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Participation and Financial Commitment on Social Live Streaming Services: Examining
Antecedents, Social Resources, and Psychological Well-being on Twitch.tv

By

GRACE HOPE WOLFF
DISSERTATION

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Dissertation Abstract

This dissertation provides a comprehensive examination into social live-streaming services (SLSSs), using a mixed-methods approach to examine how streamer and stream level factors drive viewer use, and how use has down-stream consequences on individuals' psychological well-being. SLSSs are a newer form of media content that combine video entertainment, user-generated content, and social media together in a live-setting. While well-known media platforms have added their own live-streaming capabilities, as seen through Facebook Live, Instagram Live, and YouTube Live, the most popular social live-streaming services, such as Twitch.tv, offer several thousands of channels with live professional and amateur content accessible to any and all viewers depending on their motivations, interests, needs, and mood (Spilker, Ask, & Hansen, 2020). Foundational SLSS research has examined broad-scale platform behaviors such as content and turnover in popular channels or interaction patterns (Kaytoue et al., 2012; Ford et al., 2017), needs and gratifications of users (Sjöblom et al., 2017; Hilvert-Bruce et al., 2018), and participation and gift-giving behaviors (Wohn et al., 2018; Bründl, 2018; Yu, Jung, Kim, & Jung, 2018). However, while SLSSs encompass a variety of categories such as “music,” “politics,” and “talk shows,” (Ask, Spilker, & Hansen, 2019), the majority of these studies have primarily examined video-game streaming rather than SLSSs as a whole (Harpstead et al., 2019). Additionally, due to the complex relationships between streamers and their viewers, past studies have specifically focused their research on the perspective of streamers, viewers, or the platform (Harpstead et al., 2019). The following dissertation aims to address these gaps by accounting for streamer characteristics, viewers' attitudes and behaviors, and broader community trends across SLSS categories. Specifically, this dissertation examines antecedents and outcomes of viewers' participation and financial commitment in order to gain a

comprehensive understanding of how viewers' behavior and relationship with streamers across SLSS categories contribute to the health of these communities as well as the psychological health of its members.

Contributions are key resources in online communities. In order to ensure long-term sustainability, online communities must continuously recruit, socialize, and retain members who contribute information, share support, and form social relationships with one another (Yang et al., 2017). In SLSSs, viewers can contribute through active participation, or content creation such as commenting, that facilitates further interactions (Bründl et al., 2017). Viewers can also support their communities through monthly financial contributions, demonstrating greater commitment and tangible support beyond active participation (Chen et al., 2013). While contributions provide quantifiable metrics of community growth, they may also be indicative of community health and engagement. Using APIs for data collection, the first study employs linear mixed models to analyze how audience size, moderator activity, gender, and content diversity relate to viewers' active participation and financial commitment to a streamer in the leading SLSS, Twitch.tv. Larger audiences diminished individual participation and financial commitment while moderation sparked more contribution. Female streamers especially benefited from increased moderation, earning 2-3 times more in financial contributions compared to men, who streamed more frequently but attracted much smaller audiences. Streamers with greater content diversity garnered smaller audiences, but viewer contributions did not differ. Findings demonstrate overhead costs to viewer engagement and underscore individual users' experience as indicative of community health.

Contributions not only affect communities as a whole, but also their individual members.

How members use and interact in these online communities have consequences for individuals' psychological well-being (PWB), a measure of optimal psychological health and functioning. Decades of research have examined how social media use such as active and passive participation affect individuals' well-being (see Meier & Reinecke, 2020 for review). The second study employs a cross-sectional survey to examine how use of Twitch.tv, specifically, active participation, passive participation, and financial commitment, relate to users' psychological well-being. Results from Structural Equation Models demonstrate that actively participating in a favorite streamers' Chat is directly related to increased psychological well-being. Viewers' social capital and parasocial relationship with their favorite streamer were examined as explanatory mechanisms. Structural social capital, or individuals' social interaction ties, were instrumental in providing PWB benefits to viewers who actively participated and financially contributed to their favorite streamer's channel. Findings underscore the value individual users' active and committed experiences have on their access to social resources and well-being.

Overall, this dissertation highlights the social nature of SLSSs, demonstrating how certain streamer-level factors can motivate users' contributions and improve the quality of the streaming community, as well as how users' contributions provide them access to social relationships and support that improve individuals' psychological well-being. In providing a comprehensive mixed-methods analysis that captures the relationship between streamers, viewers, and the platform as a whole, future research can further explore antecedents and outcomes related to the unique social interactions that occur within SLSS communities.

Chapter 1: Introduction

1.1 SLSSs: Transforming the Media Landscape

SLSSs are social media entertainment platforms that combine elements of connectivity and community typical in social media, with television entertainment ecosystems of producers and consumers (Johnson & Woodcock, 2019a). The global market for social live-streaming services is rapidly growing, with a 28.1% annual growth rate and projections to reach almost \$250,000 million by 2027 (Market Research Future, 2020). SLSSs add intimacy to social media and video spectatorship; streamers can broadcast or “live-stream” their own content in real time to small or massive audiences worldwide who in turn, can interact in real time through chat messages, special gifts, and financial donations (Scheibe, Fietkiewicz, & Stock, 2016).

According to Zimmer, Scheibe, and Stock (2018), SLSSs have the following key characteristics:

1. They are synchronous. While past broadcasts are often saved and accessible to viewers (similar to YouTube), SLSSs are unique in offering thousands of real-time broadcasts, or “streams.”
2. They allow users to broadcast their own content in real time over their own “channel.” Anyone and everyone can create their own channel and start streaming. Users that broadcast their own content are called streamers.
3. They require mobile devices or PCs and webcams with internet connectivity. While not all streamers include live webcam footage in their broadcast, such as some video-game streamers, webcams can increase co-presence, or the sense of being and acting with others (Durlach & Slater, 2000). Viewers can share in and react to the emotions and facial expressions of streamers (Hamilton, Garretson, &

Kerne, 2014), thereby increasing their emotional connection and intimacy with the streamer.

4. Audiences are able to interact and react with the broadcasting streamer and other viewers over text-based Chat. Chat is instrumental in transforming an otherwise passive viewing experience into an interactive one where viewers have agency in co-creating content and shaping the direction of the broadcast.
5. Some SLSSs support gamification mechanics. Many streamers include donation targets on their streams, with animations that feature and reward viewers who donate particular amounts. Some broadcasts or streams include “top donor” counters or lottery incentives that elicit competition amongst viewers. Viewers can also gamble and make predictions of what will occur during a broadcast (Johnson & Woodcock, 2019b). This provides additional means for audience engagement and interactivity.
6. Audiences can directly reward and tip streamers with money, gifts, or points. Whereas content creators on other platforms such as YouTube generate revenue via advertisements and sponsorships, SLSSs enable the direct flow of revenue from viewers to streamers in real-time.

With a focus on amateur content production and synchronous communication that facilitate greater intimacy and interactivity, SLSSs support microcelebrity sub-communities and cultures that enable streamers to monetize their content (Johnson & Woodcock, 2019a). SLSSs have also introduced “audience power,” or the mediated capacity to affect and be affected (Taylor, 2016). Carter and Egliston (2018) consider how interactivity influences the experience of using and viewing content on live-streaming platforms, detailing 3 primary areas of ‘audience

power.’ Specifically, they highlight how audience viewership is commoditized. Passively viewing content is not inconsequential but contributes towards a streamer’s popularity ranking, ability to generate revenue from advertising content, and continued reinforcement of popularity where increased views lead to more views. Second, viewers can enact their “audience power” by communicating in a Chat window to other viewers and to the streamer directly. The speed of chat messages flooding in often reflects the intensity or excitement of what occurs on stream, with viewers reacting to stream content and shaping the live broadcast. Viewers’ reactions and chat messages can amplify the streaming experience and create more content for viewers to engage with. Lastly, viewers can also post emotes (SLSS-specific and/or streamer-specific emojis) as short-form communication that are often used in response to events within the stream. These emotes in conjunction with “badges” beside commenters’ username serve to signal in-group hierarchies, distinguishing fans from casual spectators. With greater interactivity and viewer agency, SLSS have changed how users create content and interact with one another (Kaytoue et al., 2012).

1.2 Twitch.tv: The Leading SLSS

With more youths and young adults spending more time viewing live-streaming content than traditional cable shows (Hu, Zhang, & Wang, 2017), more attention has turned to SLSSs for its lucrative market potential. One of the most popular and well-known SLSSs, Twitch.tv, reported 26.5 million daily visitors, 6.9 million monthly streamers, 2.1 million average concurrent viewers in 2020 (Twitchtracker, 2021). Launched in 2011 as a live-streaming gaming and eSports platform, Twitch garnered more than 3 million viewers each month during its first year. Today, Twitch has expanded its content categories and user base beyond gaming and eSports, with over 140 million monthly visitors. 65% of all Twitch users are men and 73% of

Twitch users are below the age of 35, with the United States comprising the largest portion of viewers at 25% of viewership, followed by Germany at 7%, Russia at 5%, Canada at 4%, and Brazil at 4% of all Twitch viewership (StreamScheme, 2021). One of the most popular Twitch streamers, Ninja, made an estimated \$17 million in 2019 alone (Perez, 2020). In addition to their earnings from Twitch, many streamers have contracts with eSports organizations, sponsorship deals, and merchandise sales (Perez, 2020).



Figure 1. Layout of a typical Twitch stream and features.

On Twitch, anyone who signs up for a free account can stream or comment in a session's Chat. Even without signing up, viewers can search for live streams and freely watch the broadcasts. Figure 1 displays the layout of a typical Twitch stream when a viewer watches a streamer's channel live. The video player (Fig. 1, Nr. 1) often includes the streamer's webcam over the broadcast content. Below the video player is the streamer's profile information including their username (Fig. 1, Nr. 2), the title of their current live-stream (Fig. 1, Nr. 3), the category of their stream (ie: "Minecraft") and tags (ie: "Adventure Game") (Fig. 1, Nr. 4) that viewers can search (Fig. 1, Nr. 15). To the right of the streamer's profile information, viewers

can choose to “follow” a streamer in order to receive notifications every time they go live or broadcast in real time (Fig. 1, Nr. 5). To the right of the “follow” button, viewers can also subscribe to a streamer at different tier plans (Fig. 1, Nr. 5), paying monthly subscription fees directly to the streamer. Recent subscribers’ username and/or custom message may be featured across the broadcast, with streamers often thanking subscribers in real-time (Fig. 1, Nr. 11). Below the follow and subscribe buttons, viewers can see how many other concurrent viewers are watching the stream in real-time and how long the specific stream session has been live (Fig. 1, Nr. 6). To the right of the video player, is Twitch Chat (Fig. 1, Nr. 7) which is central to the interactive viewing experience. Viewers can comment in reaction to the stream (Fig. 1, Nr. 8) with either text or Emotes (ie: streamer-specific shark Emote). Once a certain number of subscriptions occur within a short time period, gamification mechanisms such as Twitch’s “Hype Train” are triggered (Fig. 1, Nr. 9). Hype Train includes various levels of achievement; as certain donation thresholds, or “levels” are achieved, viewers receive rewards. The addition of overlays indicate streamers’ subscription goals for the day (Fig. 1, Nr. 10) and showcase the most recent subscriber (Fig. 1, Nr. 11), further incentivizing viewers to engage and achieve a collective goal. To the left of the video player, viewers can find other available live-streamers or “channels” they follow and see their current viewership (Fig. 1, Nr. 12), in addition to other recommended channels currently live (Fig. 1, Nr. 13). As the Twitch homepage and search results display live channels according to category and concurrent viewership, viewers can also browse (Fig. 1, Nr. 14) and search (Fig. 1, Nr. 15) other categories or available live-streamers. Lastly, viewers can navigate to their own channel and profile information with icons at the top right-hand corner (Fig. 1, Nr. 16). With a plethora of live streamers and features available for users to watch and engage with, Twitch.tv offers content that continues to entertain, inform, and socialize viewers.

1.3. Research Focus

Participatory members are essential for the sustainability of online content communities; however, the type and amount of participation can drastically vary. Early studies estimated 45-90% of users do not contribute to online communities, supporting the 90-9-1 principle for online contributions that asserts 90% of online users do not participate, 9% contribute sparingly, and only 1% are active content creators (Nonnecke & Preece, 2000; Nielsen, 2006).

While foundational SLSS research examined motivations (Hilvert-Bruce et al., 2018; Wulf, Schneider, & Beckert, 2020), and affordances and practices (Carter & Egliston, 2018; Sjöblom et al., 2019) across various SLSS platforms such as YouTube Live and Twitch.tv (Pires & Simon, 2015; Stohr et al., 2015), many of them employ a single method that focuses on the perspective of the streamer, user, or platform (Harpstead et al., 2019). Additionally, a large portion of past and present SLSS research examines video game live-streaming communities and members rather than SLSSs as a whole (Pires & Simon, 2015; Pellicone & Ahn, 2017; Wulf et al., 2020). This dissertation therefore employs mixed-methods in order to capture the streamer-viewer and viewer-viewer dynamics across SLSS communities and their potential effect on viewers' life offline.

The dissertation takes a two-prong approach in comprehensively examining SLSSs in the following ways:

First, design theories including the Collective Effort Model (CEM) and heuristics of authority, reciprocity, scarcity, and similarity are applied in studying how streamer and stream-level factors—specifically audience size, moderator activity, streamer gender, and content diversity—relate to individual participation and financial commitment. Chapter 2 leverages these design principles from Kraut and Resnick's (2012) work on motivating online contributions and

applies them in the analysis of API collected behavioral data, presenting hypotheses and research questions to understand how factors relate to individual use. With large-scale observational data available, Chapter 2 provides insight into how features have a measurable impact on individuals' engagement across SLSS communities.

Second, participation and financial commitment are examined in relation to viewers' psychological well-being, with social capital and parasocial relationships explored as potential mediators. Considering how SLSSs have transformed how users interact with one another (Kaytoue et al., 2012), the nature of these social resources derived from these social relationships may likely provide well-being benefits. Chapter 3 models these paths using structural equation models from cross-sectional survey data, providing insight into the mechanisms and social resources that may not be quantifiable from observational data alone.

1.4. Research Contributions

Despite growing research interest in SLSSs across disciplines, these studies employ a singular research method to address questions from the sole perspective of streamers, viewers, or broader platform trends (Harpstead et al., 2019). While rich in findings for its specific focus, these studies have yet to fully capture the complex relationship and interaction patterns between streamers and viewers (Harpstead et al., 2019). Additionally, different operationalizations can contribute to drastically different findings (Meier & Reinecke, 2020), hindering the integration of prior research and big picture associations. With this in mind, the dissertation applies Meier and Reinecke's (2020) parsimonious taxonomy to computer-mediated communication (CMC) research that remains generalizable and useful across media platforms and can withstand technological change.

First, according to Meier and Reinecke (2020), in past CMC research, two primary conceptual approaches have emerged: the channel-centered and communication-centered approach. The channel-centered approach is often employed in mass media research, examining the channel and its effects as a black-box. This approach is often differentiated in four levels of analysis which include: (1) device, (2) type of application, (3) branded application, and (4) features. Whereas the channel-centered research approach studies media channels as a whole, the communication-centered approach examines communication as a complex social process of interactions which can be further analyzed at the (1) interaction and (2) message level. Distinguishing these two conceptual approaches is essential in maintaining consistency when comparing across or building upon studies. Chapter 2 takes on the channel-centered approach analyzed at the feature level to examine how SLSS streamer factors relate to individuals' interaction behaviors. These features examine the building blocks of certain platforms of applications that enable user interactions. Chapter 3 then takes on the communication-centered approach analyzed at the interaction level, illuminating communication processes that may further relate to psychological well-being. In this way, the dissertation provides a comprehensive overview of (1) how features relate to interaction behaviors and (2) how interaction behaviors relate to psychological well-being.

