibly explain why parasocial effects occur: while the streamer may have the full, undivided attention of a single viewer, this is almost certainly not true the other way around. This observation matches a description of parasocial interaction that Horton and Strauss provide: “In face-to-face situations a relationship is likely to become parasocial when an audience is so large that a speaker cannot address its members individually …” (1957, p.580). Clearly, the notion that ‘real’ interaction and parasocial interaction are mutually exclusive is misguided. Instead, the causes and consequences of parasocial interaction should be reconceptualized with contemporary media formats in mind. Ideas for such research will be discussed in section 5.3.

5.2 Conclusion

In this section, the hypotheses posed in this research will be evaluated in light of the findings from section 5.1. Additionally, we will answer the central research question.

The first hypothesis **(H1)** proposed that viewer engagement would have a positive impact on the emotional closeness the viewer feels toward the streamer. Contrary to prior expectations, this study’s results do not support this theory. As discussed in section 5.1, the definition of viewer engagement on Twitch is unclear, and the conceptualization used in this research likely did not fully cover the construct. This could be the reason why engagement did not impact emotional closeness as predicted.

Our second hypothesis **(H2)** stated that parasocial interaction would have a positive effect on the experienced emotional closeness in viewers. The results of the present study support this hypothesis. Parasocial interaction takes place on Twitch, and as such the definition of the concept should be revised, since parasocial interaction and actual interaction can co-exist based on our results and those of Wulf et al. (2021). Experiencing parasocial interaction has a positive effect on the perceived emotional closeness in Twitch viewers, which is in line with extant theory on parasocial interaction and parasocial relationships (Hartmann & Goldhoorn, 2011; Dibble et al., 2016).

The third hypothesis, proposing that parasocial interaction has a positive effect on the degree of viewer engagement, is also supported. While this is in line with prior expectations, the observation that this hypothesis is supported while **H1** is not is somewhat contradictory. After all, our primary reasoning for **H3** was that interaction is an important element of engagement (see section 2.3), and that experiencing parasocial interaction should thus drive engagement. The data supports this, as expected. Simultaneously, interaction was one of the elements of engagement that was expected to lead to emotional closeness, but that effect was not found. The unclear definition of live stream viewer engagement, and specifically the role that interaction has in it, is likely to be the cause for this discrepancy.

Additionally, our data showed no significant mediation effect of engagement in the relationship between parasocial interaction and emotional closeness. This is due to the insignificant effect that engagement has on closeness: because of this, the effect that PSI has on engagement does not 'reach' closeness, and as such there is no indirect effect of PSI on closeness. Considering the problematic divergent validity between PSI and viewer engagement, as mentioned above, the absence of this mediation effect in our model may not be conclusive evidence that PSI does not affect emotional closeness through viewer engagement. Ideally, this relationship should be re-investigated when newly adapted and proven conceptualizations for PSI and viewer engagement on Twitch have been established.

Finally, the central research question in this study was:
What effect do engagement and parasocial interaction have on the emotional closeness between viewers and broadcasters on Twitch.tv?

Based on an online questionnaire with 269 valid responses, we found that engagement has no significant effect on emotional closeness, while parasocial interaction does have a significant, positive effect. Furthermore, parasocial interaction also has a significant, positive effect on engagement. These effects hold when controlling for participants' age, gender, education level and the language in which they took the questionnaire. However, we must note that our conceptualizations for both viewer engagement and parasocial interaction do not appear to fully cover the meaning of their respective constructs. Thus, our most important finding is that live stream viewer engagement and parasocial interaction should be re-conceptualized and adapted to better match the intricacies of Twitch streams. Suggestions on how future studies can achieve this will be discussed in section 5.3.

5.3 Theoretical implications and future research

The results of this study have implications for academic research. The main point is the need for reconceptualization of both viewer engagement and parasocial interaction to better fit the Twitch context, as we have already discussed in section 5.1. It has become apparent that specialized constructs and measurement tools are needed to accurately research the workings of (Twitch) live streaming. As such, we recommend that future studies focus on developing and adapting live streaming-specific theory before trying to get actionable results from

Twitch-oriented research. We will discuss the important and interesting avenues for future studies below.

Primarily, the conceptualization of viewer engagement within the Twitch context should be fundamentally (re-)examined. We recommend future studies to closely investigate how engagement and parasocial interaction overlap on Twitch, as this is currently rather unclear; elements of both are used somewhat interchangeably in practice. One element that seems especially interesting to investigate is the common phenomenon of ‘lurking’: having the stream open, but not participating in any interactions (Zhou, 2019; Wohn & Freeman, 2020). Lurking as a behavior is not unique to Twitch, and the reasons why people choose to lurk are manifold and complex (Preece et al., 2004). Lurking behavior on Twitch is a rich topic, that offers plenty of interesting sub-questions that could be researched. Some examples:

- In a social, cultural setting like a Twitch livestream, what uses and gratifications do lurkers (not) get?
- Do viewers who are lurking consider themselves to be engaged with the stream?
- Inversely, focused attention is often considered to be an important element of engagement (Oh et al., 2015, Jodén & Strandell, 2021), but our results do not reflect this. Why does focused attention not appear to be part of viewer engagement on Twitch?
- To what extent do (a lack of) focused attention and lurking overlap?

Furthermore, the role that interaction plays in the Twitch viewing experience is currently unclear, while it is one of the key differences between live streaming and regular video content: a live Twitch stream offers real-time interactivity that other media formats cannot match. Yet, interaction does not appear to be a part of viewer engagement based on our results, which is quite surprising. This result could be caused by our usage of measurement items that are not tailored specifically to live streaming content. Thus, investigating the role of interactivity should be a priority when (re)conceptualizing live stream viewer engagement.

Additionally, the proposed reconceptualization of parasocial interaction brings new questions with it. Horton and Strauss (1957) already suspected that the size of a performer's audience could influence whether parasocial interaction occurred. Presumably, once the audience is large enough, the presenter is addressing the audience as a whole rather than interacting with individual audience members. However, how large the audience needs to be to cross into parasocial interaction is still unknown — which could make for an interesting study. We suspect that the limit also changes based on the media used to communicate (face-to-face, live stream with chat, video call, etc.), the nature of what is being presented (for example, a more serious presentation versus a casual livestream), and other factors. The opportunities for research here are plentiful. Among others, experimental research designs that control for the number of viewers could be very interesting, as well as studies that further explore the psychological side of parasocial interaction which has seen relatively little attention (Giles, 2002). Furthermore, studies investigating to what extent the types of communication and interaction affect the experience of parasocial interaction. An example of this could be Twitch's emote-only mode, which restricts the viewers to only type emoticons in the live chat. Uncovering how a restriction like this alters viewers' parasocial experience could be a first step to better understanding PSI as a whole — on Twitch and outside of it. Additionally, investigating whether awareness of parasocial effects (as mentioned in section 4.7) influences their occurrence would be rather interesting and applicable to Twitch.

Finally, research on how emotional closeness in Twitch viewers impacts the effectiveness of influencer marketing practices from the streamers they watch would be greatly beneficial to the interpretation and value of our results. Such studies would also be highly valuable to the organizations and brands already engaging in influencer marketing on Twitch (and similar live streaming platforms like YouTube Gaming). The role of source credibility in this process should ideally also be included, since this has been shown to affect the effectiveness of influencer marketing on other (non-live) platforms (Lou & Yuan, 2019; Xiao et al., 2018).

Miscellaneous observations and acknowledgements

Our use of the EPSI scale by Hartmann and Goldhoorn (2011) warrants some comments. Even though Hartmann and Goldhoorn developed their scale to measure PSI as a purely illusionary phenomenon (with no possibility of actual interaction), which is not a conceptualization we agree with, we note that the measurement tool worked very well for us. Even though discriminant validity between PSI and viewer engagement was somewhat problematic in this research, the EPSI items remained strongly unidimensional and consistent throughout the data analysis and reduction process. This puts us in a similar position to Wulf et al. (2021), who also achieved good results when using the EPSI scale for researching Twitch.tv — despite advocating for a different conceptualization of the PSI construct.

Furthermore, our research contributes to the small but growing pool of academic work on Twitch.tv. Specifically, it explores some of the underlying processes that drive influencer marketing on the platform. There is a need for more research on influencer marketing in general (Taylor, 2020), and such research that is specific to Twitch is still rather scarce (Woodcock & Johnson, 2019).