Second, two operational approaches to CMC research include the technology-centered and user-centered approach. Studies that are technology-centered leverage measures that capture technology usage, such as time spent or frequency of use. In contrast, user-centered operationalizations capture the social-psychological perspective, often through surveys or self-reports, quantifying how or why one uses a CMC platform. With these two primary operational approaches present in CMC research, Meier and Reinecke (2020) recommend future researchers

employ a strategic combination of technology-centered and user-centered approaches. This allows for comparisons across platforms and tests how psychological processes and motivations are modulated by channel features (Evans, Pearce, Vitak, & Treem, 2017). The dissertation employs both a technology-centered and user-centered operational approach, with Chapter 2 using publicly available API data to examine features and interactions, and Chapter 3 using cross-sectional survey data to measure interactions, social processes and resources, and resulting psychological well-being. Following the recommendations for best CMC research practices and approaches by Meier and Reinecke (2020), this dissertation applies best practices that strengthen its analysis and provide a comprehensive understanding of SLSSs.

Lastly, the strength of this dissertation research resides in filling research gaps that are of interest to researchers, designers, streamers, and viewers. Indeed, SLSS viewers primarily have social motivations (Hilvert-Bruce et al., 2018), however, questions remain as to whether specific streamer characteristics and design features motivate viewers toward participation, and whether large-scale patterns emerge across SLSS communities. While viewership, participation, and financial commitment may satisfy users' social needs and enjoyment (Bründl & Hess, 2016; Wulf et al., 2020), questions remain as to what other benefits do viewers receive? While viewers experience parasocial relationship, or perceived closeness, with their favorite streamer that is associated with financial contributions (Wohn et al., 2018), enjoyment (Wulf et al., 2020), and wishful identification with the streamer (Lim et al., 2020), questions remain as to whether this perceived closeness with a streamer provides psychological benefits to SLSS viewers. In studying participation and financial commitment, the dissertation addresses the questions posed above, gaining a comprehensive understanding of participation's effect on a community as well as individual users. The exploration of participation and financial commitment as key constructs

demonstrate the influence of streamers, viewers, and the community resources as a whole. The use of mixed-methods magnifies the value that survey and behavioral data would otherwise have alone, complementing and cross-validating self-report behaviors and preferences with observational patterns. Chapter 2 presents tradeoffs certain features or streamer factors may have on viewers' participation and financial commitment, asserting the importance of measuring community engagement at the individual level and providing implications for streamers and designers looking to increase engagement. Chapter 3 presents the important role of social capital resources in providing well-being benefits to viewers, providing future researchers guidance on explanatory mechanisms and first of its kind evidence for the relationship between SLSS use and well-being. With this in mind, designers may want to implement further features that motivate contributions to ensure the health and longevity of SLSS communities and its members.

Chapter 2: Audience Size, Moderator Activity, Gender and Content Diversity: Exploring User Participation and Commitment on Twitch.tv

2.1. Introduction

Contributing members are vital to the success of online communities (OC); they share information, help one another, and provide social connection (Yang, Kraut, & Levine, 2017). However, online membership is more ephemeral than offline; with less facetime, online members are less likely to feel attachment toward the community and each other (Kraut & Resnick, 2012), and may easily leave and join another community with a click of a button (Kim, Choi, Qualls, & Han, 2008). Similarly, SLSSs interactions are often serendipitous as viewers can easily tune in to different streamers or “channels” for live content (Harpstead et al., 2019). It is therefore imperative for SLSSs communities to attract and retain new members, socialize them, and provide enough incentives to ensure sustainability (Kraut et al., 2020; Levine & Moreland, 1994). However, the question of member participation and commitment remains underexplored in SLSSs research. Few studies have systematically investigated the drivers of viewer engagement within SLSSs and have yet to leverage theories and findings from previous OC research. Additionally, despite the topical diversity and proliferation of chatting streams, most research has largely examined SLSSs as an artifact of gaming culture (Harpstead et al., 2019; Spilker, Ask, & Hansen, 2020). This study aims to understand SLSSs communities as a whole, applying OC research to examine how group or community level characteristics relate to individual viewers’ contributions.

Drawing from the collective effort model, and heuristics of authority, reciprocity, scarcity, and similarity used in extant OC research (Kraut & Resnick, 2012), the present chapter considers the relationship audience size, moderator activity, gender, and content diversity have

on individual viewers' participation and financial commitment, which considered together are referred to viewer contributions. Audience size, moderator activity, streamer gender, and content diversity are factors that characterize a community or group context that are important considerations when applying the collective effort model and examining individual SLSS viewers' contributions. Using publicly available APIs, data on 326 Twitch streamers and their session activities were collected over the course of seven weeks. Findings indicate that in larger audiences, individual viewers socially loafed more and contributed less than those in smaller audiences. Moderator activities increased individual participation and financial commitment. Gender differences were present; while male streamers comprised the majority of the sample and streamed more sessions that lasted longer than their female counterparts, female streamers' sessions garnered audiences almost seven times larger, 46% more moderator activity, and earned more than double the financial contributions per viewer than men.

The study's findings uniquely contribute to OC research in two ways. First, this study extends the collective effort model in combination with social influence heuristics of authority, reciprocity, scarcity, and similarity to explore how salient community or group factors are related to and mutually influence individual viewers' contributions in SLSS contexts.

The results demonstrate persistent relevance of the collective effort model in newer SLSS online community contexts and validate Kraut and Resnick's (2012) design claims that individuals are more willing to contribute to smaller, high status, attractive, and similar online groups across new media. Second, this study unpacks the nuances of individual SLSS viewers' behavior. While viewership quantifies performance success and enables streamers to generate revenue (Pellicone & Ahn, 2017), per capita measures capture the average individuals' contribution to provide insight into the potential quality of communities and their ability to attract and retain members

that are otherwise difficult to assess. Taken together, this study explores various patterns that emerge when examining viewer behavior and contributions in an emergent and relatively new media platform with more intimate means of influence and interactions, extending past theories and examinations of OC contributions to SLSSs.

2.2. SLSSs as Unique Online Communities (OC)

OCs are groups of users with a shared purpose, interest, or need who socially interact with one another through computer-mediated communication (Rheingold, 2000).

SLSSs allow users to broadcast their own content using mobile devices, PCs and webcams in real time to interactive audiences that comment and reward performers with tips and gifts (Scheibe et al., 2016). SLSS communities are characterized by synchronous interactions that facilitate greater sociability (Bründl, Matt, & Hess, 2017) and are oriented around a specific streamer's chatroom, or "Chat." As the core feature for social interactions on SLSSs, Chat is a social community defined by the common interests and shared experiences of a streamer and viewers (Hamilton et al., 2014). Streamers perform and produce content for self-presentation purposes while viewers produce responses that satisfy their need to belong to the group (Nadkarni & Hofmann, 2012). Streamers then use the audience's real-time responses to perform more compelling content and produce more interactions between the streamer and audience, creating an information production/reception feedback loop (Diwanji et al., 2020). SLSSs are designed to maximize engagement between audiences and streamers, reflecting the dominant social motivations of their users (Hilvert-Bruce et al., 2018; Sjöblom et al., 2019). Streamers often overlay their video with a webcam, displaying their facial expressions to their audience. Viewers respond in real time over Chat, transforming an otherwise passive viewing experience into a participatory exchange. Chat provides an illusion of face-to-face interaction (Dux, 2018);

as viewers and streamers interact and share in experiences, they develop a sense of emotional connectedness, belonging, and community with one another (Hilvert-Bruce et al., 2018; Lim et al., 2020). Viewers often use Emotes, which are Twitch and streamer-specific emojis, to communicate in Chat. Emotes signal an instantaneous emotional reaction that can be contagious and differentiate fans from casual viewers, fostering emotional engagement and community belonging (Carter & Egliston, 2018; Seering, Kraut, & Dabbish, 2017). As the bond between viewers and streamers strengthen and viewers become more invested in the success of their favorite streamer, they may feel compelled to “give back” to the community with financial contributions in the form of subscriptions or donations to ensure continued content creation and community growth (Diwanji et al., 2020). This mass-personal broadcasting fosters micro-celebrity subcommunities with intimate interactions between streamers and their viewers (Sjöblom et al., 2019).

2.3. Participation and Commitment in SLSSs

In their 2015 meta-analysis of 83 online community articles published from 2002-2014, Malinen found that while there was no specific definition offered for participation, scholars most commonly conceptualized participation based on the visibility of activity, using an active-passive dichotomy. Active participation in OCs entail leaving a visible trace through commenting, sharing, and asking questions. In contrast, passive participation entails “lurking” behaviors such as searching, browsing, reading, and watching. While both types of participation are legitimate means of socializing oneself and feeling a sense of community, the scope of this paper focuses on the visible activities of viewers that may further create content for other viewers to interact with which may help individuals develop attachment to the community and its members (Bründl et al., 2017). Without consistent user contributions, online communities may not be able to retain

existing members or attract new members. Therefore, to sustain themselves, scholars cite the importance of motivating user participation to encourage further participation and commitment (Kraut & Resnick, 2012).

Commitment is a strong positive psychological attachment that can develop through interpersonal relationships and/or through a common group identity (Ren et al., 2012). As members actively participate and interact, they may develop personal relationships with members and become further embedded in these communities (Kraut et al., 2020). These social interactions increase commitment and motivate members to create content, post updates, share pictures, or even financially contribute (Chen et al., 2013). In this way, commitment can be considered an extended form of active participation, contributing to a feedback loop of engagement (Yang et al., 2017). Because of this, social interactions within OCs are an essential resource for the sustainability of online communities—they engender further interactions and relationship development while socializing new members towards participation.

Participation within SLSSs can similarly be passive or active. Whereas passive participation in SLSSs entails merely watching or browsing content, active participation leaves visible traces via Chat comments or subscription and donation notifications (Bründl et al., 2017). The shared interactions and experiences that result from active participation foster community and belonging (Hilvert-Bruce et al., 2018) which may motivate continued viewership, active participation in Chat, and commitment. Prior research assessed SLSSs commitment through continuous watching intentions (Hu et al., 2017; Lim et al., 2020), emotional connectedness (Hilvert-Bruce et al., 2018), and financial support (Hilvert-Bruce et al., 2018; Wohn et al., 2018). Similar to OCs, participation and commitment in SLSSs are entwined-- participation and socially interacting in a streamer's Chat may further viewers' attachment to a community and motivate

financial contributions which may lead to more participation and embeddedness in the community. As participation and expressions of commitment in SLSSs occur within a group context, it is important to consider what factors related to the group motivate or demotivate individuals' effort and contribution. The following section builds upon the collective effort model (CEM) as a theoretical foundation to examine the mutual influence salient group characteristics in concert with authority, reciprocity, scarcity, and similarity heuristics have on viewer contributions.

2.4. The Collective Effort Model (CEM)

The collective effort model provides a framework for examining individual contributions in group settings that identifies likely threats to individual motivation and predicts how valued outcomes influence motivation and effort. Built upon expectancy-value models of work motivation, CEM draws from social identity and self-evaluation theories to identify key outcomes individuals are likely to value in collective or group settings (Karau & Williams, 1997). According to CEM, individuals are more willing to contribute to a group when they deem their individual effort as unique, important, and identifiable, and when they like the group (Karau & Williams, 2001). While an individual's motivation to contribute stems from their individual effort, performance, and the perceived value of individual outcomes, in groups contexts an individual's motivation is also tied to individuals' perceived contribution to the group, group members' performance, and the perceived value of group outcomes (Karau & Williams, 1993). In SLSSs, individual contributions over Chat and financial contributions via subscriptions and donations can benefit and influence individual contributions as well as the group or community. Chat participation enables lively interactions and facilitates the development of relationships between the individual contributor and other viewers, and between the individual contributor and

the streamer. Frequent commenters can gain the attention of the streamer or other moderators in the community, which can lead to the potential promotion of these frequent contributors to the role of moderator, further embedding themselves in these communities and providing value to both the individuals and the communities they help govern. Similarly, individuals' financial contributions in the form of subscriptions or donations benefit and influence both the individual and the community. Individuals can broadcast a customized message attached to their financial contribution to the streamer which is often acknowledged by the streamer. This recognition of individuals' contributions as identifiable or unique may further encourage more contributions while also contributing to the overall community's growth. Individuals can also "gift" subscriptions to other viewers, with these notifications similarly broadcasted during a live-stream and acknowledged by the streamer and community. In this way, contributions beget and influence other individual contributions while also contributing to the success or "performance" of a streamer's community.

It is important to note that while CEM is often used to examine social loafing, or the demotivating effect of working in a group, social loafing within SLSSs is not necessarily indicative of a passive audience as a whole. Streamers can select who can contribute, providing viewers with subscriber-only or follower-only Chats, as well as what content viewers can contribute with Emote-only Chats. Streamers can also communicate with their viewers using other communication platforms outside of SLSSs, including Twitter, Discord, Reddit, and other applications that can support multiple channels and subgroups synchronously. This means a passive audience within an SLSS Chat could possibly be actively participating with the streamer and community on another more intimate channel. While multimodality presents a challenge in studying streamer and viewer dynamics (Harpstead et al., 2019), contributions (or lack thereof)

within an SLSS platform nevertheless influence other SLSS viewers' and their contributions during a live-stream. Additionally, viewers can interact and contribute to a streamers' channel outside of Chat participation and financial commitment. While these were outside the scope of this study, it is important to note that the lack of participation and commitment within SLSSs are the end all be all. Nevertheless, this study focuses on participation and financial commitment within SLSSs as salient contributions that can affect a streamer's response during a live-stream, as well as newcomers' and other viewers' socialization and subsequent contributions. If all viewers congregated in a streamer's Discord channel rather than the SLSS platform, it would be detrimental to the streamer's community outreach, growth, and sustainability within that SLSS platform. Contributions in the form of active participation over Chat and financial contributions are what make SLSS communities social and appealing to viewers (Hilvert-Bruce et al., 2018); they provide a streamer's community access to potential new members, develop commitment of existing members, and enable its growth both within and outside of SLSSs.

While CEM has been tested and supported across a variety of OCs (Ling et al., 2005; Rashid et al., 2006), it has yet to be applied to SLSSs when examining viewers' contributions. Findings demonstrate that smaller groups and homogeneous subgroups where contributions are more easily identifiable and groups more liked are related to greater contributions and less social loafing (Kraut & Resnick, 2012; Rashid et al., 2006). More recently, one study found that smaller groups, and having an administrator role, more consistent communication, and more close friends were the strongest predictors of commitment in OCs, related to more recognizable contributions and in-group similarity (Kraut et al., 2020). The proceeding sections examine how salient group characteristics including audience size, moderator activity, streamer gender, and content diversity relate to individuals' active participation and financial commitment. Cialdini

(2001) and Cialdini and Goldstein's (2004) heuristics of persuasive appeal which include authority, reciprocity, scarcity, and similarity build upon CEM to elaborate how each characteristic relates to individual viewers' motivation to contribute. In larger audiences with more collective active participation, SLSS viewers may not perceive their individual effort as valuable or influential to the overall group and therefore may not contribute as much. Conversely, SLSS viewers may be more motivated to contribute when moderators are more active in the Chat. Moderators have the authority to shape clear community norms and identity which may lead to a more cohesive and homogenous group. Considering how individuals may contribute more to cohesive groups they like and feel committed to (Karau & Williams, 1997), greater moderator presence may motivate more contributions. Moderators are also responsive to individuals' questions in Chat; this reciprocity may aid in socializing viewers while also making their contributions identifiable and unique, further increasing liking to the group and motivating further contributions. A streamer's gender may also have a mutual influence on viewer's contributions. Considering the perceived scarcity of female streamers and female viewers alike, in addition to stereotyped expectations regarding their sociality or sexualized performance, viewers may be more motivated to watch and contribute to their live streams. Lastly, streaming more diverse content across categories may relate to a more heterogeneous group without a clear shared interest or identity --without this cohesion or similarity, individuals may not like the group or feel invested in its success and therefore may not be as motivated to contribute.

Audience Size

According to the CEM, individuals will contribute less, or "socially loaf" if they believe their efforts are unimportant, unidentifiable, or if they do not like the group (Karau & Williams, 2001). With larger audiences, live-streaming communication moves from small-scale

interpersonal interactions to crowd-based interactions, with messages flooding the Chat window so quickly they cannot be read by viewers (Carter & Egliston, 2018). The resulting overload in communication may lead to a decrease in participation and affinity for the group as users may deem their contributions inconsequential (Kraut et al., 2020). One of the first studies examining the limits of individual information processing synchronous environments found that as chat room size increased, the number of messages posted per person decreased (Jones et al., 2008). Amongst large audiences and their deluge of comments, viewers may perceive their contributions as redundant, unimportant, or unidentifiable and may not be motivated toward active participation. They may also be unable to frequently or effectively communicate with one another which may hinder their ability to build connections and commitment (Yang et al., 2017).

At the same time, CEM may not apply across all group contexts and individual motivations. For example, while CEM predicts more social loafing with larger audiences, it is possible that more viewers facilitate more participation. In their survey of over 650 users across two different OCs, Ma and Agarwal (2007) found that virtual co-presence, or the awareness of being with others in a virtual environment, had a positive effect on driving user contributions. The attention received from larger audiences may positively influence the intention to create user-generated content, thereby increasing the amount of participation from viewers (Huberman, Romero, & Wu, 2008). The increased presence of others can affect interpersonal awareness, which in turn may affect social interactions and engagement in OCs (Yang et al., 2017).

RQ1: How is audience size of a live streaming session associated with individual viewers'

a) participation during the live session and b) financial commitment to the streamer?

Moderator activity

Concerns over trolling, harassment, and misbehavior are pervasive across OCs. In anonymous and pseudonymous virtual spaces, individuals may behave in disinhibited ways, contrary to their normal face-to-face behavior, with minimal consequences (Suler, 2004). As high-status authority figures that are influential and committed to the communities they govern, moderators handle misbehavior and socially engage its members (Seering et al., 2017). The heuristic of authority demonstrates how moderators are able to influence others with their position in the hierarchy and expertise (Cialdini & Goldstein, 2004). In SLSSs, a moderator's position is especially salient given the visibility of their actions and their ability to ban certain members and promote norms of reciprocity (Seering et al., 2017). Rather than simply removing users with the technical tools available, a study across Twitch, Reddit, and Facebook found that moderators socially engage with the community during occurrences of misbehavior (Seering, Wang, Yoon, & Kaufman, 2019). This consideration to members' social needs is likely to generate favorable compliance and contributions from members (Cialdini & Goldsetin, 2004), allowing viewers opportunities to observe, internalize norms, and emulate positive behaviors. With established behavioral norms set by moderators, communities may be more cohesive and homogenous, with individuals liking the community and finding greater similarity with other members which may motivate more contributions.

Responsiveness, related to trust, commitment, and feelings of relational closeness (Reis, Clark, & Holmes, 2004) may also influence members in establishing norms around reciprocity. When moderators engage in Chat, the perceived likelihood of receiving a response is greater, and may encourage viewers to participate or ask a question. In their study of Twitch moderators, Seering and colleagues (2017) found that text Chat behaviors were contagious; viewers imitated moderators' behavior when posting spam, questions, and smiles significantly more so than non-

moderators. These positive emojis, such as smiles, can increase the intimacy level between social interactants (Janssen, Ijsselsteijn, & Westerink, 2014). Additionally, many streamers include Chatbot moderators that answer viewers' informational questions related to streaming equipment used or length of stream. This responsiveness and recognition of viewers' contributions may increase viewers' perception that their contributions are identifiable, unique, and important which may further motivate more contributions. In this way, moderators' authority and norms of reciprocity may encourage more individual participation and commitment.

H1: Moderator activity will be positively associated with individual viewers' a) participation during a live session and b) financial commitment to a streamer.

Gender

SLSSs are considered to be a male-dominated domain (Sjöblom et al., 2019) with some viewers preferring to watch and comment in only male or female streamers' channels (Gerber, 2017). According to the scarcity heuristic, opportunities become more desirable the more they are perceived as scarce and unavailable (Cialdini, 2001). The scarcity of female streamers as well as the lack of female viewers' visible participation who do not chat with or reward streamers as often as male viewers (Long & Tefertiller, 2020), may increase interest from those who prefer watching female streams. Additionally, female streamers are perceived as more socially-oriented compared to male streamers (Zimmer & Scheibe, 2019), which viewers may perceive as reciprocating their own social behaviors. Given SLSSs users' social motivations (Hilvert-Bruce et al., 2018), the scarcity and perceived reciprocity of socially-oriented streams that recognize and reciprocate viewers' interactions may increase interest in female streamers and relate to more participation.

At the same time, due to their marginalized status in live-streaming contexts, female streamers are especially vulnerable to harassing behavior (Pellicone & Ahn, 2017), which may affect streamers' performance and viewers' experience. A recent study examined discriminatory rhetoric used to reference female streamers across several forum threads on r/Twitch, a Reddit community focused on Twitch (Ruberg, et al., 2019). The term "cam girl" or "boobie streamer" was as a common-place label that denigrated the work of female streamers as illegitimate and undeserved (Ruberg et al., 2019). While the practices of all live-streamers are essentially body work -- streamers are paid through a system of subscriptions and tips and perform with their personalities and their bodies to hold viewers' attention online -- the association to sex work is reserved for only female streamers (Ruberg et al., 2019). One study examined gamers' reactions to pre-recorded audio of a male, female, or no voice and found that the female voice elicited three times more negative comments than the male voice and no voice condition. Female voices also received more questions and messages, with a clear pattern of gendered derogatory language and questions regarding competency (Kuznekoff & Rose, 2012). The perceived scarcity of female streamers as well as the antipathy they receive may increase viewership and negative comments. As gender differences still largely remain underexplored in live-streaming communities, the follow research question is presented:

RQ2: Are there significant differences between male and female streamers' a) number of streaming sessions, b) audience size, c) moderator activity, d) individual viewers' participation, and e) individual viewers' financial commitment?

In response to potentially more negative comments and behaviors, female streams may have more evidence of moderator activity. While subsequent moderator response to harassment or negative behaviors may actively combat harassment, establish clearer norms, and ensure a

safe space for streamers and viewers to interact, the removal of comments to ensure a more positive space may also lead to a decline in participation per capita. One study examined Reddit comments across two communities with differing moderation policies; one favored “safe space” while the other favored “free speech.” While moderators removed more comments in the safe space community, language used in the safe space was more positive than the free speech community which featured more negative and angry messages (Gibson, 2019). In this way, moderators may be more present and active for female streamers’ broadcasts which may garner larger audiences and more negative comments, while also influencing the quality and quantity of subsequent comments and behavior. Therefore:

RQ3: How does streamer gender moderate the relationship between moderator activity and individual viewers’ a) participation and b) financial commitment to a streamer?

Content Diversity

With competition from alternative groups a click away, it is imperative for streamers to continuously create content that provides value to their viewers (Kim et al., 2008; Kraut & Resnick, 2012). Content diversity may have a role in the sustainability of an online group through the heuristic of similarity which may serve as a cue of being amongst like-minded or similar people. While niche content communities cater to a smaller pool of potential members, they may have clearer content expectations that attract and retain homogenous viewers more easily than communities that address diverse topics. In their examination of the diversity of Twitter messages, Wang and Kraut (2012) found more focused topics increased a group’s ability to attract new members and establish social connections. Similarly, a Reddit study found higher retention rates for niche subcommunities oriented around a distinct topic (Zhang et al.,

2017). These homogenous groups with more similar members that like the group may in turn motivate more contributions.

While less content diversity may seem beneficial for short-term gains, it may not be optimal for long-term sustainability. Communities with greater content diversity appeal to a wider audience which may increase its ability to adapt towards long-term survival should trends or viewer preferences change. Diverse content may enliven discussions and provide more opportunities for members to find common ground and establish deeper social connections. One survey found greater affinity for Facebook groups that spanned a diverse range of topics, with stronger effects for topical groups compared to family, identity, and task-oriented communities (Kraut et al., 2020). Despite having more content diversity and less homogeneity, this greater affinity for the group may lead to more individual contributions. The relationship between content diversity and individual contributions may also differ by viewers' tenure, in that diverse content communities may provide an entry point for newcomer participation. One study on Reddit subcommunities found that niche groups exhibited larger linguistic and acculturation gaps between new and established members, with newcomers more engaged in diverse content communities (Zhang et al., 2017). Communities must therefore balance content diversity when considering how to socialize and motivate newcomers toward participation while fostering greater affinity and opportunities for deeper connections amongst existing members. While larger or more established communities may be able to address turnover more easily than smaller or newer communities, commitment is essential to withstanding challenges with retention, social loafing, and misbehavior (Kraut & Resnick, 2012). Communities with less diverse content and homogenous groups can more easily establish member commitment than diverse content communities, but may want to explore other categories after becoming established in order to

continue their growth. In their field analysis of Twitch forums where experienced streamers provide advice to “noob” or newer streamers, Pellicone and Ahn (2017) found that experimenting and attempting to perform across a variety of genres may negatively affect viewership. Established streamers encouraged newer streamers to broadcast uniform and focused content in order to first grow a consistent and committed viewer base, who will be patient and continue watching as the streamer branches out to different content (Pellicone & Ahn, 2017). Considering attention is a limited resource and high value commodity in SLSSs, the following is explored:

RQ4: How is content diversity associated with a stream's a) audience size and individual viewers' b) participation and c) financial commitment to a streamer?

2.5. Methods

Data collection

Twitch's top 5 streaming categories were identified at the time of data collection (Just Chatting, League of Legends, Fortnite, Call of Duty: Modern Warfare, and Ghost of Tsushima), then from each category, 100 streamers were randomly selected from a list of all streamers who were currently live at the time of data collection, for a total of 500 streamers. The sample was then filtered based on the following criteria: streamers must have a webcam on for gender coding, be a Twitch affiliate or partner with at least 100 followers at the start of data collection, have had an account for at least 100 days, stream in English, be a private individual (rather than a group or eSports channel), be a mature streamer (18+), have a publicly available Chat for viewers, and have at least a maximum of 4 concurrent viewers during a stream. This was to ensure the analysis did not skew heavily towards streamers that did not have any viewer interactions or a semblance of a community established. This resulted in 326 eligible streamers.

Data from a total of 5620 live-sessions and their accompanying Chats were collected every time the 326 streamers went live, between July 17th and September 5th, 2020. Data included streamers' id, account creation date, follower count, language, date and time of each stream, tags, stream title, viewer counts, and all Chat comments and notifications.

20% of streamers in the sample were women and 80% were men. As detailed in Table 1 below, streamers live-streamed an average of 18.42 sessions (*Median* = 11, *SD* = 19.06). The average session lasted 309.8 minutes or over 5 hours (*Median* = 262, *SD* = 287.64), garnered 432 viewers (*Median* = 26, *SD* = 2611), and 3305 comments (*Median* = 793, *SD* = 27958.5). Streamers earned an average of \$142.58 in subscriptions and 1543 bits (\$15.43) in a session.

Measures

Dependent variables

Participation per capita. Participation per viewer was measured by dividing the total number of comments in a chat by the maximum (or peak) concurrent audience size in each live-session.

Commitment. Commitment was measured by the amount of financial support viewers voluntarily donated to a streamer through premium subscriptions and bits. **Subscriptions per capita** measured the average amount (in dollars) subscribed per viewer in a given live-session. Twitch viewers can subscribe to a streamer at \$4.99, \$9.99, or \$24.99 per month, and can gift subscriptions to other viewers. The dollar amount across all subscriptions for one month was summed then divided by the maximum viewership size. **Bits per capita** measured the amount of in-game currency donated to a streamer during a live session through “cheering,” with 1 bit equal to 1 cent. Cheering expresses excitement during a live-stream and is accompanied by an

animated or custom Emote and message to the streamer. Bits per capita was measured by taking the total number of bits donated during a session divided by the maximum audience size.

Independent variables

Gender. Streamer gender was manually coded as male (0) or female (1) by examining the webcam during a live-stream or recently streamed videos and the self-identified pronouns used by the streamer in their profile. Non-binary individuals were not identified in the sample by the coder.

Content Diversity. Streamers used tags to classify their live-streaming session within Twitch, allowing potential viewers to search for specific streaming content. These tags were qualitatively coded under 10 different categories ranging from art, mental health, and specific video game titles. As a streaming session can include multiple tags, the number of distinct categories within each one session and across all sessions were summed to create a session content diversity score and a streamer content diversity score, respectively.

Audience Size. An API call collected total viewership counts every 10 minutes during a live-stream. The highest viewership count was then used to measure audience size of the session.

Moderator Activity. Using chat logs that accompanied each session, moderator activity was measured by summing all moderator messages, notifications of banned users, and deleted messages (an action exclusive to moderators).

Control Variables

The following streamer-level variables were controlled for: account age (in days), number of followers, and number of streaming sessions recorded during data collection.

Additional session-level control variables include the duration of a streaming session (in

minutes) and viewership incentives (binary), such as “drops” which offer viewers in-game loot for linking their game account to Twitch and watching streamers play a specific game title.

Analysis

To estimate both streamer- and session-level effects, linear mixed effects models were run in R (version 1.2.5033) using the lme4 package. Three linear mixed effects models were estimated to explore the effect of viewership size (RQ1), moderator activity (H1), gender (RQ2d/e), streamer and session content diversity ((RQ4b/c), onto participation per capita, subscriptions per capita, and bits per capita respectively (see Table 2, 3, & 4), with individual streamers as the random effect. Another linear mixed effects model was run to assess how streamer and session content diversity relate to audience size (RQ4a). Three additional quadratic mixed effects models were run to explore the potential curvilinear relationship between audience size and outcome variables, accounting for both social loafing and social facilitation theories (see Table 5). Streamer follower count, account age, session count, session duration, and incentive were included in all of the models as covariates.

To compare male and female streamers’ number of streaming sessions, audience size, and moderator activity (RQ2a/b/c), Welch’s t-tests were used to account for sample size differences (see Table 1). Three additional models were estimated to explore the interaction between gender and moderator activity (RQ3) onto participation and the two measures of financial commitment (see Table 2, 3, 4). Significance was determined using Satterthwaite's method to estimate degrees of freedom and generate p-values for mixed effects models (Kuznetsova, Brockhoff, & Christensen, 2017). Decreases in Akaike information criterion (AIC; Akaike, 1973) assessed model fit improvement.

2.6. Results

RQ1 asked how audience size related to individual viewers' a) participation and b) financial commitment. Audience size had a significant and negative association with participation per capita (Coefficient = -3.06, $p < .05$) as well as subscriptions per capita (Coefficient = -0.09, $p < .05$), but was not significantly related to bits per capita (Coefficient = -1.36, $p = .34$). In other words, an increase in audience size by 1000 viewers relate to 3 fewer comments and \$0.09 less in subscriptions per viewer.