As mentioned before, we believe that much more research on Twitch is needed to fully understand how live streaming content is different from other social media, conventional video content and other forms of entertainment. Existing concepts must be re-evaluated to adapt them to the live streaming paradigm.

5.4 Practical implications

The outcomes of the present research also provide takeaways for organizations operating on, or with, Twitch.tv as a platform. For businesses that wish to partner with (additional) Twitch streamers to promote their brand and/or products, the finding that viewer engagement does not appear to predict emotional closeness is noteworthy. Closeness has been shown to benefit the effectiveness of influencer marketing, as it impacts purchase intention and brand attitudes (Hoos, 2019; Kim & Kim, 2021). While viewer engagement is considered to be very important on Twitch (Twitch.tv, n.d.-b; Sjöblom et al., 2019), and indeed in digital marketing as a whole, our findings suggest that it does not drive emotional closeness — and thus not purchase intention through closeness. However, we must keep in mind that the exact definition of viewer engagement on Twitch is up for debate and is arguably rather unknown at the moment. Marketing practice seems to be ahead of the academic literature in this aspect. Since the theoretical understanding of how engagement on Twitch works is lacking, we would advise organizations that intend to use Twitch as a marketing channel to ensure that they understand Twitch and its culture, as creating a Twitch marketing strategy based on existing knowledge is likely to create a similar mismatch as was present in our study. Our findings suggest that viewer engagement do not drive emotional closeness between viewers and streamers, and would therefore presumably not contribute to purchase intention, either. That observation is certainly not enough to discard viewer engagement as an important factor in Twitch marketing, since engagement with partnered streamers would likely contribute to brand recognition and recall simply by virtue of exposure. But the marketing effects of viewer engagement on Twitch remain relatively unknown, and thus some caution when considering Twitch as a marketing channel is justified.

Additionally, parasocial interaction's role as a predictor for emotional closeness also yields recommendations for marketeers seeking Twitch streamers to partner with. We would recommend such organizations to look for streamers who pay a lot of attention to their live chat, individually address the audience and look into the camera, since these behaviors have been shown to induce feelings of parasocial interaction (Hartmann & Goldhoorn, 2011; Dibble et al., 2016; Wulf et al., 2021). Selecting streamers based on how emotionally close their audience feels to them would also be preferable, but since this would likely be difficult to measure accurately without conducting field research, this seems less practical.

This recommendation can also be applied to Twitch streamers who wish to make themselves more effective as a social media influencer. Our results show that a strong experience of parasocial interaction serves as a predictor for higher emotional closeness in viewers. Since emotional closeness is positively associated with purchase intention and improved brand attitudes (Kim & Kim, 2021; Hoos, 2019; Sashi, 2012), streamers are recommended to induce parasocial interaction in their viewers. They can do this by looking into their camera, individually addressing viewers and paying attention to their live chat (Dibble et al., 2016; Hartmann & Goldhoorn, 2016; Wulf et al., 2021). Generating a higher feeling of emotional closeness in viewers is expected to lead to increased marketing effectiveness, increasing a streamer's chances of being recruited or retained as marketing partner.

5.5 Limitations

The results of this research should be interpreted with its limitations in mind. Primarily, the construct validity of two of the main variables (engagement and emotional closeness) was rather suboptimal, with multiple questionnaire items that did not appear to measure what they were intended to measure. A few items even showed significant loading on a different construct. While we believe that our final model is a good representation of the different latent variables, our factor analysis showed that discriminant validity was problematic. Even though our statistical analysis showed no indication of significant collinearity issues, the conclusions from our research should be treated with some caution.

Next, one key assumption of our research is that perceived emotional closeness in Twitch viewers is desirable for the effectiveness of influencer marketing. This expectation is based on existing literature (Kim & Kim, 2021; Hoos, 2019; Sashi, 2012). However, given the difficulties with construct validity we experienced, it is not certain that this assumption will also hold true for Twitch. Our conceptualizations of engagement and emotional closeness were also derived from existing, relatively thoroughly researched fields of study, yet not all dimensions of these conceptualizations appeared to accurately measure their construct based on our results. This could also be the case for the relationship between emotional closeness and marketing outcomes, severely limiting the practical usefulness of our results.

Additionally, our sample of Twitch viewers was largely Dutch. While representative for our target audience, this limits the generalizability of our findings. Since the focus of this research includes social factors of watching live streams, it appears likely that cultural differences could influence viewers' attitudes and experiences. Since our data showed that Dutch-language participants recorded higher levels of viewer engagement on average, there is (some) reason to believe that cultural or linguistical factors influence are at play.

Our questionnaire also showed very significant non-response: of 455 non-filtered respondents, only 273 (60%) completed the full survey. This introduces the risk of non-response bias (Berg, 2005, in Kempf-Leonard, 2005), and can be indicative of a problem with the questionnaire. While our data analysis showed that the viewing time did not significantly differ between participants who did or did not fully complete the questionnaire, it is very possible that the incomplete respondents are not random. Sadly, since our demographic questions were at the end of the questionnaire, our ability to analyze these differences is severely limited. In any case, this risk of non-response bias means that our sample is possibly unrepresentative of the population, limiting the impact and generalizability of our findings.

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Appendix A: Description of Twitch.tv and streamers

Twitch.tv

Twitch.tv, or simply 'Twitch', is a live video streaming service owned by Amazon.com, Inc. The website was founded in 2011 by live streaming platform Justin.tv, as a video game-focused sister site (Wilhelm, 2011). The broadcasting of video game gameplay, by either individuals, groups or organizations, is the primary content found on the website. After being separated from the more general-purpose Justin.tv platform, Twitch.tv grew rapidly (Rao, 2011). In 2014, the website was bought by Amazon.com, Inc for the sum of 970 million US dollars (Gittleson, 2014). Since then, the platform has expanded its focus to include non-gaming related content as well (Berrones, 2016; Khalid, 2019), though gaming and the culture surrounding it remains the primary focus. Per February 2021, the platform attracts over 2.9 million concurrent viewers on average, with an average of about 120,000 different channels (or 'streamers') broadcasting at any given time (TwitchTracker, 2021b). The site was within the top 30 most visited websites in the world as of March 2021 (SimilarWeb, 2021) and controls the vast majority of the live streaming market (Yosilewitz, 2019)

An average broadcast on Twitch.tv contains video and audio footage from a video game that's being played, a webcam showing the face and direct surroundings of the broadcaster, and often some miscellaneous features like information about recent donations or links to other social media channels (Woodcock & Johnson, 2019). Alongside each broadcast is a live text chat, in which viewers can send messages to the broadcaster or to other viewers (the whole chat is public and can be seen by anyone). This live chat is the primary method for interaction on Twitch. The platform includes a number of other options for interaction, though these are more focused on interacting with (and supporting) the broadcaster specifically. The most prominent examples are 'cheering' (small donations through the chat using in-platform currency) and channel subscriptions (a monthly fee in exchange for certain stream-related benefits) (Johnson & Woodcock, 2019). Additionally, broadcasters and/or their supporting crew can set up polls or predictions with which viewers can interact, amongst other features.