Table 1. Descriptive Statistics for Twitch Streamers and Streaming Sessions

	Total (N _{str.} = 326, N _{sess.} = 5620)		Male (N _{str.} = 259, N _{sess.} = 4725)		Female (N _{str.} = 67, N _{sess.} = 895)		t
	Mean	SD	Mean	SD	Mean	SD	
Streamer							
Content Div.	2.18	1.15	2.18	1.09	2.19	1.37	-0.09
Age (in days)	1714	948.2	1755	974.9	1557	824.96	1.68
# of Followers	37194	144771	34208	141042.4	48739	158971	-0.68
# of Sessions	18.42	19.06	19.7	19.79	13.66	15.17	2.7**
Session							
Audience Size	432	2611	231.6	1111.56	1488.6	5917	-6.33***
Mod. Activity	590.1	2966.75	550.1	2735	801.7	3967.32	-1.82
Content Div.	1.87	0.87	1.88	0.84	1.83	1	1.37
Duration (min)	309.8	287.64	312.7	303.6	294.2	180.82	2.47*
# of Comments	3305	27958.5	3208	29419.6	3820.1	18674.8	-0.81
Part. per Cap.	41.52	131	41.16	130.71	43.41	132.5	-0.47
Total Subs (\$)	142.58	1467.6	134.65	1569.46	184.5	721.18	-1.5
Subs per Cap.	1.06	4.06	0.95	3.71	1.62	5.52	-3.49***
Total Bits	1543	12696.6	1230	8944.2	3192	24233.04	-2.39*
Bits per Cap.	20.14	141.36	17.75	112	32.78	243.2	-1.81

Note. * $p < .05$. ** $p < .01$. *** $p < .001$. "Div" is abbreviated for diversity, "Part. per Cap." for individual viewers' participation per capita, "Total Subs" for total subscription amount, "Subs per Cap." for individual viewers' subscriptions per capita, and "Bits per Cap." for individual viewers' bits per capita.

To explore a possible curvilinear relationship between audience size and viewers' participation and financial commitment, 3 additional models were run. Audience size had a significant quadratic relationship with participation per capita (Coefficient = 0.31, $p < .001$) as well as subscriptions per capita (Coefficient = 0.01, $p < .001$), but was not significantly related to bits per capita (Coefficient = 0.15, $p = 0.14$). Models that examined the curvilinear relationship

of audience size on participation per capita, $\chi^2(1) = 12.68, p < .001$ and subscriptions per capita, $\chi^2(1) = 6.85, p < .01$ fit significantly better than the linear mixed effect models reported, while there was no difference between the bits per capita models, $\chi^2(1) = 2.31, p = 0.13$.

H1 predicted that moderator activity would be positively associated with a) individual viewers' participation and b) individual viewers' financial commitment. Confirming H1a, moderator activity had a significant positive association with participation per capita (Coefficient = 0.2, $p < .001$). Moderator activity was also positively and significantly associated with subscriptions per capita (Coefficient = 0.41, $p < .001$), and bits per capita (Coefficient = 6.47, $p < .001$), confirming H1b. Overall, every 1000 activities from moderators relates to .21 more comments per viewer, \$0.47 more subscriptions per viewer, and \$.13 more bits per viewer.

Table 2. Mixed Effects Models for Participation per Capita ($N_{\text{streamer}} = 326, N_{\text{session}} = 5620$)

<i>Predictors</i>	Model 1			Model 2		
	<i>Estimates</i>	<i>S.E.</i>	<i>t</i>	<i>Estimates</i>	<i>S.E.</i>	<i>t</i>
(Intercept)	0.36	0.11	3.3 **	0.36	.11	3.33**
Audience Size	-3.12	1.4	-2.24*	-3.06	1.4	-2.19*
Mod. Activity	0.21	0.53	38.75***	0.2	.63	31.76***
Gender	3.49	8.73	0.4	1.26	8.81	0.14
Sess. Diversity	6.48	3.86	1.68	56.52	3.86	1.69'
Str. Diversity	5.17	3.59	1.44	5.14	3.58	1.43
Mod x Gender				2.04	1.17	1.75'
<i>Covariates</i>						
Incentive	0.17	0.12	1.49	0.17	0.12	1.48
Duration	0.01	0.01	1.61	0.01	0.01	1.64
Session Count	-0.59	0.17	-3.43***	-0.59	0.17	-3.43***
Acct. Age	0.01	0.01	-1.64	0.01	0.01	-1.63
# Followers	0	0	-3.22**	0	0	-3.19**
σ^2	12193			12191		
τ_{00}	2149			2138		
AIC	69212			69211		

Note. * $p < .05$. ** $p < .01$. *** $p < .001$. ICC = 0.145. "Audience Size" and "Moderator Activity" are scaled down by 1000. "Sess. Diversity" is abbreviated for session diversity, "Str. Diversity" for streamer diversity, "Mod x Gender" for the interaction of moderator activity and gender, and "Acct. Age" for streamers' account age.

RQ2 examined how male and female streamers differed in the number of streaming sessions, audience size, and moderator activity respectively. Male streamers streamed significantly more sessions than female streamers ($M_{male} = 19.7$, $M_{female} = 13.66$, $t = 2.7$, $p = .007$). Female streamers' sessions garnered almost seven fold the audience size of male streamers' sessions ($M_{male} = 232$, $M_{female} = 1489$, $t = -6.33$, $p < .001$) and had 46% more moderator activity than male streamers' ($M_{male} = 550.06$, $M_{female} = 801.73$, $t = -1.99$, $p = .063$).

Table 3. Mixed Effects Models for Subscriptions per Capita ($N_{streamer} = 326$, $N_{session} = 5620$)

<i>Predictors</i>	Model 1			Model 2		
	<i>Estimates</i>	<i>S.E.</i>	<i>t</i>	<i>Estimates</i>	<i>S.E.</i>	<i>t</i>
(Intercept)	1.57	0.35	4.47***	1.59	0.35	4.54***
Audience Size	-0.1	0.05	-2.22*	-0.09	0.04	-2.08*
Mod. Activity	0.47	0.02	27.57***	0.41	0.02	20.30***
Gender	1.01	0.28	3.6***	0.78	0.28	2.76**
Sess. Diversity	0.01	0.13	0.09	0.01	0.12	0.12
Str. Diversity	-0.01	0.12	-0.1	-0.01	0.12	-0.12
Mod x Gender				0.21	0.04	5.62***
Covariates						
Incentive	0.03	0.38	0.09	0.02	0.38	0.06
Duration	0	0	2.25*	0	0	2.34*
Session Count	-0.02	0.01	-3.15**	-0.02	0.01	-3.15**
Acct. Age	0	0	-1.83'	0	0	-1.8'
# Followers	0	0	-2.17*	0	0	-2.08*
σ^2	12.91			12.84		
τ_{00}	2.21			2.17		
AIC	30705			30676***		

Note. * $p < .05$. ** $p < .01$. *** $p < .001$. ICC = 0.137. "Audience Size" and "Moderator Activity" are scaled down by 1000. "Sess. Diversity" is abbreviated for session diversity, "Str. Diversity" for streamer diversity, "Mod x Gender" for the interaction of moderator activity and gender, and "Acct. Age" for streamers' account age.

RQ2d examined how male and female sessions differed in individual viewers' participation and RQ2e examined individual viewers' financial commitment. There were no gender differences in participation per capita (Coefficient = 1.26, $p = .89$) or bits per capita

(Coefficient = -5.78, $p = .50$), however, gender was significantly related to subscriptions per capita (Coefficient = 0.78, $p = .006$).

RQ3 examined whether gender moderated the relationship between moderator activity and individual viewers' a) participation and b) financial commitment. The interaction term of moderator activity and gender was not significant on participation per capita (Coefficient = 2.04, $p = .08$), but had a positive and significant relationship with subscriptions per capita (Coefficient = 0.21, $p < .001$), and bits per capita (Coefficient = 0.24, $p < .001$). In other words, for every additional 1000 moderator actions in Chat, female streamer sessions earned \$0.21 more in subscriptions per viewer, and \$0.24 more in bits per viewer than male streamer sessions.

Table 4. Mixed Effects Models for Bits per Capita ($N_{\text{streamer}} = 326$, $N_{\text{session}} = 5620$)

<i>Predictors</i>	Model 1			Model 2		
	<i>Estimates</i>	<i>S.E.</i>	<i>t</i>	<i>Estimates</i>	<i>S.E.</i>	<i>t</i>
(Intercept)	0.22	0.11	2.01*	0.24	0.11	2.29*
Audience Size	-2.08	1.45	-1.43	-1.36	1.42	-0.96
Mod. Activity	0.13	0.62	21.55***	6.47	0.72	9.00***
Gender	0.19	8.62	2.18*	-5.78	8.52	-0.68
Sess. Diversity	2.40	4.21	0.57	2.67	4.10	0.65
Str. Diversity	-1.55	3.60	-0.43	-1.7	3.51	-0.49
Mod x Gender				0.24	1.33	8.11***
<i>Covariates</i>						
Incentive	-7.50	0.13	-0.58	-8.72	0.13	-0.69
Duration	0.01	0	1.42	0.01	0	1.73'
Session Count	-.15	0.17	-0.89	-0.14	0.16	-0.87
Acct. Age	-0.01	0	-1.48	0	0	0.18
# Followers	0	0	-1.8	0	0	-1.54
σ^2	17313			16353		
τ_{00}	1658			1586		
AIC	71074			70757***		

Note. * $p < .05$. ** $p < .01$. *** $p < .001$. ICC = .084. "Audience Size" and "Moderator Activity" are scaled down by 1000. "Sess. Diversity" is abbreviated for session diversity, "Str. Diversity" for streamer diversity, "Mod x Gender" for the interaction of moderator activity and gender, and "Acct. Age" for streamers' account age.

RQ4 asked how content diversity related to a stream session's a) audience size and individual viewers' b) participation and b) financial commitment. Streamer content diversity was

not significantly related to audience size (Coefficient = -0.05, $p = .55$ and session content diversity was similarly not significant in relation to audience size (Coefficient = 0.02, $p = .48$).

Streamers' content diversity was not significantly related to participation per capita (Coefficient = 5.14, $p = .15$), subscriptions per capita (Coefficient = -0.01, $p = .91$), and bits per capita (Coefficient = -1.7, $p = .63$). Sessions' content diversity was also not significantly related to participation per capita (Coefficient = 6.52, $p = .09$), subscriptions per capita (Coefficient = 0.01, $p = .91$), and bits per capita (Coefficient = 2.67, $p = .52$).

Table 5. Mixed Effects Models Curvilinear Analysis ($N_{\text{streamer}} = 326$, $N_{\text{session}} = 5620$)

<i>Predictors</i>	Participation Per Capita		Subscriptions Per Capita		Bits Per Capita	
	<i>Estimates</i>	<i>t</i>	<i>Estimates</i>	<i>t</i>	<i>Estimates</i>	<i>t</i>
(Intercept)	0.38	3.59 ***	1.64	4.70***	0.25	2.38*
Audience Size						
Linear	-0.12	-4.16***	-0.31	-3.28**	-5.60	-1.76'
Quadratic	0.31	3.54***	.01	2.60**	0.15	1.49
Mod. Activity	0.20	31.93***	0.42	20.44***	6.55	9.09***
Gender	0.15	0.02	0.76	2.70**	-6.16	-0.73
Sess. Diversity	6.27	1.64	0.01	0.06	2.49	0.61
Str. Diversity	4.94	1.41	-0.01	-0.13	-1.72	-0.49
Mod x Gender	1.91	1.64	0.21	5.53***	0.24	18.04***
Covariates						
Incentive	0.18	1.55	0.02	0.04	-8.95	-0.71
Duration	0.01	1.82'	0	2.45*	0.01	1.78'
Session Count	-0.61	-3.65***	-0.02	-3.27**	-0.15	-0.95
Acct. Age	-0.01	-1.67'	0	-1.80'	0	-1.36
# Followers	0	-1.92'	0	-1.14	0	-0.92
σ^2	12199		12.84		16358	
τ_{00}	1974		2.13		1559	
AIC	69201***		30671**		70757	

Note. * $p < .05$. ** $p < .01$. *** $p < .001$. ICC = 0.145. "Audience Size" and "Moderator Activity" are scaled down by 1000. "Sess. Diversity" is abbreviated for session diversity, "Str. Diversity" for streamer diversity, "Mod x Gender" for the interaction of moderator activity and gender, and "Acct. Age" for streamers' account age. Models that examined the curvilinear relationship of audience size on participation per capita, $\chi^2(1) = 12.68$, $p < .001$ and subscriptions per capita, $\chi^2(1) = 6.85$, $p < .01$ fit significantly better than the linear mixed effect models, while there was no difference between the bits per capita models, $\chi^2(1) = 2.31$, $p = 0.13$.

2.7. Discussion

Guided by CEM and the heuristics of social influence used in prior OC research, this study examined how group context characteristics including audience size, moderator activities, gender, and content diversity influence viewers' active participation and commitment. Whereas larger audiences signal streamer popularity, there was greater social loafing in individual engagement. Moderator activity related to more individual participation and financial commitment, especially for female streamers, who financially benefited more, earning \$0.21 more in subscriptions per viewer, and \$0.24 more in bits per viewer for every additional 1000 moderator actions in Chat. Despite streaming less than men, female streamers attracted almost sevenfold the number of viewers and earned 2-3 times more financial contributions. Content diversity was not related to individual contributions.

It is important to note that, like all theories, CEM does not account for each and every viewers' motivation to watch SLSS streams and contribute to certain communities. For example, some viewers may have performative motivations and may contribute more in larger audiences where they can potentially exert more influence and garner more attention. Viewers may also be more motivated around crowd-based contributions rather than social interactions, copy/pasting Emotes or phrases based on other viewers' responses. For these individuals, CEM may not explain their behavior but rather social facilitation. In addition to viewer motivations, there are multiple ways in which viewers can behave and interact which this study did not examine. For example, viewers can "follow" a streamer, signaling interest and investment in future broadcasts that may not appear as involved or salient as Chat participation or subscribing. While this is another avenue for viewers to more passively participate, it was not considered in the scope of this study. Lastly, the salient group or community factors examined do not fully capture all the potential factors related to individual contributions which can become more complex when

factoring multimodality and subgroups as well as in-stream factors that capture streamer personality, degree of interaction with audience, quality of video production, and much more. Nevertheless, by examining these characteristics that provide group context and mutually influence the quality and quantity of viewer contributions, we can better understand the dynamics and patterns present in SLSS communities.

Larger Audiences, Smaller contributions

In line with prior research, this study demonstrated more social loafing in larger audiences (Jones et al., 2008; Karau & Williams, 2001). While large audiences, thousands of comments, and hundreds of dollars earned may serve as a heuristic measure of success, focusing on individual contributors per viewer is a better performance indicator when comparing across different communities. Large audiences will naturally result in greater participation, but as the results demonstrate, they come at the cost of diminishing individual participation and commitment. For streams with larger audiences, individuals may perceive their contribution to the group as inconsequential and instead opted out of more active participation in Chat. As chatrooms with larger audiences cannot support meaningful interpersonal interactions at the same frequency or quality as smaller audiences, this likely affected members' ability to build emotional bonds and attachments to the group (Kraut et al., 2020; Yang et al., 2017). As previously mentioned, another explanation for smaller individual contributions in larger audiences may be due to segmented audiences interacting on platforms outside of SLSSs during a live-stream. Similarly, more popular streamers with large audiences may signal the entertainment value of a stream to potential viewers who want to just watch without viewing or interaction in Chat. Despite these possibilities, this study highlights the importance of individual contributions as their influence on newcomer socialization and further viewer

contributions. Designers and streamers can segment audiences by employing subscriber-only chat rooms that reduce the amount of noise, reward committed members, and motivate others toward more visible participation (Hamilton et al., 2014).

Additional curvilinear analyses were run to account for both social loafing and social facilitation hypotheses relating to audience size. Participation per viewer consistently declined as audiences grew, however, started to rise again after reaching a threshold of 193 viewers. Similarly, subscriptions per capita consistently declined as audiences grew but started to rise again after reaching a threshold of 1,550 viewers. Audience size did not have a significant quadratic relationship with bits per capita. These findings imply that smaller communities may have more involved or stronger contributors, however as audiences grow, individuals may not contribute as much due to social loafing, different motivations that are not socially oriented, or because of multi-modal communication outside of the SLSS platform. However, after a certain threshold, the size of the audience may motivate more contributions, supporting social facilitation hypotheses. These findings potentially highlight the role of strong contributors in smaller communities as well as the influence passive viewers may have in larger communities. In making the presence of passive spectators more visible, individuals may be motivated to perform in front of audiences and contribute to the group.

Modelling Moderators

More moderator activity was related to more participation and financial commitment per viewer, implying moderators may have encouraged viewer contributions through their authority to model group norms, reinforce positive behaviors, and shape more cohesive communities, as well as their reciprocity in addressing viewers' questions and comments. The findings build on prior SLSS research that found that viewers imitated moderators significantly more than non-

moderators when posting spam, questions, and smiles (Seering, Kraut, & Dabbish, 2017). While the study sought to explore the potential social influence moderators have on the communities they govern, it is possible that increased moderator activity was a result or response to greater participation, whether by larger audiences or strong commenters. In fact, consistent and regular participation is the primary path to developing familiarity, recognition, and history with other stream community members (Hamilton et al., 2014). For many streamers, moderators are given their status just to distinguish them as regulars who engage communities by greeting viewers, answering questions, and reaching out personally to newcomers. (Hamilton et al., 2014). Considering how the most common route to becoming a moderator is through frequent and positive contributions (Wohn, 2019), it is possible that viewers contributed more either as regulars or in an attempt to become a regular and later a moderator. Given the mutual influence between moderator activity and viewer participation, causality cannot be asserted. Nevertheless, the findings provide insight into the instrumental role of moderators in engaging and maintaining participatory communities. Future studies should further examine the differences proactive moderation strategies have in driving viewer behavior compared to reactive moderation strategies that are driven by viewer behavior.

Female Streamers: Larger Audiences, More Moderation

The results suggest that gender is especially salient in live-streaming contexts that are primarily dominated by male streamers who tend to stream more often (Sjöblom et al., 2019). The majority of streamers in the sample were men, who also streamed significantly more sessions than female streamers but experienced diminishing returns for their effort in regard to audience size and financial capital. While female streamers were outnumbered, they were more popular and successful than male streamers, attracting audiences seven times larger and earning

2-3 times as much in subscriptions per capita and total number of bits. The scarcity of female streamers and their streaming session activity may have increased interest, especially for viewers who selectively watch streamers because of gender-stereotypes regarding their sociability and reciprocity (Gerber, 2017; Zimmer & Scheibe, 2019). Male viewers tend to have stronger motivations for “partnership seeking” than female viewers when watching live-streams and female SLSSs viewers do not chat with and reward streamers with gifts as often as men (Long & Tefertiller, 2020). This lack of visible participation from female viewers may further contribute scarcity perceptions on Twitch, driving interest in female streamers. It is important to note that the streamers in this study were sampled from the top 5 Twitch categories at the time of collection, 4 of which are video game titles. The perceived scarcity of female streamers in the male-dominated domain of both gaming and SLSSs may have driven viewership for those who selectively watch streamers because of their gender or gender-stereotypes regarding their sociability (Gerber, 2017; Zimmer & Scheibe, 2019). In this way, the perceived scarcity of female streamers may be further exacerbated by female viewers’ lack of visibility. While the possibility remains for streamer gender dynamics to differ in less popular categories, these findings demonstrate that across the top 5 streaming categories, visible female participation through streaming literally pays off.

At the same time, female streamers’ increased popularity and success may come with more misbehavior and gender-based harassment. Female streamers had 46% more moderator activity than male streamers and earned an additional \$0.21 in subscriptions per viewer and \$0.24 in bits per viewer for every 1000 actions done by moderators. Female streamers averaged 1257 more viewers in a session compared to male streamers which can translate to an additional \$264 total in subscriptions and \$301.68 total in bits donated. While the influence of moderator

activity may have motivated more contributions, especially for female streamers, it is possible that increased moderator activity emerged as a consequence of greater participation indicative of greater misbehavior, sexism, and gender-based harassment. In their study examining over one billion Twitch Chat messages, Nakandala and colleagues (2017) found that streamers' gender was significantly related to the types of messages received, with female streamers receiving more objectifying messages compared to male streamers who received more game-related messages. These findings were even more pronounced for popular female channels. In response to such misbehavior and subsequent moderation, female streamers may have received increased financial returns as a form of social support. Considering how the act of donating bits is called "cheering," viewers may have donated more bits in an attempt to counteract negative messages and support the streamer. No matter the direction of causality, female streamers' increased financial returns related to moderator activity may demonstrate moderator's role in mitigating misbehavior, promoting a safer space for the female streamers' communities, and signaling the desirability and quality of the community (Pellicone & Ahn, 2017; Ruberg et al., 2019). Female streamers may especially be interested in formalized moderation paths mentioned above to further motivate user contributions.

More or Less Content Diversity?

Content diversity at both the streamer and session level were not related to audience size nor individual participation and financial commitment. This could be due to the use of stream tags to measure content diversity, rather than distinct genres. As some streamers do not update tags throughout a session while other streamers only use generic tags unrelated to a distinct category (ie: "English" or "Family-friendly"), the measure may have been skewed. Session tags were categorized qualitatively into distinct genres to measure streamer and session content

diversity, however, this may have introduced certain biases against video-gaming streams. Because various video game titles were coded under “game related” streams, the measure did not capture the diversity within gaming-related content. Research examining content diversity should therefore explore qualitative methods to more accurately identify categories.

The lack of significance may also imply how both popular and less popular streamers stream a variety of content categories as a community outreach or retention strategy. Streaming diverse content may be perceived as a strategy to cater to a larger potential audience pool for both new and veteran streamers alike. While newcomers are generally encouraged to limit their content scope in order to first establish a community of followers who will then stick with the streamer when they later explore more diverse content (Pellicone & Ahn, 2017), some newcomers may attempt to leverage as many tags and categories as possible to expand their reach and potential viewership. Similarly, after building a strong viewer base, established streamers may stream more diverse content to enliven their community and expand their reach into tangential communities. The findings also indicate no difference in individual contributions across streamers’ content diversity, signaling another tradeoff for designers and streamers to consider. While focused content increases a group’s ability to attract new members and establish connections (Wang & Kraut, 2012), newcomers may struggle to participate in these tight-knit communities. As diverse content communities attract a wider audience pool, they may provide an entry point for newcomers to participate (Zhang et al., 2017) and may offer novel content that enlivens more homogenous communities. It is therefore essential to strike a balance between more niche or diverse content in order to attract newcomers while maintaining individual contributions for long-term success.

2.8. Limitations & Future Directions

The most significant limitation of the current study is the lack of causality, given the cross-sectional nature of the analysis. As the analysis examined a variety of streamers across the top 5 Twitch categories at the time of data collection, the findings may not hold for less popular categories. Additionally, data was collected during the COVID-19 pandemic when many countries issued stay-at-home orders. During this time, viewership over Twitch and the live-streaming industry increased substantially (Kastrenakes, 2020), with viewers likely seeking entertainment, distraction, and a sense of community as a coping mechanism (de Wit et al., 2020). A Twitch survey conducted during late 2019 found that Twitch helped the majority of participants cope during difficult life periods such as relationship issues, death of a loved one, or job loss and that Twitch became a larger part of their lives during the difficult period compared to regular viewing (de Wit et al., 2020). Increased viewership from new and returning viewers due to lockdown restrictions may have influenced their participation in Chat in addition to their relationship development with a streamer and their community. While attachment and financial commitment to a streamer may have increased as a result of individuals' social isolation, is it also possible that viewers financially contributed less compared to pre-pandemic levels due to future uncertainty, unemployment, and a shrinking global economy. Replication of this study is warranted to validate the findings and explore the potential influence COVID-19 may have had on both streamers' and viewers' behavior. Longitudinal research covering extended periods and across a large number of streamers and across live-streaming platforms is similarly warranted to generalize findings.

Additionally, the analysis consisted of English-speaking channels within Twitch, which is heavily skewed more towards American and Western audiences. While live-streaming practices have only more recently begun to enter into mainstream culture in North America, usage in

countries such as China has been more ubiquitous with more viewers and professional/full time streamers, and more diverse content streamed compared to North American or European streamers (Lu et al., 2018). Additionally, while American live-streamers have various avenues to generate revenue including ads, endorsements, subscription fees, and direct donations from viewers, Chinese live-streamers earn the majority of their revenue directly from viewers in the form of virtual gifts that can be converted back into cash proportionally by the streamer (Long & Tefertiller, 2020). Considering these differences and the influence they may have on interaction dynamics and whether individuals contribute in group contexts, further research should examine a variety of SLSS platforms both within and outside the Western-English speaking context. Second, viewers' financial commitment was calculated for a single month only, regardless of subscription durations.

Additionally, this study did not account for the various ways in which streamers can control the quantity and quality of comments on Chat. For example, streamers can opt for subscriber-only, follower-only, or Emote-only Chats which may influence how and how much individuals participate and subscribe. Future studies should therefore account for multimodality and Chat elements that streamers are able to control which may affect audience size and viewership behavior. Lastly, the analysis did not account for strong contributors and their influence on other viewers' contributions. Future fine-grain analyses of viewers in Chat may provide insight on gender differences, newcomer socialization and contributions compared to established members, identify strong commenters and their potential influence on other contributors, and the type of viewers and behaviors that are likely to be moderated.

2.9. Conclusion

SLSSs are an emerging genre of OC with salient group characteristics that influence individuals' viewership choices and stream contributions, both essential to a streamers' community growth. More specifically, this study examined audience size, moderator activity, a streamer's gender, and content diversity to their relationship to individuals' willingness to contribute to a group. Using CEM and social influence heuristics which include authority, reciprocity, scarcity, and similarity, the study found that the mutual influence between salient SLSS community or group factors and viewer behavior is complex, with multiple avenues for how individuals can be motivated toward or away from contributing to online communities. The collective effort model and heuristics of social influence that are well-supported in traditional OCs also hold true in understanding group factors related to individual viewer participation and financial commitment in SLSSs. Distinct overhead costs and diminishing returns in individual contributions were found for streamers with larger audiences. In contrast, moderator activity related to more individual contributions for all streamers, with female streamers financially benefiting more than male streamers. As more users rely on streaming technologies to create and maintain social relationships, streamers should consider trade-offs in their audience size, moderator activity, gender, and content diversity that may influence and be influenced by individual viewers' contributions. While the quantity of viewers has been a primary consideration for SLSS community growth, these results demonstrate the mutual influence of group characteristics on individual viewers' experience and contributions as an indicator of community quality and potential longevity.

Chapter 3: Twitch Use, Social Resources and Psychological Well-being

3.1. Introduction

The relationship between social media use (SMU) and PWB has long been scrutinized and discussed over the years, with the majority of prior research contextualized in platforms such as Facebook that primarily reflect existing offline social ties (see Meier & Reinecke, 2020 for review). Despite mixed conclusions, general research trends indicate a positive relationship between active participation and PWB and a negative relationship between passive participation and PWB (Liu, Baumeister, Yang, & Hu, 2019), with recent research emphasizing the importance of *how* people interact and *with whom* in predicting well-being outcomes (Burke & Kraut, 2016; Ernala et al., 2020). However, with increased interactivity, SLSSs have changed how users interact and the nature of their social relationships (Diwanji et al., 2020), leaving questions remaining as to how SLSS use relates to individuals' psychological well-being (PWB). Considering how viewers are motivated to continue viewing due to their perceived relationship with a streamer (Hu, Zhang, & Wang, 2017; Lim, Choe, Zhang, & Noh, 2020), it is imperative for researchers, designers, streamers, and viewers alike to understand whether these asymmetrical mediated ties, or parasocial relationships, are substantial in providing benefits to individuals' well-being.

Leveraging social capital and parasocial relationships as explanatory mechanisms, this study examines how active participation, passive participation, and financial commitment to a streamer on the leading SLSS, Twitch.tv, relate to individuals' psychological well-being. The 3 dimensions of social capital are applied to demonstrate how various social resources mediate the relationship between use and well-being. Data from 396 respondents was analyzed by comparing a fully saturated structural equation model with a similar model that included control variables. Findings indicate that SLSS users derive well-being benefits from actively participating in the

Chat of their favorite streamers' broadcasts, and that having close social interaction ties on Twitch benefit the well-being of actively participatory and financially committed members. While SLSSs environments provide optimal conditions for parasocial relationships to emerge, findings indicate that these asymmetrical relationships, or the perceived relational closeness with a streamer, are not substantial in providing well-being benefits to viewers.

This paper extends existing research on the relationship between media use and psychological well-being, being the first to examine the role of social resources in SLSS contexts. While more recent studies have emerged examining well-being of SLSS users, these have primarily been grounded in e-Sports or video game live-streaming contexts (Kim & Kim, 2020; Chen & Chang, 2019) or have focused on problematic or addictive use and their relationship to negative indicators such as depression and loneliness (Chen & Chang, 2019; Wan & Wu, 2020). Rather than demonstrating how use is related to individuals' psychological well-being, or how well a person is thriving psychologically, these negative indicators focus on psychopathology, or the severe disturbances to individuals' psychological functioning that often result in negative outcomes (Meier & Reinecke, 2020). Psychological well-being and psychopathology are not mutually exclusive -- the presence of one often doesn't indicate the absence of the other -- and are often empirically dissociated and sensitive to different factors (Meier & Reinecke, 2020). Additionally, these SLSS studies do not highlight the explanatory role of social resources, which have long been established as a key mechanism influential to psychological well-being (Burke et al., 2011; Ellison, Steinfeld, & Lampe, 2007; Joseph, 2020; Kim & Shen, 2020).

In examining the role of social resources in SLSSs --specifically viewers' social capital derived from their favorite streamers' community as a whole as well as viewers' parasocial

relationship with their favorite streamer—the study demonstrates how social interaction ties indirectly affect the relationship between active participation and well-being, and also demonstrate how financial commitment to a streamer can essentially pay for these social interaction ties and lead to downstream benefits to one’s well-being. Lastly, the following study considers the three dimensions of social capital that account for one’s social ties, degree of community identification, and their alignment with community values. While prior studies have examined social capital in light of network structure and related outcomes (Williams, 2006), measuring social capital as a social resource that considers the norms and values of the community may be more suitable for consumer-generated content communities (Bründl & Hess, 2016; Jeong, Ha, & Lee, 2020).

3.2. Social interactions in SLSSs

SLSSs enable users to broadcast or “live-stream” their own content in real time to interactive and responsive audiences who can in turn influence the broadcast with their suggestions, comments, and financial contributions (Carter & Egliston, 2018; Scheibe et al., 2016). With a focus on amateur content production and synchronous communication that facilitate greater intimacy and sociability, SLSSs support microcelebrity sub-communities and cultures that enable streamers to monetize their content and receive direct financial contributions from viewers (Johnson & Woodcock, 2019a). Below I outline SLSSs’ unique network structure and interaction affordances that set it apart from other social media platforms.

Researchers have examined social media and networking sites with a focus on tracing patterns of relations, the flow of information and resources, and the effects these networks, relations, and resources have on individual attitudes and behaviors (Garton, Haythornthwaite, & Wellman, 1997). A social network is a set of people or entities connected by some kind of social

relationship, such as a friendship, colleague, or information-provider. These relationships are described as “ties,” which vary in direction and strength. A tie can be symmetric (ie: Person A and Person B are mutually connected) or asymmetric or uni-directional (ie: Person A “follows” Person B only). Ties can also vary in strength, or the amount of time, emotional intensity and intimacy of a relationship, and are often referred to as “strong” and “weak” (Granovetter, 1973). Weak ties are characterized by relatively infrequent interactions and low levels of emotional closeness (Putnam, 2001) and help to facilitate information diffusion and access to diverse types of resources, helping to integrate smaller network clusters into larger social networks (Granovetter, 1974). In contrast, strong ties embody relationships with greater emotional intimacy, support, and more frequent interactions (Granovetter, 1973), and can provide emotional support and reinforce tight-knit group identities (Putnam, 2001).