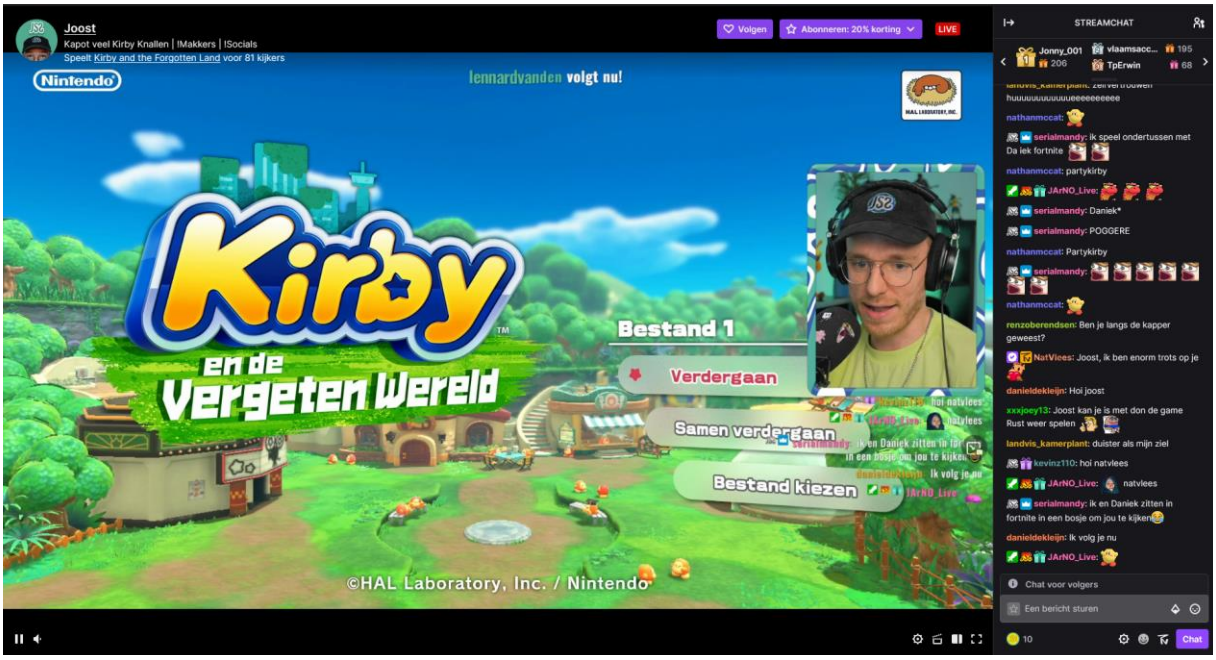


Figure 1: Example of a stream on Twitch.tv. The video feed takes up the majority of the screen real estate, and is accompanied by the live chat on the right. Screenshot captured from *www.twitch.tv/joost*.

Streamers

As the term is understood within the context of Twitch and in wider internet culture, a 'streamer' is someone who broadcasts themselves and/or their gameplay live to an audience (Urban Dictionary, n.d.). Though Twitch enables practically anyone to stream, giving the platform a relatively large focus on amateur content production (Johnson & Woodcock, 2019), this thesis will look at (semi-) professional streamers: those who stream on a regular schedule and use Twitch to generate (part of) their income. Streamers of this caliber are typically part of Twitch's Partner or Affiliate programs (Twitch.tv, n.d.-d) and attract a significant number of viewers with each broadcast: an average of at least 3 concurrent viewers is required to become an Affiliate, while a streamer needs 75 viewers on average (among other criteria) to qualify for the Partner status (Twitch.tv, n.d.-a).

Appendix B: Adaptations to Engagement measurement items

The conceptualization of user engagement used in this research is based on the model developed by Oh et al. (2015). However, since the original measurement items were made to assess user engagement with a website, several adaptations were needed to make the indicators properly applicable to Twitch.tv. Table 1 shows the original indicators and the adapted versions.

Where possible, a direct conversion was used, such as the items pertaining to focused attention. However, in other cases a substitute for the phenomenon that an indicator targeted had to be found. An example of this is the ‘ease of browsing’ within the dimension of interface assessment. Since all Twitch streams are hosted on the same website and have the exact same interface, measuring the ease of using the stream page is not interesting. However, the layout of the video feed itself can vary significantly between different streamers: the position, size, shape and presence of different visual elements is completely variable. Since understanding these elements may contribute to the enjoyment and understanding of the stream, they were chosen to substitute the user interface-focused items from Oh and colleagues.

Not all of our original indicators were direct adaptations of existing indicators by Oh et al. (2015). Some were added based on other research regarding user engagement, and the researcher's personal knowledge of Twitch.tv and its user experience.

Dimension	Original indicator (Oh et al., 2015)	Adaptation
Interface assessment		[Streamer]’s stream looks good.
	This website is … “difficult to browse" to “easy to browse” (semantic differential scale).	I can clearly distinguish the different visual elements that are visible in [Streamer]'s stream.
		I understand what the different visual elements in [Streamer]'s stream mean.
	My interaction with the website was intuitive.	I understand what’s happening in [Streamer]'s stream.
Absorption	While browsing the website content, I was immersed in what I was doing.	Watching [Streamer]'s stream is immersive.
	While browsing the website content, my attention did not get diverted.	While watching [Streamer]’s stream, I don't get distracted by other things.
		While watching [Streamer]’s stream, I’m doing other things or am not paying attention. [reverse-scored]
Digital outreach		I actively participate in the live chat in [Streamer]'s stream.
	I would visit this website again in the future.	I plan to watch [Streamer]'s stream again in the future.

Table 1: Comparison of original indicators by Oh et al. (2015) and the adaptations made for use in this research.

Appendix C: Final questionnaire

Below, the full English version of the questionnaire used for this research can be found. Note that all places where [Streamer] is displayed, the answer to the question *Please enter the (user)name of one Twitch streamer whose stream you have recently watched* would be shown when completing the survey.

Additionally, the survey allows respondents to complete the main questions again for a second streamer. These questions are not displayed here for the sake of space, and the answers to these secondary and tertiary questions were not used in the dataset because they could skew the results.

Start of Block: Inleiding

A Dutch version of this survey can be accessed using the menu above.

Welcome to this survey, and thank you in advance for participating! My name is Jordi Agricola and I am in the process of finishing my Master's degree in Marketing at Radboud University Nijmegen (the Netherlands). For my thesis I am researching how people watch livestreams on Twitch.tv, and what their experience is like. This questionnaire is done in collaboration with Cooler Master Europe.

In this survey, several aspects of the Twitch viewing experience are investigated. There are no 'right' or 'wrong' answers; please indicate what <u>you</u> think and/or experience.

Participation in this survey is voluntary and you may stop at any time. Your answers are anonymous and will solely be used for the purpose of this research. Your answers will only be available to the researcher and his supervisor(s), and will not be publicly shared in any way.

Completion of the survey takes about 5 minutes.

By agreeing to these terms, you declare that your answers may be used only for research purposes.

Should you have any questions or comments regarding this survey or research, then you can direct these to Jordi Agricola (jordi.agricola@ru.nl).

P.S.: This survey contains a completion code for SurveySwap.io.

○ I agree with the terms (start survey) (1)

○ I do NOT agree with the terms (end survey) (2)

End of Block: Inleiding

Start of Block: 1. Filtering Twitch-kijkers

Are you familiar with the Twitch.tv live streaming service?

- Yes (1)
- No (2)

Have you watched a Twitch stream, for 10 minutes or more, in the past month?

- Yes (1)
- No (2)

End of Block: 1. Filtering Twitch-kijkers

Start of Block: 2. Streamer

*

Please enter the (user)name of one Twitch streamer whose stream you have recently watched.

____

End of Block: 2. Streamer

Start of Block: 3. Intensiteit

Over the past month, (approximately) how much time did you spend per week watching [Streamer]?

- 0 to 15 minutes (1)
- 15 minutes to 1 hour (2)
- 1 to 3 hours (3)
- 3 to 6 hours (4)
- 6 to 9 hours (5)
- 9 to 12 hours (6)
- more than 12 hours (7)

End of Block: 3. Intensiteit

Start of Block: 4. Engagement

Please indicate to what extent you agree with the following statements about [Streamer]'s streams.

	Totally disagree (1)	Disagree (2)	Slightly disagree (3)	Do not agree, do not disagree (4)	Somewhat agree (5)	Agree (6)	Totally agree (7)
[Streamer]'s stream looks good. (1)	◯	◯	◯	◯	◯	◯	◯
I can clearly distinguish the different visual elements that are visible in [Streamer]'s stream. *Think of elements such as a webcam, counters/bars for e.g. donations or subscribers, a game being played, sponsor logos, etc.* (2)	◯	◯	◯	◯	◯	◯	◯
I understand what the different visual elements in [Streamer]'s stream mean. *Again, think of elements such as a webcam, counters/bars for e.g. donations or subscribers, a game being played, sponsor logos, etc.* (3)	◯	◯	◯	◯	◯	◯	◯

I understand what's happening in [Streamer]'s stream. (4)	○	○	○	○	○	○	○
Watching [Streamer]'s stream is immersive. (5)	○	○	○	○	○	○	○
While watching [Streamer]'s stream, I don't get distracted by other things. (6)	○	○	○	○	○	○	○
While watching [Streamer]'s stream, I'm doing other things or am not paying attention. (7)	○	○	○	○	○	○	○
I actively participate in the live chat in [Streamer]'s stream. (8)	○	○	○	○	○	○	○
I plan to watch [Streamer]'s stream again in the future. (9)	○	○	○	○	○	○	○

End of Block: 4. Engagement

Start of Block: 5. Parasocial Interaction

Please indicate to what extent you agree with the following statements about [Streamer]'s stream(s).

While watching [Streamer]'s stream, I get the feeling that [Streamer]…

	Totally disagree (1)	Disagree (2)	Slightly disagree (3)	Do not agree, do not disagree (4)	Somewhat agree (5)	Agree (6)	Totally agree (7)
... is aware of me. (1)	○	○	○	○	○	○	○
… knows I am there. (2)	○	○	○	○	○	○	○
… knows that I am aware of him/her. (3)	○	○	○	○	○	○	○
… knows that I am paying attention to him/her. (4)	○	○	○	○	○	○	○
… knows that I am reacting to him/her. (5)	○	○	○	○	○	○	○
… reacts to what I say or do. (6)	○	○	○	○	○	○	○

End of Block: 5. Parasocial Interaction

Start of Block: 6. Emotional Closeness

Please indicate to what extent you agree with the following statements about [Streamer].

	Totally disagree (1)	Disagree (2)	Slightly disagree (3)	Do not agree, do not disagree (4)	Somewhat agree (5)	Agree (6)	Totally agree (7)
I feel [Streamer] is honest. (1)	◯	◯	◯	◯	◯	◯	◯
I feel like I can trust [Streamer]. (2)	◯	◯	◯	◯	◯	◯	◯
[Streamer] and I share a mutual trust. (3)	◯	◯	◯	◯	◯	◯	◯
I enjoy watching [Streamer]'s stream. (4)	◯	◯	◯	◯	◯	◯	◯
I enjoy my connection with [Streamer]. (5)	◯	◯	◯	◯	◯	◯	◯
I have the feeling that [Streamer] and I enjoy each other's presence. (6)	◯	◯	◯	◯	◯	◯	◯
When I have free time, I choose to spend it watching [Streamer]'s stream. (7)	◯	◯	◯	◯	◯	◯	◯
I want to spend time watching [Streamer]'s stream. (8)	◯	◯	◯	◯	◯	◯	◯

I have a close relationship with [Streamer]. (9)	○	○	○	○	○	○	○
Me and [Streamer] have a strong connection. (10)	○	○	○	○	○	○	○
[Streamer] influences how I spend my free time. (11)	○	○	○	○	○	○	○
I care about [Streamer]. (12)	○	○	○	○	○	○	○
I feel that [Streamer] and I care about each other's feelings. (13)	○	○	○	○	○	○	○

Please indicate to what extent you agree with this last statement.

	Totally disagree (1)	Disagree (2)	Slightly disagree (3)	Don't disagree, don't agree (4)	Somewhat agree (5)	Agree (6)	Totally agree (7)
I feel a stronger bond with a Twitch streamer than with content creators/influencers on other social media. (1)	○	○	○	○	○	○	○

End of Block: 6. Emotional Closeness

Start of Block: 7. Tweede streamer vragen

Besides [Streamer], are there any other streamers you watch?

◯ Yes (1)

◯ No (2)

Display This Question:

If Besides [Streamer], are there any other streamers you watch? = Yes

Would you also like to answer questions about a second streamer?
This is not mandatory, but it would be very helpful!

◯ Yes, I want to complete the survey for a second streamer (1)

◯ No, I would like to proceed to the end of the survey (2)

End of Block: 7. Tweede streamer vragen

Start of Block: 8. Demographics

The survey is almost done – just a few more questions about yourself.

---

*

What is your age (in years)?

____

What is your gender?

◯ Female (1)

◯ Male (2)

◯ Other (3)

◯ I'd rather not say (4)

What the highest level of education you follow(ed)?

◯ High school / GSCE / GCE (1)

◯ Vocational training (2)

◯ Associate's Degree / BTEC Level 3 (3)

◯ HND / DipHE (4)

◯ Bachelor's Degree (6)

◯ Master's Degree (7)

◯ Doctorate / PhD (8)

◯ Other (please specify): (11) ____

In which country do you live?

◯ The Netherlands (1)

◯ Belgium (2)

◯ United Kingdom (3)

◯ Germany (4)

◯ United States (5)

◯ Other (please specify): (6) ____

End of Block: 8. Demographics

Start of Block: 88. Final Goodbye

Thank you for your participation! Your answers have been saved.

If you have any questions or comments about the survey, you can always send **them to**

jordi.agricola@ru.nl. You can also post comments below.

The SurveySwap code can be found on the next page.

____

____

____

____

____

End of Block: 88. Final Goodbye

Appendix D: Variable distribution and transformations

Statistics

		SCORE_ENG	SCORE_PSI	SCORE_CLO
N	Valid	269	269	269
	Missing	0	0	0
Mean		6,0738	3,9938	3,5489
Skewness		-2,408	-,128	,396
Std. Error of Skewness		,149	,149	,149
Kurtosis		7,790	-,990	-,364
Std. Error of Kurtosis		,296	,296	,296

Figure 1: Skewness, kurtosis, and their standard errors for the summated scales of Engagement, PSI and Closeness.

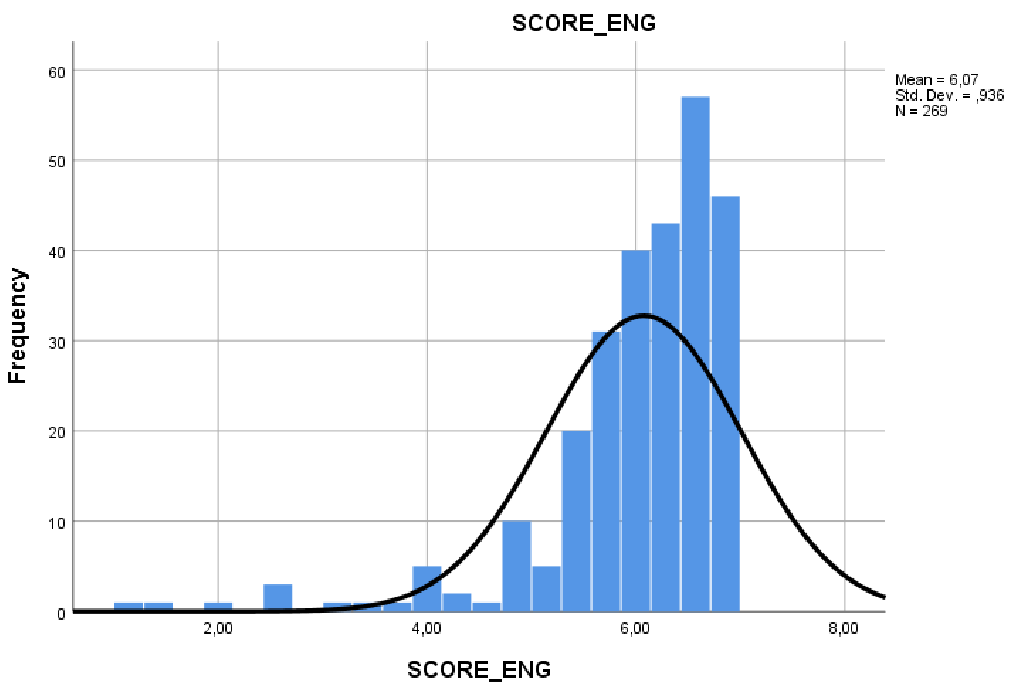


Figure 2: Histogram for Engagement scores with normal curve overlay.