Much like the majority of social media networks, SLSSs’ reflect a skewed distribution of weak ties apparent in influencer communities (Manago, Taylor, & Greenfield, 2012; Abidin, 2016). However, SLSSs are a richer form of media compared to other platforms, such as Facebook and Twitter, in that they carry more information that can facilitate better communication and relationship development amongst users (Sheer, 2011). Individuals often select certain media for certain relationships, with rich media often used with strong ties, and media that communicate fewer cues used with weak ties (Baym, Zhang, & Lin, 2004; Goodman-Deane et al., 2016). With both video and text-chat that afford more social cues and synchronous communication, individuals may experience heightened intimacy and perceived relational closeness with a streamer and one another. In fact, many viewers are motivated to continue their SLSS use due to their asymmetrical socioemotional bond with a streamer, or parasocial relationship, as well as their wishful identification with the streamer (Baek, Bae, & Jang, 2013;

Lim et al., 2020). In this way, the network structure and richer media affordances may create the perception of strong ties with a streamer that may have consequences on individuals' access to social resources and well-being.

SLSSs also afford a unique means of participation; rather than employing advertisements and sponsorships to generate revenue, streamers are able to monetize their content from viewers' direct financial contributions that are designed to encourage long-term financial and emotional support from viewers (Johnson & Woodcock, 2019a). Viewers can gain visibility and build connections not just by social interactions, but also by financial contributions, which may affect their access to social resources and have downstream consequences for their well-being.

Considering the increased intimacy between streamers and viewers and that different media are often used to communicate with different types of connections (Liu & Yang, 2016), use of SLSSs may affect relationships and yield differential outcomes onto individuals' psychological well-being.

3.3. Use & Psychological Well-being

Psychological well-being (PWB) reflects optimal psychological health and functioning based on an individual's positive relationships, sense of life purpose, self-acceptance, personal growth, autonomy, and mastery (Ryff & Keyes, 1995). A wealth of literature has examined how social media use (SMU) relates to PWB with early research focusing on general indicators such as time spent on a device or platform that neglected the specific actions users were engaged in (Ellison, Steinfield, & Lampe, 2011). More recently, researchers have highlighted the importance of specific activities in contributing to well-being outcomes (Burke & Kraut, 2016; Ernala et al., 2020). While some research examined active versus passive use (Verduyn et al., 2015; Escobar-Viera et al., 2018), directed communication versus consumption (Burke, Marlow, & Lento, 2010;

Burke & Kraut, 2016) or further examined active and passive use by degree of sociality (Gerson, Plagnol, & Corr, 2017), the key distinction lies in examining the interactivity and responsiveness between communication partners (Verduyn et al., 2017). Given the nuanced and complex relationship between usage and well-being across platforms, how individuals interact may indicate the directionality of their communication behaviors as well as the relational tie strength between communication partners that may differentially affect individuals' access to social resources. For example, receiving targeted and personalized communication such as a comment or message from strong ties were found to be associated with improvements in well-being while receiving one-click interactions such as "likes" from weak ties and viewing broadcasting content (even with strong ties) for a wide-audience such as an update or tweet were not (Burke & Kraut, 2016). Findings from this study suggest that actively using social media to connect and engage with strong ties lead to well-being benefits by increasing the perception of social support. In a similar vein, active social media use was found to be associated with lower depression while passive social media use was associated with increased depression (Escobar-Viera et al., 2018), indicating that active users may be engaging in activities that elicit emotional support from friends and acquaintances, leading to well-being improvements (Burke, Marlow, & Lento, 2010). Considering the degree of interactivity SLSSs afford and the unique affordances that enable financial support to flow directly from viewers to streamers, this study examines active participation, financial commitment to a streamer, and passive participation as means of SLSS interactions.

Active use encompasses activities that leave visible traces and facilitate direct interactions with others via commenting and posting (Verduyn et al., 2015; Verduyn et al., 2017). Within SLSSs, viewers can actively participate by commenting in a streamer's chatroom

or “Chat,” responding to other commenters, and by spamming “Emotes,” which are custom Twitch and streamer emojis imbued with their own meaning. In their meta-analysis, Meier & Reinecke (2020) found that interactions (replying, commenting, and liking) were positively related to overall well-being. Active participation in online activities have been associated with improved psychosocial outcomes (Verduyn et al., 2015; Escobar-Viera et al., 2018). As interactivity online is typically associated with improve well-being outcomes (Liu et al., 2019):

H1. Active participation will positively relate to psychological well-being.

Paying for premium services is strongly associated with active social behaviors in online communities; subscribers tend to have more connections and are often more participatory, with their payment contributing to an improved content experience (Oestreicher-Singer & Zalmanson, 2009). In SLSSs, viewers can engage in a more committed form of active participation by engaging in subscribing or donating behaviors that directly support a streamer. Research indicates that spending money on others may increase happiness and potentially enhance well-being (Dunn, Aknin, & Norton, 2014; Diener et al., 2018). Subscribers and donors can attach a custom message to their contribution that is highly visible on stream and often elicits a direct response from the streamer in-real-time. Financial contributions therefore provide a means to directly socialize and self-disclose with a streamer and reflect more effortful active participation beyond simply posting in Chat (Johnson & Woodcock, 2019a; Wohn, Freeman, & McLaughlin, 2018). Tamir and Mitchell (2012) demonstrated that individuals are willing to forgo money for the opportunity to disclose information about themselves to others which may lead to a response, liking, and possibly stronger social attachments and relationships. This act of self-disclosure or expressive writing, independent of social interaction, may itself promote psychological well-being (Pennebaker & Chung, 2011). Streamers’ responsiveness and acknowledgement of

financial contributors may further elicit feelings of trust, commitment, and closeness that may provide downstream benefits to well-being, similar to active participation. Therefore:

H2. Financial commitment will positively relate to psychological well-being.

Passive consumption is the most common activity on social media sites (Krasnova et al., 2013) and is related to decreased well-being (Meier & Reinecke, 2020; Verduyn et al., 2015). Passive use involves the monitoring or consumption of content without interactions and can include scrolling through a newsfeed or simply viewing content (Verduyn et al., 2017). While there has been robust support for the negative association between passive participation and PWB, often explained by social comparison and envy (Verduyn et al., 2017; Liu et al., 2019), the displacement hypothesis may be more appropriate for SLSS contexts. The displacement hypothesis predicts a negative association between time spent online and well-being; as time is inelastic, investing time in online spaces detracts or displaces time that would otherwise be spent investing in offline activities and relationships, leaving individuals feeling lonelier (Nie, 2001). Early research supported the displacement hypothesis with findings of greater Internet use associated with decreased social involvement and psychological well-being (Kraut et al., 1998). Specifically, spending time online browsing or passively using social media has been related to poorer well-being (Verduyn et al., 2015; Joseph, 2020). One study found that Facebook activity led to a deterioration of mood due to the perception of having wasted time (Sagioglou & Greitemeyer, 2014). Therefore:

H3. Passive participation will negatively relate to psychological well-being.

3.4. The Role of Social Capital

Social capital has notably been used to explain how use in certain media relate to PWB (see Spottswood & Wohn, 2020 for review). Social capital is the sum of actual and potential

resources embedded within and access through an individual's network of relationships (Nahapiet & Ghoshal, 1998). While social capital can take multiple forms, it always consists of a social structure and the individual actions taken within that structure (Coleman, 1988; Putnam, 2001). As individuals interact and strengthen their social relationships with a network, social capital is formed through these exchanges and creates value for the community (Arregle et al., 2007). In this way, social capital embodies the multiple resources that are derived from social relationships, such as norms of reciprocity and values systems (Tsai & Ghoshal, 1998; Putnam, 2001; Williams, 2006).

According to Nahapiet and Ghoshal (1998), social capital encompasses three distinct dimensions that capture the structural, relational, and cognitive aspects of social resources accessed from social ties. Prior research validated these measures, demonstrating their strength in capturing the dynamics of social capital in online brand and consumer-generated content communities (Bründl & Hess, 2016; Meek, et al., 2019; Jeong et al., 2020). While the structural dimension is tangible and can be observed by the impersonal configuration of network ties, the relational dimension captures the nature and quality of these relationships and the cognitive dimensions describes the wider social context of share language, goals, vision, and culture (Tsai & Ghoshal, 1998).

Structural social capital considers the social interaction ties or connections that create the network structure and provide individuals with access to information, knowledge, and other social resources. Within this dimension, many scholars have described these network ties by distinguishing between bonding and bridging social capital (Williams, 2006; Claridge, 2018).

While structural social capital describes the network relationships, relational social capital captures the quality of those relationships. As individuals interact over time, their relationships with other group members may deepen to reflect trust, norms and sanction, obligations and expectations, and identity and identification that comprise the relational dimension (Nahapiet & Ghoshal, 1998). Relational social capital encourages normative group behavior and relational cohesion based on trust, reciprocity, and a shared identity but is distinct from these concepts individually. At its core, relational social capital captures associability, or the willingness to prioritize collective goals over individual goals (Lazarova & Taylor, 2009; Claridge, 2018). As relational social capital develops over a history of social interactions, so does the cognitive dimension. While relational social capital captures the quality of social interaction ties, cognitive social capital describes the wider social context manifested in shared representations, interpretations, and meaning with a group (Nahapiet & Ghoshal, 1998). Cognitive social capital captures the systems of meaning generated by communities, including common vocabulary and shared goals, vision, and values that allow a common understanding of community norms (Nahapiet & Ghosal, 1998). Some scholars have described cognitive social capital as shared culture in reference to how norms of behavior govern behavior and relationships (Inkpen & Tsang, 2005), however, rather than capture broader cultural practices as a whole, cognitive social capital often manifests as specific language and shared codes within a community that may have different or no meaning outside of that community (Ansari et al., 2012). Despite their distinct definitions, the three dimensions of social capital are highly interconnected and mutually reinforcing and may therefore be difficult to fully separate (Claridge, 2018).

As a result, the structural dimension can be considered an antecedent to both the cognitive and relational dimensions (Tsai & Ghosal, 1998). Social interactions and resulting connections are required for the development of relational and cognitive social capital which may further reinforce and develop structural social capital by providing common ground and mutual trust and identification which may motivate interactions and the formation of new relationships (Claridge, 2018). Indeed, making new connections is a common motivator for participation across online communities (Brandtzæg & Heim, 2009). While viewers have many intrinsic motivations for participating in SLSSs, chief among them are social motivations (Bründl & Hess, 2016; Hilvert-Bruce et al., 2018). As individuals actively participate in a streamers' Chat, they are likely to develop more social connections, or structural social capital within that community. When engaged in responsive live environments, users may experience a sense of immersion and emotional connectedness with the streamer and other viewers who are participating in real-time conversations over Chat (Lim et al., 2020). Individuals' participation and shared experiences within the community may further foster a sense of community and relational closeness with other members, captured by relational social capital (Hilvert-Bruce et al., 2018). As socialization and enculturation progresses, individuals internalize shared meanings, values, and community goals, or cognitive social capital (Chang & Hsu, 2016). Chat in SLSSs often employ short-hand communication via meaningful Emotes that are often used in response to certain events. This shared language, meaning, and values are shared within the community and may distinguish ingroup fans or members from casual spectators who may not understand (Carter & Eglinton, 2018). Considering how close relationships are imperative to well-being (Valkenburg & Peter, 2007), more social interaction ties, shared community norms

and identity, as well as common language and values may satisfy individuals' inherent need to belong which may positively affect their PWB (Baumeister & Leary, 1995). Therefore:

H4. Active participation will positively relate to a) structural social capital, b) relational social capital, and c) cognitive social capital.

H5. a) Structural social capital, b) relational social capital, and c) cognitive social capital will positively relate to psychological well-being.

H6. a) Structural social capital, b) relational social capital, and c) cognitive social capital will positively mediate the relationship between active participation and psychological well-being.

Previous research has suggested that all three dimensions of social capital can affect the amount of content contribution in online communities, with social capital often concentrated among highly involved and participatory members (Wasko & Faraj, 2005; Chiu, Hsu, & Wang, 2006). Subscribers tend to have more friends and connections to a virtual community; they tend to post more, lead more groups, and create more content (Oestreicher-Singer & Zalmanson, 2009). This increase in commitment and involvement may essentially pay for social connections, or structural social capital, and help users gain visibility and access to other social resources, supporting prior assertions that different forms of capital can be converted into one another, with economic capital leading to access to social capital (Coleman, 1988). Additionally, considering subscribers and donors can send a custom message to the streamer with their financial contribution, this act of directed communication may reflect a closer attachment to the streamer, as well as greater shared identification and values with the streamer, thereby relating to an increase in relational and cognitive social capital. In their study of social capital and well-being on Facebook, Burke, Marlow, and Lento (2010) found that directed communication with close

ties is related to increased social capital and lower loneliness. Financial contributions may provide quicker access to social capital and its benefits than social interactions alone. Payment can materialize as a form of emotional support to the streamer (Wohn, Freeman, & McLaughlin, 2018); as viewers become more invested in their perceived relationship with their favorite streamer, they may desire to reciprocate or give back to the streamer (Diwanji et al., 2020). Becoming a paying member may aid in the maintenance of viewers' social ties to the streamer and community, signifying stronger commitment to the streamer and their values. Direct payments to SLSS streamers often accompany premium and exclusive content ranging from specialized Emotes, subscriber-only Chats, ad-free viewing experiences, and badges that signal relational investment to the streamer and other viewers. Financial commitment may help highly participatory members build their reputation and garner the attention of the streamer that may eventually lead to community administrator or moderator status (Wohn, 2019). In this way, paying and highly participatory members develop greater cognitive social capital, tangibly supporting a streamer's vision for their community and acting as informal and formal moderators to ensure the language, goals, and norms of the community are maintained. Considering how those who use SNS more intensely receive increased social capital and social resources (Meier & Reinecke, 2020):

H7. Financial commitment will positively relate to a) structural social capital, b) relational social capital, and c) cognitive social capital.

H8. a) Structural social capital, b) relational social capital, and c) cognitive social capital will positively mediate the relationship between financial commitment and psychological well-being.

As passive viewers merely monitor or consume content without interactions (Verduyn et al., 2017), they may not have the same access to the social connections or support of active or paying viewers. Central to structural social capital, interactions enable access to social resources; without purposive action, these potential resources remain unrealized (Lin, 2008). While passive and active participation are not mutually exclusive in that individuals can both passively view a broadcast for the majority of a live-stream and intermittently participate over Chat, greater passive consumption may not lead to the social connections and benefits that accompany more active participation. Therefore,

H9. Passive participation will negatively relate to structural social capital.

However, even without direct or active participation, individuals may still experience gains in other dimensions of social capital. Passive participation is still just that -- participation to a limited capacity -- which is still more active than those who do not attend a streaming session. In being present and witnessing the interactions between the streamer and other viewers, passive participants may experience emotional connectedness and engagement from the fast-moving Chat and social interactions amongst members (Lim et al., 2020). Some studies suggest that passive members do not feel alienated or disconnected from their social institutions and may still reap benefits that are embedded within their groups (Wollebaek & Selle, 2003). Lakey and colleagues (2014) found that merely observing other people's conversations and activities may elicit positive affect and perceived support. These passive members may still feel a sense of community and mutual identification by watching others which may aid in the development of their relational social capital. This emotional connectedness may reinforce a shared sense of social identity, so that just by tuning in, passive viewers can affiliate themselves with the community. A recent study found that SLSS viewers that experienced flow, or the act of total

concentration and enjoyment, reported greater satisfaction with their experience. In turn, satisfaction enhanced respondents' social well-being and decreased feelings of loneliness (Kim & Kim, 2020). Passive spectators may experience emotional connectedness and immersion or flow, which may aid in their socialization of shared community representations, language, and values, or cognitive social capital. As passive viewers observe, they slowly acculturate themselves and gather discursive tools which may eventually motivate them toward more visible and active participation (Georgen et al., 2015). In this way, passive viewers may still be able to experience benefits in relational social capital and cognitive social capital. With this in mind:

RQ1. How does passive participation relate to a) relational social capital and b) cognitive social capital?