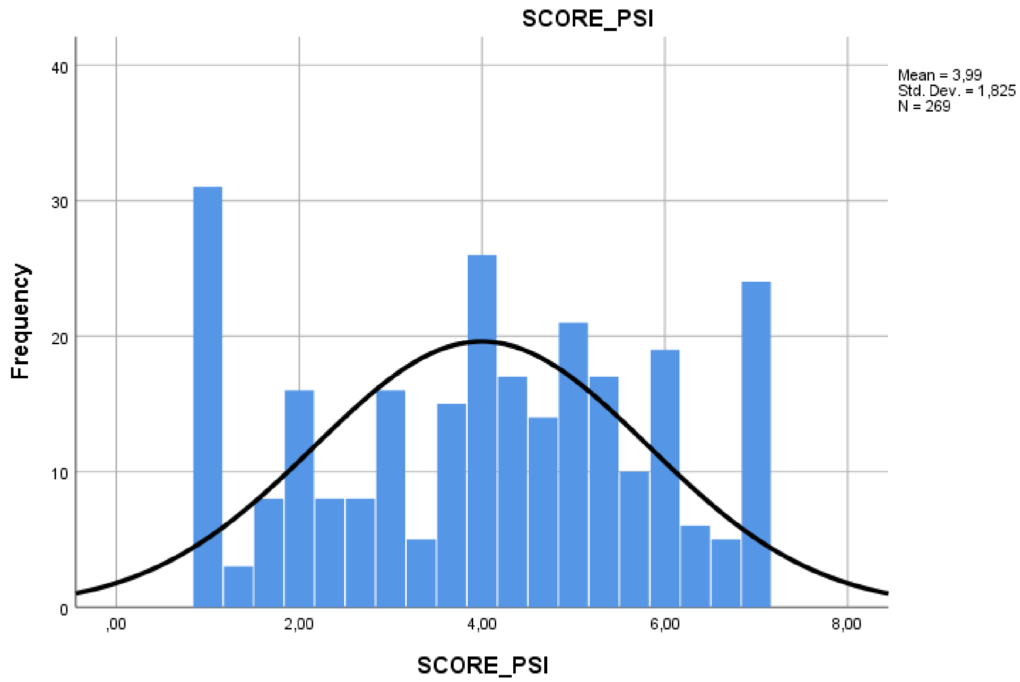


Figure 3: Histogram for PSI scores with normal curve overlay.

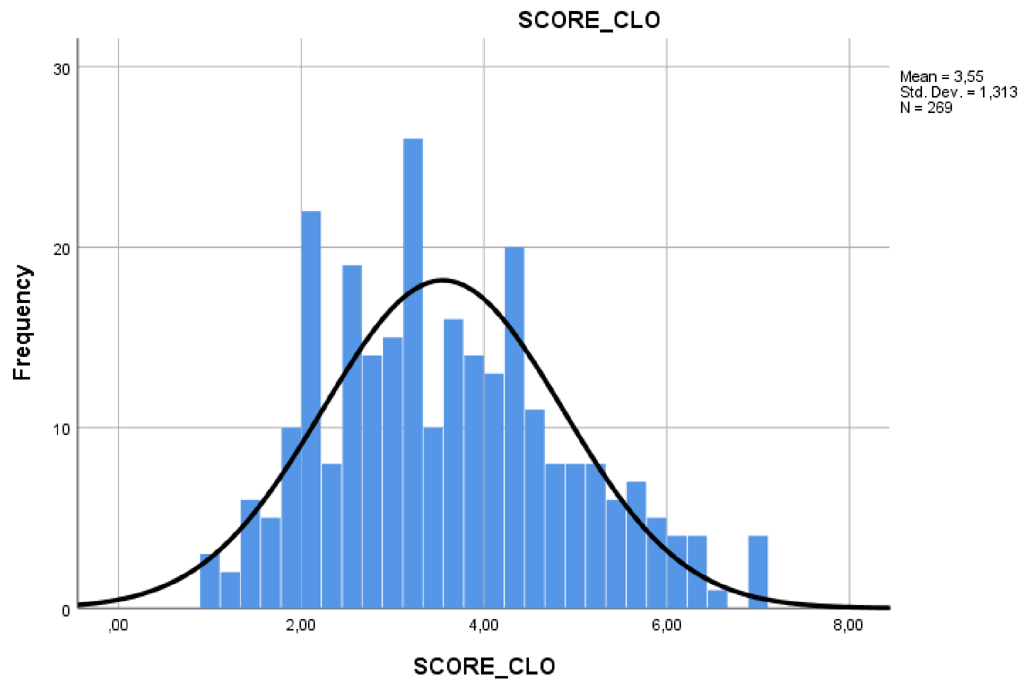


Figure 4: Histogram for Closeness scores with normal curve overlay.

Statistics

		SCORE_ENG	ENG_SQRT	ENG_SQUARE	ENG_LN	ENG_INV
N	Valid	269	269	269	269	269
	Missing	0	0	0	0	0
Mean		6,0738	2,4547	37,7640	1,7855	,1736
Skewness		-2,408	-3,176	-1,445	-4,244	7,234
Std. Error of Skewness		,149	,149	,149	,149	,149
Kurtosis		7,790	13,565	2,581	23,747	62,644
Std. Error of Kurtosis		,296	,296	,296	,296	,296

Figure 5: Transformations of Engagement score.

Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	,687[a]	,472	,468	,95810	,472	118,747	2	266	,000

a. Predictors: (Constant), ENG_SQUARE, SCORE_PSI

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	218,009	2	109,005	118,747	,000[b]
	Residual	244,177	266	,918		
	Total	462,186	268			

a. Dependent Variable: SCORE_CLO

b. Predictors: (Constant), ENG_SQUARE, SCORE_PSI

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	1,322	,252		5,252	,000
	SCORE_PSI	,482	,033	,670	14,543	,000
	ENG_SQUARE	,008	,006	,057	1,243	,215

a. Dependent Variable: SCORE_CLO

Figure 6: Multiple regression results with squared Engagement score.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,687[a]	,472	,468	,95768	,472	118,968	2	266	,000

a. Predictors: (Constant), SCORE_PSI, SCORE_ENG

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	218,223	2	109,112	118,968	,000[b]
	Residual	243,962	266	,917		
	Total	462,186	268			

a. Dependent Variable: SCORE_CLO

b. Predictors: (Constant), SCORE_PSI, SCORE_ENG

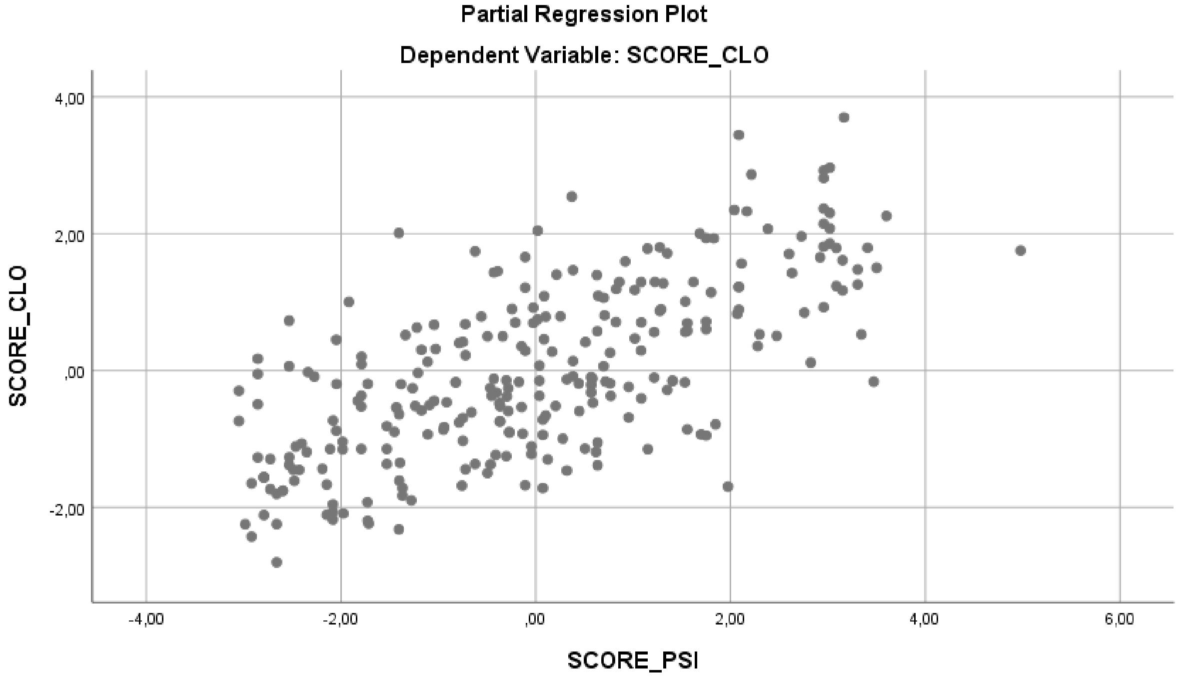
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,101	,386		2,852	,005
	SCORE_ENG	,086	,064	,061	1,335	,183
	SCORE_PSI	,482	,033	,670	14,619	,000

a. Dependent Variable: SCORE_CLO

Figure 7: Multiple regression results with untransformed variables (base model).

Appendix E: Assumptions of multiple regression



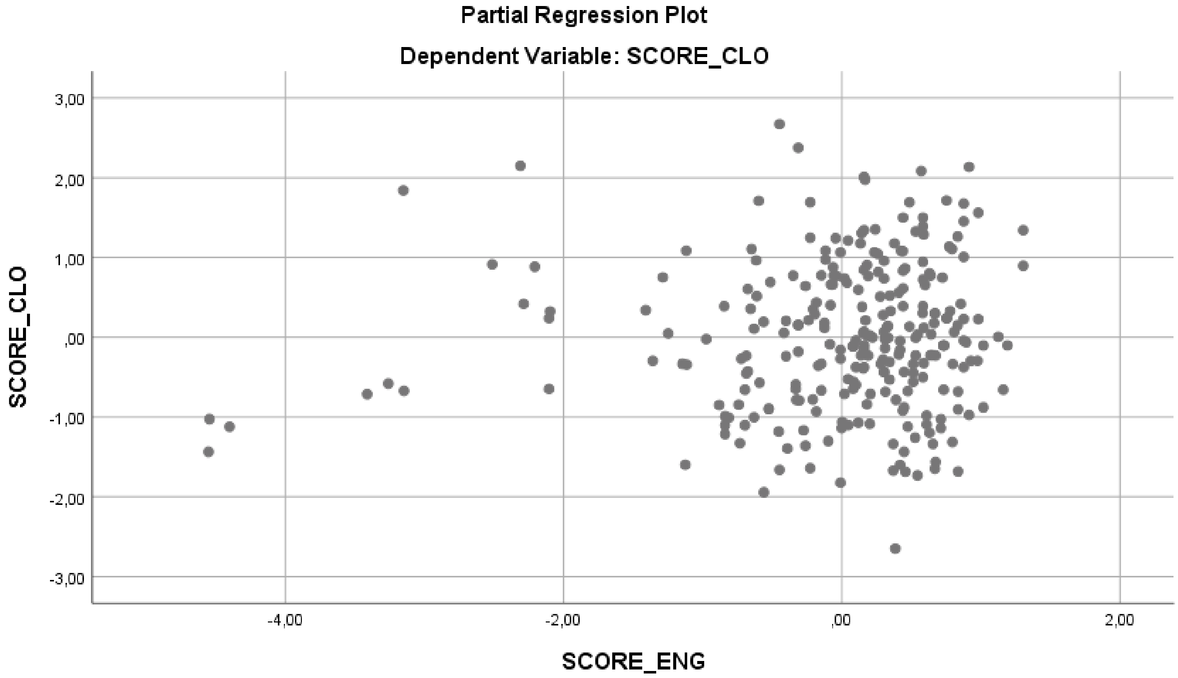


Figure 1: Partial regression plots for PSI and Engagement.

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1,605	,106		15,128	,000
	SCORE_ENG	,033	,017	,088	1,939	,054
	PSI_C	,106	,022	,548	4,769	,000
	PSI_C2	,014	,005	,136	3,070	,002
	PSI_C3	,004	,003	,142	1,251	,212

a. Dependent Variable: CLO_SQRT

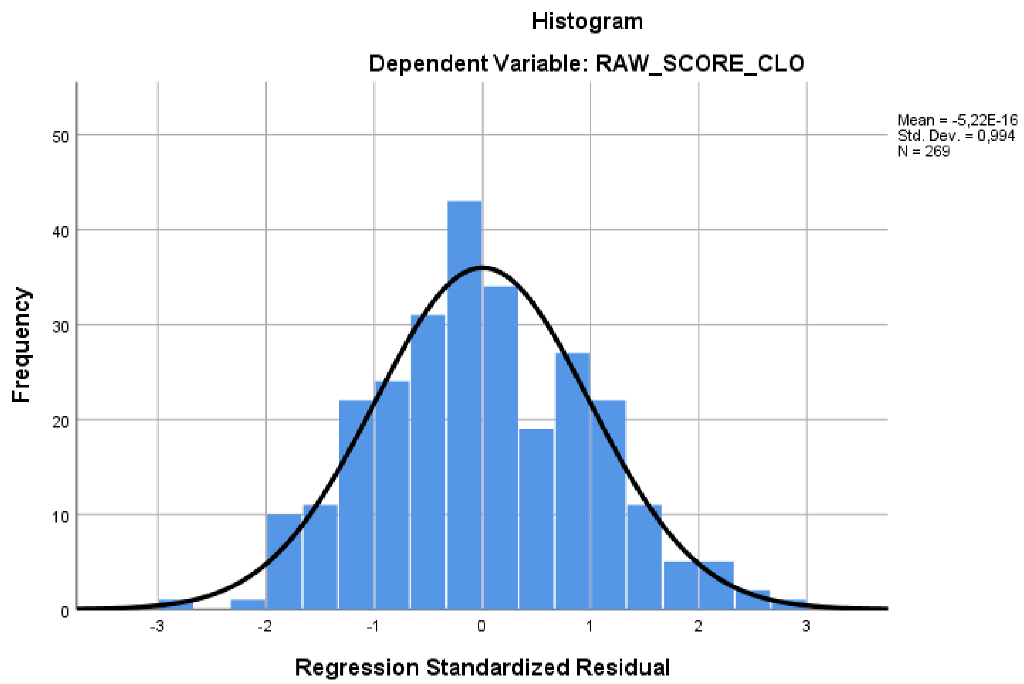
Figure 2: Results of multiple regression with polynomials of PSI.

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	VIF
1	(Constant)	,772	,382		2,022	,044		
	SCORE_ENG	,089	,062	,063	1,426	,155	,944	1,059
	SCORE_PSI	,499	,032	,693	15,498	,000	,931	1,075
	PSI_C2	,074	,017	,187	4,291	,000	,984	1,017

a. Dependent Variable: RAW_SCORE_CLO

Figure 3: Regression results including tolerance and VIF values.



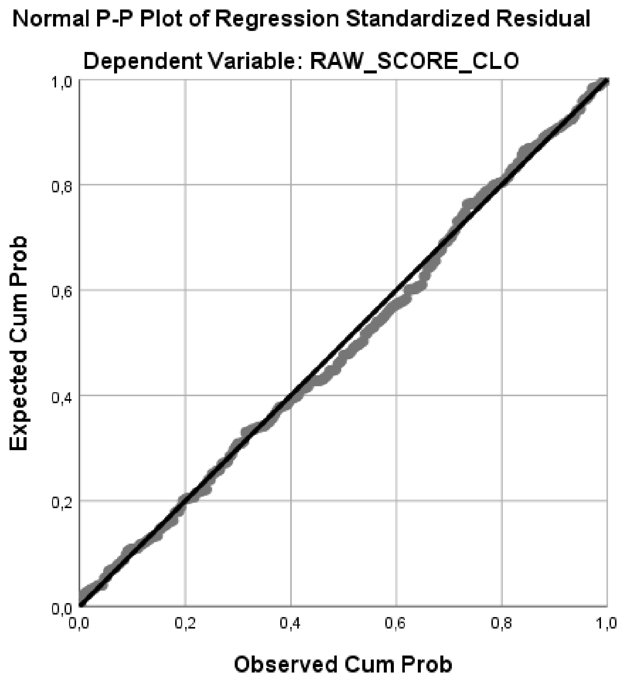


Figure 4: Plots of standardized regression residuals.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	,712[a]	,506	,501	,92779	,506	90,643	3	265	,000	1,967

a. Predictors: (Constant), PSI_C2, SCORE_ENG, SCORE_PSI

b. Dependent Variable: RAW_SCORE_CLO

Figure 5: Summary of the regression model, including the Durbin-Watson statistic.

Appendix F: SPSS outputs for multiple regression models 1a and 1b

Note: Model 1a is displayed as hierarchical regression step 1, with model 1b being represented as step 2 in the SPSS outputs.