RQ2. How do the three dimensions of social capital mediate the relationship between passive participation and psychological well-being?

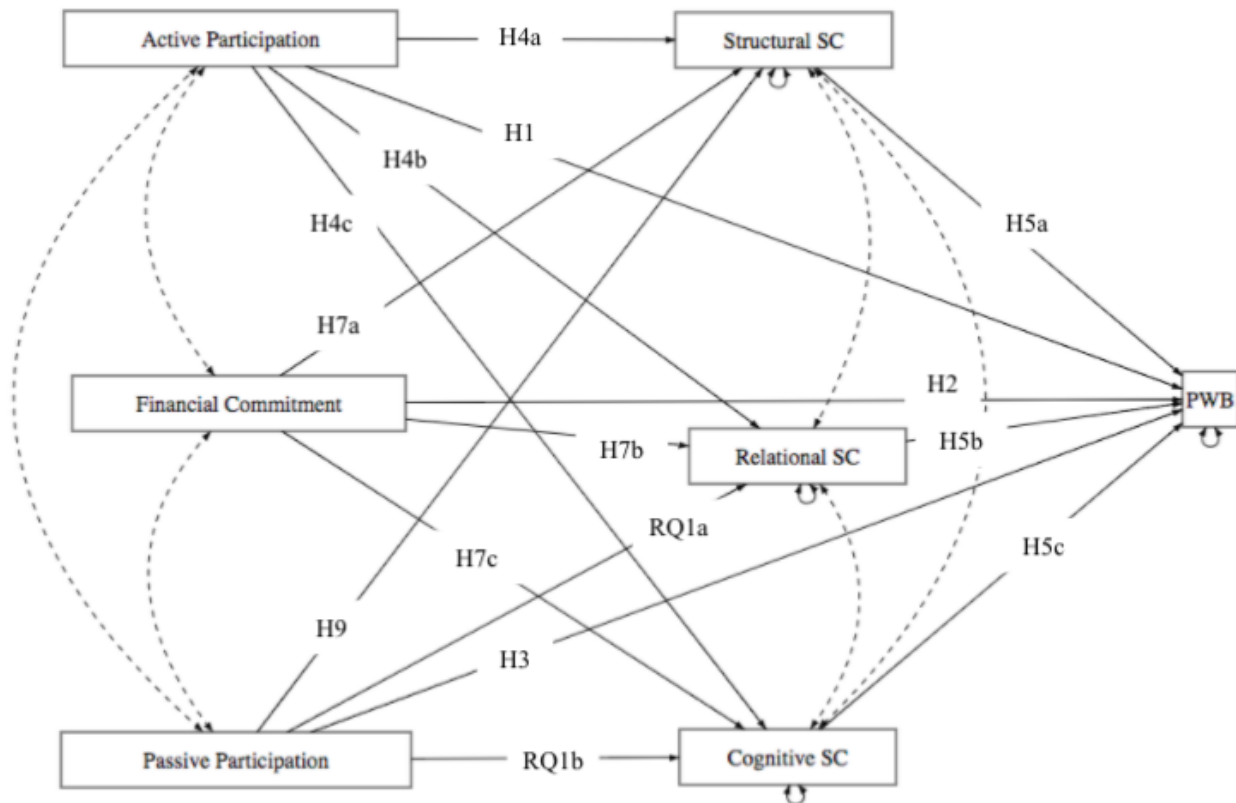


Figure 2. Visual depiction of social capital hypotheses and research questions, excluding hypotheses predicting 3-dimensions of social capital as mediators between active participation and PWB (H6a, b, c), 3-dimensions of social capital as mediators between financial commitment and PWB (H8a, b, c), and a research question examining 3-dimensions of social capital as mediators between passive participation and PBW (RQ2).

3.5. The Role of Parasocial Relationship

While social capital has been the dominant theory used in prior research, it has primarily applied to social media sites where users have mutual ties and relationships with one another (Ding, Qiu, & Li, 2012). As SLSSs primarily reflect asymmetric social connections between viewers and the streamer they watch, parasocial relationships may capture the social resources generated from these unique ties.

Parasocial relationship (PSR) is an enduring asymmetrical relationship based on repeated encounters during which a user forms a socioemotional bond with a mediated performer (Horton & Wohl, 1956; Dibble, Hartmann, & Rosaen, 2016). A media performer may encourage the development of parasocial relationships with viewers by using conversational and informal communication and gestures within a face-to-face setting that emulates interpersonal communication and interactivity (Horton & Wohl, 1956). Over time, users may perceive the media personality as directly interacting with them as an individual which in turn may increase emotional bonding and the feeling of intimately “knowing” the media personality (Ding et al., 2012). Horton and Wohl (1956) stipulated that due to the asymmetric nature in which a performer is not aware of the audience nor their reactions, parasocial relationships must be contingent upon the audience successfully forming an illusion of a face-to-face relationship with a performer. Due to the interactive nature of communication on live-streaming platforms, this relationship is no longer completely illusory as live-streamers are encouraged to interact directly with their viewers in real time (Hou, Guan, Li, & Chong, 2019). This increase in interactivity

and mutual awareness facilitates the development of parasocial relationships more so than most other media (Lim, Choe, Zhang, & Noh, 2020). PSR with a streamer has shown to be related to media enjoyment (Wulf, Schneider, & Beckert, 2020), loyalty through intention to continue viewing content (Hu, Zhang, & Wang, 2017; Lim, Choe, Zhang, & Noh, 2020), and willingness to provide financial support to a streamer (Wohn, Freeman, & McLaughlin, 2018).

Research examining the role of parasocial relationships on PWB is scarce with conflicting findings (Hartman, 2016). The asymmetric nature of parasocial relationships may hurt an individual's social capital and increase loneliness (Burke, Marlow, & Lento, 2010) and may be an unsatisfactory way to compensate for a lack of symmetrical relationships (Hartmann, 2016). One study found a dependency on PSR was positively related to negative indicators of well-being that include loneliness and social networking addiction, with the relational reciprocity a key determinant in whether social media use enhanced or harmed PWB (Baek, Bae, & Jang, 2013). This is likely explained by the compensation hypothesis where those who may not have substantial social relationships seek out illusory and asymmetric ones to compensate for their own deficiencies (Hartman, 2016).

On the other hand, PSR may positively relate to PWB by satisfying one's need to belong (Hartmann, 2016), which can occur when social interactions are pleasant and occur within a relational context characterized by stability, mutual concern, and intention to continue a relationship (Baumeister & Leary, 1995). This need to belong is closely tied to well-being and if satisfied, promotes subjective well-being (Hartmann, 2016). Studies show that mediated partners are social partners that people respond to in a similar manner if encountered face-to-face (Giles, 2002). Interactions with a mediated other may trigger enjoyment or the perception of social support which in turn, improves well-being (Lakey et al., 2014; Hartmann, 2016). Therefore, the

intimate and mediated nature of SLSSs that simulate face-to-face interactions may result in the perception of closeness and familiarity between viewers and a streamer, which may provide benefits to well-being.

RQ3. Does PSR mediate the relationship between Twitch use and psychological well-being?

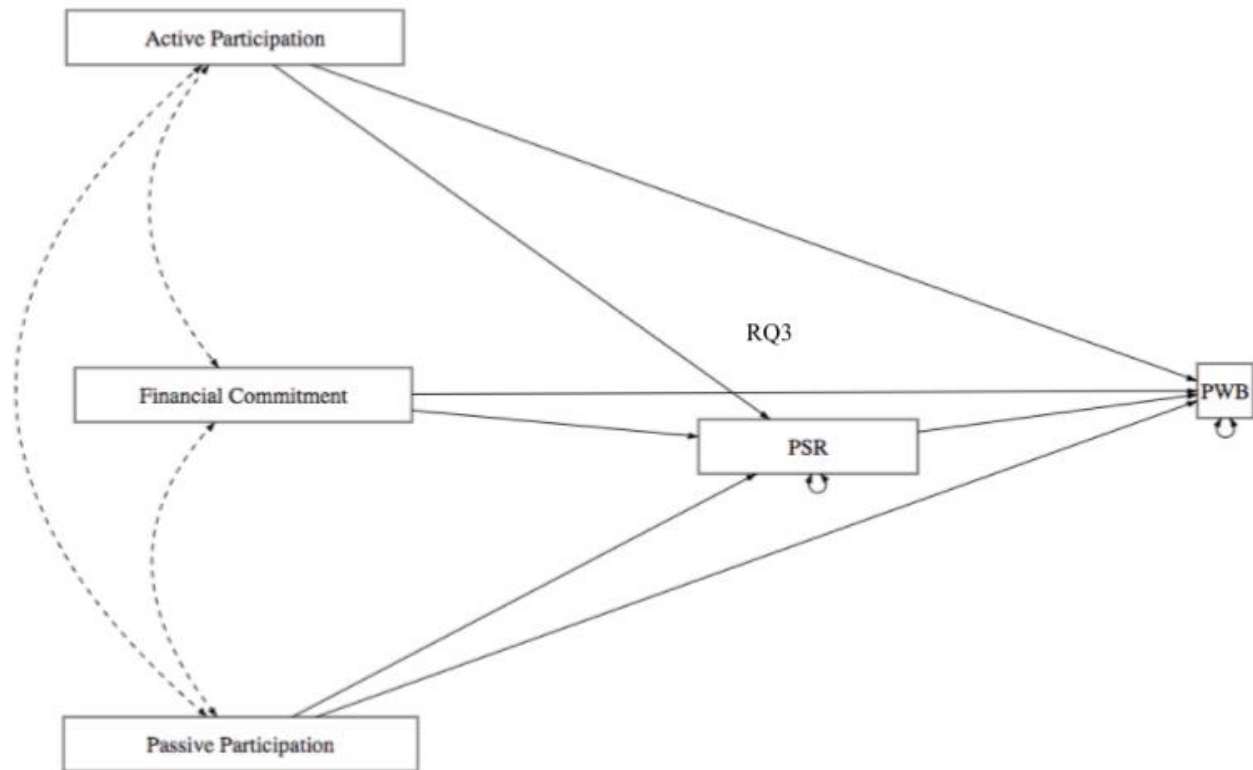


Figure 3. Visual depiction of parasocial relationship research question (RQ3).

3.6. Methods

Measures

Psychological well-being. PWB was measured using the Brief Inventory of Thriving (BIT) (Su, Tay, & Diener, 2014). Created to synthesize the well-being literature, BIT accounts for all the core subdimensions of positive psychological health and functioning. Specifically, BIT captures subjective well-being or the feeling of satisfaction, supportive positive relationships,

interest in daily activities, sense of accomplishment, autonomy, meaning in life, and optimism (Su et al., 2014). Ten items measured participants' PWB with a 5-point Likert scale where 1 = strongly disagree and 5 = strongly agree. Sample items include, "I feel a sense of belonging in my community," "I can succeed if I put my mind to it," and "I am optimistic about my future." This scale was reliable ($\alpha = .93$).

Social capital. Structural social capital was measured using the Chui and colleagues' (2006) sub-scale for structural social capital. Four items measured the social interaction ties along a 5-point Likert scale that ranged from strongly disagree (1) to strongly agree (5). Sample items include, "I maintain close social relationships with other Twitch users who watch {favorite streamer}'s channel," and "I have frequent communication with some Twitch users who watch {favorite streamer}'s channel." The scale was reliable ($\alpha = .908$). Relational social capital was measured using Chiu and colleague's (2006) subscale for relational social capital that measured identification with the community using four items measured at a similar scale and range. Items include, "I feel a sense of belonging toward {favorite streamer}'s Twitch channel," and "I am proud to be a viewer of {favorite streamer}'s Twitch channel. This scale was reliable ($\alpha = .848$). Cognitive social capital was measured using Lin and Lu's (2011) subscale that was adapted from Chiu and colleagues (2006) cognitive social capital scale. This captured the shared values between viewers and their favorite Twitch streamer with items such as, "{Favorite streamer}'s Twitch channel activities are in line with my personal values," and "I agree with what {favorite streamer}'s Twitch channel considers to be important." This scale was reliable ($\alpha = .88$).

Parasocial relationship. Thirteen items measured participants' parasocial relationship with their favorite streamer, using Wulf and colleagues' (2020) adaptation of Hartmann and colleagues' (2008) positive PSR scale for Twitch. The scale measures the intimacy of the

perceived relationship as well as viewer's interest in the media figure. Sample items include, "My favorite Twitch streamer makes me feel as comfortable as when I am with friends," and "I would like to meet my favorite Twitch streamer in person." The scale was reliable ($\alpha = .87$).

Participation. Participation was distinguished by active participation, passive participation, and financial commitment given to participants' favorite streamer. Currently one of the only validated measures of passive and active use is the Passive Active Use Measure (PAUM; Gerson, Plagnol & Corr, 2017). Originally created for Facebook use, the PAUM categorized various Facebook activities as active or passive use, asking respondents to self-report how frequently they engaged in each activity (Trifiro & Gerson, 2019). Escobar-Viera and colleagues (2018) utilized a similar scale originally developed to measure general internet use but assessed various activities across any social media site that were later categorized into active and passive media usage. For the purpose of this study, various Twitch activities and behaviors were delineated into active or passive behaviors taken while watching respondents' favorite streamer. Active use included "Commenting directly to the streamer," "Responding or Reacting," and "Spamming Emotes" which were answered on a 5-point Likert scale ranging from "Never (0% of the time)" to "Very frequently (100% of the time)." Passive participation items included, "Reading Twitch Chat," also answered on a 5-point Likert scale ranging from "Never (0% of the time)" to "Very frequently (100% of the time)." Financial commitment was measured as the total amount of money given to their favorite streamer, accounting for the number of months subscribed, tier plan and price of subscription, as well as the dollar amount of bits donated over Twitch. Respondents were asked whether they had ever subscribed or are currently subscribed to their favorite streamer. If they responded yes, they were asked for how

many months and at what Tier plan. Similarly, respondents were asked whether they had donated to their favorite streamer and were asked to estimate the dollar amount.

Control Variables. The following variables were controlled for: the amount of time (in hours) respondents spent watching their favorite streamer in the last week. Perceived offline social support was measured using the Interpersonal Support Evaluation List (ISEL-12) (Cohen et al., 1985) and was reliable ($\alpha = .90$). Additional variables included respondents' education, sex, and a measure of the extent that health issues (mental and physical) affected respondents' daily life for over a week (from "Never" to "Frequently"), all of which may affect users' well-being.

Participants and procedure

A screening survey was administered to 980 participants over Prolific.co to identify eligible participants within the U.S. Participants were compensated \$0.15 for completing the 2-minute screener. 665 respondents who were 18+ years of age and had a Twitch account that was active in the past month were then invited to participate in the full survey. 427 participants completed the survey during February 2021. Participants first reported their PWB, answered questions regarding their perceived offline social support, then were asked specific questions about their favorite individual streamer (excluding group, eSport, and developer channels), including the degree of parasocial relationship, social capital resources. The survey then asked respondents about the time spent watching their favorite streamer in the past week, the passive and active behaviors they engaged in while watching their favorite streamer in the last week, whether they had subscribed and/or donated to the streamer ever (and if so, how much / at what tier and for how long), as well as information regarding their account age and number of streamers they follow. Lastly, respondents were asked questions on their demographic

information and health status. An optional question requested respondents' Twitch ID to verify their account.