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	D_ENGLISH, EDU_LOW, Gender: Female, EDU_MID, What is your age (in years)?[b]	.	Enter
2	SCORE_PSI, PSI_C2, SCORE_ENG[b]	.	Enter

a. Dependent Variable: SCORE_CLO

b. All requested variables entered.

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	,140[a]	,020	,001	1,31015	,020	1,038	5	258	,396	
2	,717[b]	,514	,499	,92789	,494	86,454	3	255	,000	2,025

a. Predictors: (Constant), D_ENGLISH, EDU_LOW, Gender: Female, EDU_MID, What is your age (in years)?

b. Predictors: (Constant), D_ENGLISH, EDU_LOW, Gender: Female, EDU_MID, What is your age (in years)?, SCORE_PSI, PSI_C2, SCORE_ENG

c. Dependent Variable: SCORE_CLO

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8,908	5	1,782	1,038	,396[b]
	Residual	442,858	258	1,717		
	Total	451,766	263			
2	Regression	232,215	8	29,027	33,714	,000[c]
	Residual	219,551	255	,861		
	Total	451,766	263			

a. Dependent Variable: SCORE_CLO

b. Predictors: (Constant), D_ENGLISH, EDU_LOW, Gender: Female, EDU_MID, What is your age (in years)?

c. Predictors: (Constant), D_ENGLISH, EDU_LOW, Gender: Female, EDU_MID, What is your age (in years)?, SCORE_PSI, PSI_C2, SCORE_ENG

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3,688	,341		10,808	,000		
	What is your age (in years)?	-,009	,009	-,064	-,943	,347	,832	1,202
	Gender: Female	,026	,266	,006	,098	,922	,884	1,132
	EDU_MID	,358	,229	,102	1,566	,119	,896	1,117
	EDU_LOW	,153	,229	,043	,670	,504	,929	1,076
	D_ENGLISH	,156	,190	,058	,821	,412	,761	1,315
2	(Constant)	,959	,494		1,942	,053		
	What is your age (in years)?	-,009	,006	-,067	-1,401	,162	,827	1,209
	Gender: Female	-,002	,189	,000	-,010	,992	,883	1,133
	EDU_MID	-,003	,164	-,001	-,019	,985	,877	1,140
	EDU_LOW	,145	,163	,041	,889	,375	,912	1,096
	D_ENGLISH	,125	,136	,046	,916	,361	,740	1,350
	SCORE_ENG	,096	,068	,064	1,400	,163	,919	1,088
	SCORE_PSI	,494	,033	,690	15,197	,000	,923	1,083
	PSI_C2	,076	,017	,192	4,317	,000	,966	1,036

a. Dependent Variable: SCORE_CLO

Appendix G: SPSS outputs for regression model 2

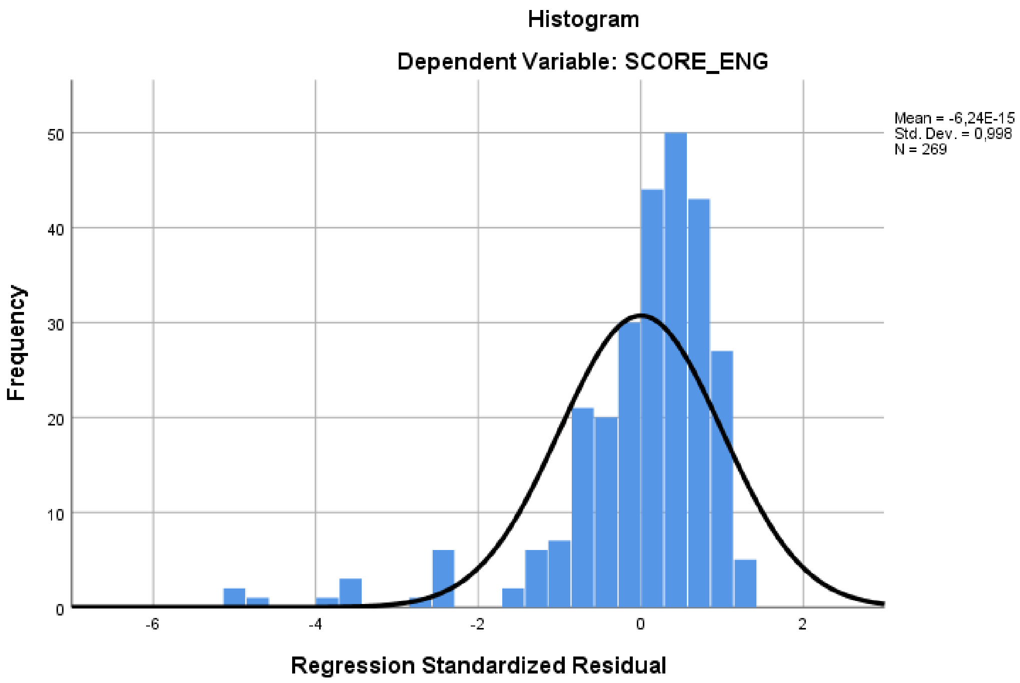


Figure 1: Histogram of standardized regression residuals.

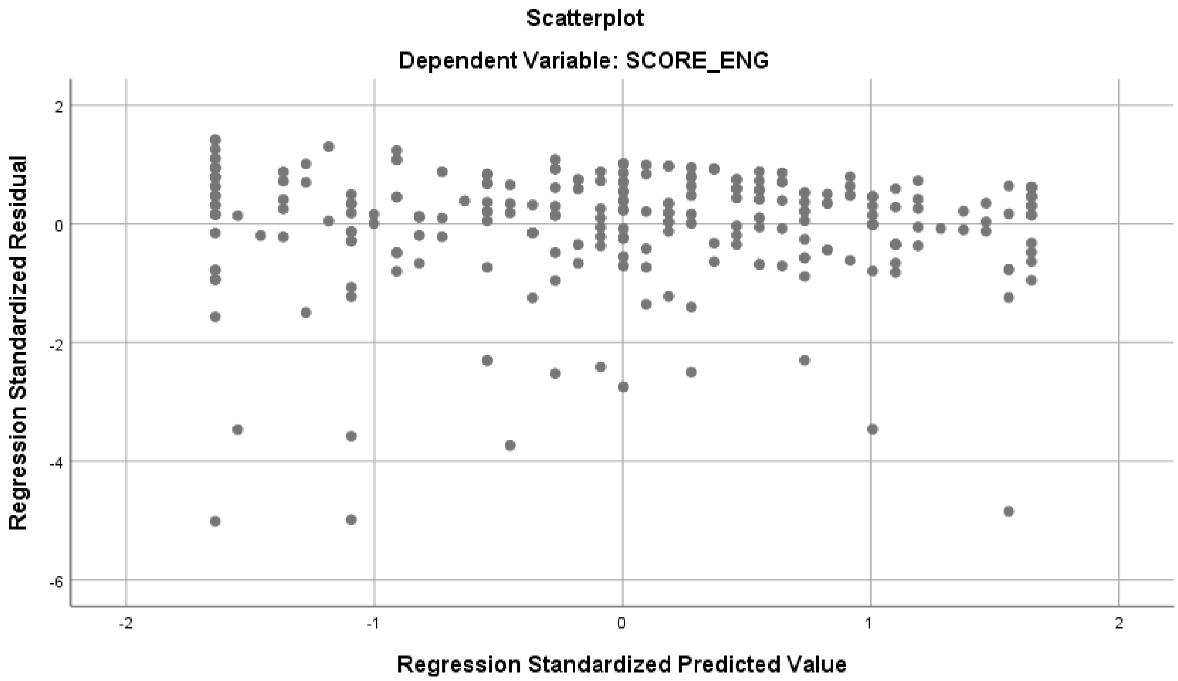


Figure 2: Scatterplot of regression residuals.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	,236[a]	,056	,052	,91123	,056	15,726	1	267	,000	1,805

a. Predictors: (Constant), SCORE_PSI

b. Dependent Variable: SCORE_ENG

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13,058	1	13,058	15,726	,000[b]
	Residual	221,701	267	,830		
	Total	234,759	268			

a. Dependent Variable: SCORE_ENG

b. Predictors: (Constant), SCORE_PSI

Bootstrap for Coefficients

Model		B	Bootstrap[a]				
			Bias	Std. Error	Sig. (2-tailed)	BCa 95% Confidence Interval	
						Lower	Upper
1	(Constant)	5,591	,000	,165	,000	5,237	5,906
	SCORE_PSI	,121	,000	,035	,001	,060	,185

a. Unless otherwise noted, bootstrap results are based on 2000 bootstrap samples

Figure 3: Regression results, based on 2000 bias-corrected accelerated bootstrap samples.

Appendix H: PROCESS output for regression model 3

```
Run MATRIX procedure:

*************** PROCESS Procedure for SPSS Version 3.4.1 ***************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2018). www.guilford.com/p/hayes3

**************************************************************************
Model  : 4
    Y  : SCORE_CLO
    X  : SCORE_PS
    M  : SCORE_EN

Sample
Size:  269

**************************************************************************
OUTCOME VARIABLE:
 SCORE_EN

Model Summary
          R       R-sq        MSE          F        df1        df2
p
      ,2358      ,0556      ,8303    15,7256     1,0000   267,0000
,0001

Model
              coeff         se          t          p       LLCI       ULCI
constant     5,5907      ,1339    41,7491      ,0000     5,3270     5,8543
SCORE_PS      ,1210      ,0305     3,9656      ,0001      ,0609      ,1810

Standardized coefficients
              coeff
SCORE_PS      ,2358

**************************************************************************
OUTCOME VARIABLE:
 SCORE_CLO

Model Summary
          R       R-sq        MSE          F        df1        df2
p
      ,6871      ,4722      ,9172   118,9679     2,0000   266,0000
,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     1,1012      ,3861     2,8519      ,0047      ,3410     1,8615
SCORE_PS      ,4823      ,0330    14,6191      ,0000      ,4174      ,5473
SCORE_EN      ,0858      ,0643     1,3346      ,1832     -,0408      ,2125

Standardized coefficients
              coeff
SCORE_PS      ,6701
SCORE_EN      ,0612

************************** TOTAL EFFECT MODEL ****************************
OUTCOME VARIABLE:
```

```
 SCORE_CLO

Model Summary
          R       R-sq        MSE          F        df1        df2
p
      ,6846      ,4686      ,9198   235,4659     1,0000   267,0000
,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant     1,5811      ,1409    11,2182      ,0000     1,3036     1,8586
SCORE_PS      ,4927      ,0321    15,3449      ,0000      ,4295      ,5559

Standardized coefficients
              coeff
SCORE_PS      ,6846

************** TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y **************

Total effect of X on Y
     Effect         se          t          p       LLCI       ULCI
c_ps       c_cs
      ,4927      ,0321    15,3449      ,0000      ,4295      ,5559
,3752      ,6846

Direct effect of X on Y
     Effect         se          t          p       LLCI       ULCI
c'_ps      c'_cs
      ,4823      ,0330    14,6191      ,0000      ,4174      ,5473
,3673      ,6701

Indirect effect(s) of X on Y:
             Effect     BootSE   BootLLCI   BootULCI
SCORE_EN      ,0104      ,0087     -,0049      ,0295

Partially standardized indirect effect(s) of X on Y:
             Effect     BootSE   BootLLCI   BootULCI
SCORE_EN      ,0079      ,0066     -,0037      ,0225

Completely standardized indirect effect(s) of X on Y:
             Effect     BootSE   BootLLCI   BootULCI
SCORE_EN      ,0144      ,0121     -,0068      ,0410

*********************** ANALYSIS NOTES AND ERRORS ************************

Level of confidence for all confidence intervals in output:
  95,0000

Number of bootstrap samples for percentile bootstrap confidence intervals:
  5000

NOTE: Variables names longer than eight characters can produce incorrect
output.
      Shorter variable names are recommended.

------ END MATRIX -----
```

Appendix I: Additional analyses output

Group Statistics

	LANGUAGE	N	Mean	Std. Deviation	Std. Error Mean
SCORE_ENG	NL	163	6,2051	,85656	,06709
	EN	106	5,8720	1,01781	,09886
SCORE_PSI	NL	163	4,0481	1,75972	,13783
	EN	106	3,9104	1,92549	,18702
RAW_SCORE_CLO	NL	163	3,4860	1,34778	,10557
	EN	106	3,6457	1,25840	,12223

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
SCORE_ENG	Equal variances assumed	3,966	,047	2,891	267	,004	,33312	,11521
	Equal variances not assumed			2,788	196,920	,006	,33312	,11947
SCORE_PSI	Equal variances assumed	1,715	,191	,604	267	,546	,13768	,22793
	Equal variances not assumed			,593	209,903	,554	,13768	,23232
RAW_SCORE_CLO	Equal variances assumed	,529	,468	-,974	267	,331	-,15968	,16387
	Equal variances not assumed			-,989	235,238	,324	-,15968	,16150

Figure 1: Independent samples T-test for the effect of survey language.

Group Statistics

	WTIME_HI	N	Mean	Std. Deviation	Std. Error Mean
SCORE_ENG	0	124	5,7650	1,04506	,09385
	1	145	6,3379	,73825	,06131
SCORE_PSI	0	124	3,7110	1,77113	,15905
	1	145	4,2356	1,84075	,15287
RAW_SCORE_CLO	0	124	3,3065	1,22434	,10995
	1	145	3,7563	1,35472	,11250

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
SCORE_ENG	Equal variances assumed	7,312	,007	-5,247	267	,000	-,57295	,10920
	Equal variances not assumed			-5,111	216,676	,000	-,57295	,11210
SCORE_PSI	Equal variances assumed	,077	,781	-2,371	267	,018	-,52461	,22127
	Equal variances not assumed			-2,378	263,292	,018	-,52461	,22060
RAW_SCORE_CLO	Equal variances assumed	1,544	,215	-2,837	267	,005	-,44987	,15856
	Equal variances not assumed			-2,860	266,169	,005	-,44987	,15731

Figure 2: Independent samples T-test comparing viewers who watch their streamer for more than 3 hours (WTIME_HI = 1) against those who watch for less than three hours.

Group Statistics

	Besides [Streamer], are there any other streamers you watch?	N	Mean	Std. Deviation	Std. Error Mean
SCORE_ENG	Yes	223	6,1807	,78863	,05281
	No	46	5,5559	1,34829	,19879
SCORE_PSI	Yes	223	3,9813	1,84958	,12386
	No	46	4,0543	1,71596	,25300
RAW_SCORE_CLO	Yes	223	3,5042	1,29683	,08684
	No	46	3,7657	1,38426	,20410

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
SCORE_ENG	Equal variances assumed	11,878	,001	4,251	267	,000	,62475	,14695
	Equal variances not assumed			3,037	51,524	,004	,62475	,20569
SCORE_PSI	Equal variances assumed	1,288	,257	-,247	267	,805	-,07303	,29598
	Equal variances not assumed			-,259	68,358	,796	-,07303	,28169
RAW_SCORE_CLO	Equal variances assumed	,268	,605	-1,231	267	,220	-,26147	,21246
	Equal variances not assumed			-1,179	62,355	,243	-,26147	,22181

Figure 3: Independent samples T-test comparing viewers who do (Yes) or do not (No) watch other streamers than the one they indicated in the questionnaire.

Group Statistics

	Gender: Female	N	Mean	Std. Deviation	Std. Error Mean
SCORE_ENG	0	236	6,0866	,89231	,05808
	1	33	5,9827	1,21626	,21172
SCORE_PSI	0	236	3,9944	1,81931	,11843
	1	33	3,9899	1,89019	,32904
RAW_SCORE_CLO	0	236	3,5386	1,30821	,08516
	1	33	3,6229	1,36703	,23797

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
SCORE_ENG	Equal variances assumed	2,167	,142	,596	267	,551	,10388	,17415
	Equal variances not assumed			,473	36,970	,639	,10388	,21955
SCORE_PSI	Equal variances assumed	,037	,847	,013	267	,990	,00445	,33973
	Equal variances not assumed			,013	40,735	,990	,00445	,34970
RAW_SCORE_CLO	Equal variances assumed	,111	,740	-,345	267	,731	-,08429	,24447
	Equal variances not assumed			-,333	40,630	,740	-,08429	,25275

Figure 4: Independent samples T-test for the effect of gender (male = 0; female = 1) on Engagement, PSI and Closeness.