A total of 21 responses were excluded from the analysis; 14 participants failed the attention check and 17 participants responded with false streamer information that did not comply with question requirements, resulting in a final sample size of 396 participants. Participants were compensated \$2.90 for completing the 15 minute survey. Data were de-identified prior to analysis.

68% of participants identified as male, 28% as female, 3% as non-binary, and 1% preferred not to identify. 36% experience occasional or frequent health issues that impact their day-to-day lives, 61% reported seldom to no issues with their health, and 3% preferred not to disclose. Respondents spent an average of 9.592 hours on Twitch per week (*Median* = 5, *SD* = 11.75) and contributed \$21.57 to their favorite streamer in total since first subscribing or following (*Median* = 4.99, *SD* = 45.32).

Analysis

Structural Equation Modeling (SEM) was used to analyze the data, using the *lavaan* package (Rosseel, 2012) in *R* and bias-corrected 95% bootstrapped confidence intervals (CI) based on 5000 resamples. After calculating the reliability of the observed variables, two structural equation models were run for each proposed mediator, one that was the baseline model (see Fig. 1, 2), and the second that added control variables including time spent, perceived social support, education, health, and sex. As the models are fully saturated, meaning all variances and covariances of the variables are estimated as model parameters, goodness of fit measures such as Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) were equivalent across models.

Additional analyses factored employment status as another covariate was run on a sample of 257 respondents due to missing data for 139 other respondents. 32% of this sample were employed full-time, 30% were unemployed (and job seeking), 17% were employed part-time, 12% were not involved in paid work (e.g. homemaker, retired, or disabled), and the remaining 9% reported “Other.” Employment status was not significantly related to structural social capital (β [bootstrap 95% CI] = .045 [-.029, .123], $Z = 1.137$), relational social capital (β [bootstrap 95% CI] = .026 [-.039, .082], $Z = .858$), cognitive social capital (β [bootstrap 95% CI] = .002 [-.059, .057], $Z = .058$), parasocial relationship (β [bootstrap 95% CI] = .009 [-.042, .060], $Z = .362$), nor psychological well-being (β [bootstrap 95% CI] = .017 [-.033, .066], $Z = .025$). As the addition of Employment Status only explained an additional 1% more variance on average, this variable was excluded from the final analyses reported below (see Appendix for Model Results).

3.7. Results

Goodness of fit was assessed using R-Squared. For the social capital models, there was a (Δ) R^2 of .43 in PWB, .02 in structural social capital, .06 in relational social capital, and .04 in cognitive social capital. In other words, model 2 explained 43% more variance in PWB, 2% more variance in structural social capital, 6% more variance in relational social capital, and 4% more variance in cognitive social capital. For the PSR models, there was a (Δ) R^2 of .38 in PWB and .01 in PSR, meaning model 2 explained almost 38% more variance in PWB, and 1% more variance in PSR. Model 2 results for social capital and PSR are therefore reported below to address the proposed hypotheses and research questions.

H1 predicted active participation will be positively related to PWB. This relationship was significant (β [bootstrap 95% CI] = .089 [.003, .174], $Z = 2.028$), confirming the direct relationship between active participation and psychological welling. H2 similarly predicted a

positive direct relationship between financial commitment and PWB, however, this was not significant (β [bootstrap 95% CI] = 0 [-.192, .152], $Z = .005$). H3 predicted a negative direct relationship between passive participation and PWB, however, this was also not significant (β [bootstrap 95% CI] = -.01 [-.08, .057], $Z = -.291$).

H4 predicted active participation will positively relate to a) structural social capital, b) relational social capital, and c) cognitive social capital. Active participation was significantly related to structural social capital (β [bootstrap 95% CI] = .528 [.385, .665], $Z = 7.459$) and relational social capital (β [bootstrap 95% CI] = .236 [.133, .331], $Z = 4.668$), but was not a significant factor onto cognitive social capital (β [bootstrap 95% CI] = .094 [-.004, .195], $Z = 1.911$). H4a and H4b were therefore confirmed while H4c was disconfirmed.

H5 predicted the three dimensions of social capital will positively relate to PWB. Structural social capital was positively related to PWB (β [bootstrap 95% CI] = .086 [.021, .153], $Z = 2.485$), while cognitive social capital was negatively related to PWB (β [bootstrap 95% CI] = -.111 [-.206, -.011], $Z = -2.256$). Relational social capital was not significantly related to PWB (β [bootstrap 95% CI] = .055 [-.039, .144], $Z = 1.182$).

H6 predicted the three dimensions of social capital will positively mediate the relationship between active participation and PWB. Structural social capital was a significant mediator (β [bootstrap 95% CI] = .045 [.012, .089], $Z = 2.273$) between active participation and PWB, but relational social capital (β [bootstrap 95% CI] = .013 [-.009, .038], $Z = 1.104$) and cognitive social capital (β [bootstrap 95% CI] = -.011 [-.033, .000], $Z = -1.333$) were not significant mediators.

H7 predicted financial commitment will positively relate to a) structural social capital, b) relational social capital, and c) cognitive social capital. Financial commitment was significantly

related to structural social capital (β [bootstrap 95% CI] = .272 [.017, .607], $Z = 1.852$) and relational social capital (β [bootstrap 95% CI] = .262 [.084, .466], $Z = 2.737$), but was not a significant factor onto cognitive social capital (β [bootstrap 95% CI] = .151 [-.012, .339], $Z = 1.705$). H7a and H7b were therefore confirmed while H7c was disconfirmed.

H8 predicted the three dimensions of social capital will positively mediate the relationship between financial commitment and PWB. Structural social capital was a significant mediator (β [bootstrap 95% CI] = .023 [.002, .070], $Z = 1.456$), but relational social capital (β [bootstrap 95% CI] = .014 [-.008, .050], $Z = 0.985$) and cognitive social capital (β [bootstrap 95% CI] = -.017 [-.052, .000], $Z = -1.316$) did not significantly mediate the relationship between financial commitment and PWB.

H9 predicted passive participation will negatively relate to structural capital. This relationship was not significant (β [bootstrap 95% CI] = -.073 [-.186, .042], $Z = -1.262$), disconfirming H9. RQ1 examined how passive participation relates to a) relational social capital and b) cognitive social capital. Passive participation was positively associated with relational social capital (β [bootstrap 95% CI] = .108 [.006, .211], $Z = 2.085$), but was not significantly related to cognitive social capital (β [bootstrap 95% CI] = .006 [-.022, .156], $Z = 1.443$).

RQ2 examined how the three dimensions of social capital mediate the relationship between passive participation and PWB. Structural social capital (β [bootstrap 95% CI] = -.006 [-.023, .002], $Z = -1.058$), relational social capital (β [bootstrap 95% CI] = .006 [-.002, .023], $Z = .994$), and cognitive social capital (β [bootstrap 95% CI] = -.007 [-.026, .001], $Z = 2.273$) did not mediate the relationship between passive participation and PWB.

RQ3 examined whether PSR mediated the relationship between Twitch use and PWB. While active participation was significantly related to PSR (β [bootstrap 95% CI] = .18 [.102,

.259], $Z = 4.485$), PSR did not mediate the relationship between active participation and PWB (β [bootstrap 95% CI] = .006 [-.012, .027], $Z = .594$), financial commitment and PWB (β [bootstrap 95% CI] = .002 [-.003, .014], $Z = .51$), nor passive participation and PWB (β [bootstrap 95% CI] = .005 [-.008, .032], $Z = .5$).

3.8. Discussion

Highlighting the influence of social capital and PSR, this study examines how use in the popular SLSS, Twitch.tv, relates to viewers' psychological well-being. Findings demonstrate active participants report significantly greater PWB, partially explained by their structural social capital, or social interaction ties within the community. Individuals who financially contributed more to their favorite streamer also reaped PWB benefits by way of their social ties.

Interestingly, individuals who reported having greater shared values with their favorite streamer experienced declines in their PWB. Ultimately, while structural social capital explained the relationship between active use and positive PWB, and financial commitment and PWB, shared identity and values with a streamer as well as parasocial relationship between individuals and their favorite streamer were not instrumental to participants' PWB. This study reveals the importance of actively participating in a favorite streamers' SLSS community to provide social interaction ties who may provide psychological benefits to SLSS users' overall health and wellbeing.

Active Use Promotes PWB

In line with prior research in social media contexts, active SLSS use was directly related to increased PWB (Verduyn et al., 2017; Meier & Reinecke, 2020), even after controlling for demographic variables, perceived offline social support, and health status. Active social media use can provide opportunities to connect and maintain social relationships that yield positive

outcomes for individuals' PWB (Ellison et al., 2007). Actively participating in SLSS Chat may yield PWB benefits by fulfilling individuals' personal integrative or self-presentation needs (Hsu, Tien, Lin, & Chang, 2015). Expressing oneself through SLSS Chats may serve a self-affirming purpose for viewers (Toma & Hancock, 2013), with the immediate nature of Chat feedback facilitating the receipt of emotional rewards or online social support (Reinecke & Trepte, 2014). At the same time, it is also possible that individuals who are more psychologically healthy actively participate more in Chat compared to individuals with lower PWB. Individuals with higher PWB may have robust offline social networks that provide social support and supplement these social interactions with SLSS activities, reflecting Bekalu and colleagues (2019) findings that SLSS integration into social routines is related to greater well-being, mental health, and health outcomes. Future research should employ longitudinal analysis to better ascertain directions of causality.

The Benefits Social Interaction Ties

Structural social capital was the only dimension that mediated the positive relationship between active participation and PWB, as well as financial commitment and PWB. As users are motivated to use SLSSs for their interactive and increased sociability (Hilvert-Bruce et al., 2018), it is understandable how more active or committed actions taken during individuals' favorite streamers' live-session may facilitate stronger connections that bring foster social support and feelings of community. An alternative explanation is that individuals with higher PWB may have existing offline friendships that are also present and actively involved in a favorite streamer's channel. As perceived offline social support was a significant covariate that was positively related to structural social capital, relational social capital, and PWB, it is possible that individuals with high PWB have strong social networks that may share their SLSS interests.

It is also possible that those with higher PWB may have more time or disposable income that enable them to actively participate and financially contribute more which may more easily facilitate connections on SLSSs. While additional analyses in this study examined employment status as a heuristic indicator of income, it was not significant. Future studies should collect income in order to discern its influence on individuals' financial contributions and well-being.

While relational and cognitive social capital are important in capturing other social resources created from social interactions and relationships, the findings demonstrate that they do not provide tangible benefits to individuals' PWB. Similarly, while a parasocial relationship provides viewers with a sense of closeness with the streamer, this perceived social relationship does not compensate for real social interaction ties and does not provide psychological well-being benefits. While PSR, relational social capital, and cognitive social capital may not explain the relationship between use and PWB, these are important factors to consider when assessing viewers' relationship and support of streamers (Lim et al., 2020; Wohn et al., 2018). Future research should further examine how use relates to the three dimensions of social capital as social resources.

Cognitive Social Capital, Decreased PWB?

Interestingly, more cognitive social capital was related to decreased PWB. As cognitive social capital relates to the shared values or vision with the streamer and their community (Lin & Lu, 2011), it is possible that individuals who report greater alignment with a streamer's goals may be displacing time investment away from their own. A recent survey of American adults found that individuals with greater reliance on social media, indicative of problematic social media dependency, reported lower social well-being, positive mental health, and self-rated health outcomes (Bekalu et al., 2019). On the other hand, it is possible that individuals who lack

community or social connections that align with their values instead turn to SLSS streamers' communities to compensate (Hilvert-Bruce et al., 2018). However, some researchers suggest that sole reliance on social media to relieve stress, loneliness, or depression for individuals with poorer well-being may be a precursor to problematic use (Xu & Tan, 2012). This presents an interesting tradeoff to the benefits of social capital; while the frequency and closeness of SLSS social connections provide benefits to PWB, the shared values and cognitive social resources may be associated with declines to PWB. Future research should further explore individuals' pre-existing mental health and the degree of reliance on SLSSs to understand why greater cognitive social capital is associated with lower PWB and the potential tradeoffs different dimensions of social capital have for various populations.

The findings of this study have theoretical and practical implications for researchers, designers, and users. In terms of theory, this study provides researchers a foundation in examining how SLSS use affects individual viewers' PWB. As digital and streaming technologies continue their market growth across entertainment and educational contexts, it is essential for researchers to pay attention to whether these interactive affordances are being fully leveraged by their users. With social capital being the predominant mechanism connecting online media use with PWB (Spotswood & Wohn, 2020), researchers should continue examining how these social resources provide access to benefits that lead to beneficial outcomes. These findings also demonstrate the importance of designing systems and features that can maximize users' active participation and provide access to social capital resources beyond standard means of participation. As Chats can quickly become congested with larger audiences, it is essential that designers consider more avenues for users to actively participate. Further exploration and implementation of interactive games and gambling (Abarbanel & Johnson, 2020) and

examinations into how these features benefit streamers and viewers is warranted. Lastly, streamers and viewers alike may want to pay further attention to individual user contributions, ensuring their time on live broadcasts are spent fostering social interactions and connections. In this way, streamers and viewers can ensure both the health of their communities as well as their members.

3.9. Limitations & Future Directions

Given the cross-sectional nature of the study, causality cannot be asserted. As discussed above, it is possible these findings point to the inverse pathway, where individuals with high PWB actively participate and financially contribute more than individuals with lower PWB. A longitudinal study could establish a more direct link between SLSS use and its effect on users' psychological well-being. Second, while this study examined both social capital and parasocial relationships as potential mechanisms, other theories may apply that explain the relationship between Twitch use and psychological well-being, such as the feeling of having wasted time (Sagioglou & Greitemeyer, 2014). Lastly, while running an SEM helped address potential issues with the relatively small sample size, future studies should examine larger samples of SLSS users across live-streaming platforms. In this way, the benefits or downsides of SLSS on well-being can be further established. While a number of studies have focused on the intrinsic motivations of SLSS viewers (Bründl & Hess, 2016; Hilvert-Bruce et al., 2018), future research should examine how viewers' motivations in concert with design features meant to motivate use have consequences on individual use and PWB. Similarly, prior research indicates that individuals' degree of extroversion or introversion may influence their social media use and communication behaviors (Chen, 2014). Future examinations should consider users' extroversion or personality which may explain why active use in SLSSs provides direct benefits

to PWB. Lastly, while this study examined active participation, passive participation, and financial commitment, future research can examine use by distinguishing directed and targeted communication, broadcast communication, and one-click communication, in order to examine how different actions with different audiences relate to PWB.

3.10. Conclusion

While there has been a wealth of research examining the relationship between SMU and PWB, there has yet to be an examination of this relationship in the context of SLSSs. With greater interactivity that has changed how users engage and develop relationships, this study examines the role of social capital resources and parasocial relationships on SLSS users' PWB. Social relationships are absolutely essential in delivering well-being benefits to active and financially committed participants. As long as users are engaging in social interactions in SLSSs, they will reap these benefits. From viewers to streamers across this new media landscape, active participation and commitment within SLSSs is indispensable for the creation and maintenance of social relationships and improvement of psychological well-being. As more users turn to SLSSs, we must continue to consider and understand the potential benefits and harms their use may have on our well-being.

Chapter 4: Conclusion

This dissertation leveraged parsimonious and comprehensive approaches in examining antecedents and outcomes related to SLSS use. Using a mixed-methods approach that employed behavioral log data as well as cross-sectional survey data, the dissertation aimed to explore streamer-factors that motivated participation and financial commitment, as well as its related outcomes. The following concluding chapter includes a summary of the research findings, implications for the research field, and design recommendations and suggestions for future research.

4.1. Research Findings

Chapter 2 examined the relationship between audience size, moderator activity, streamer gender, and content diversity onto individuals' active participation per capita, subscriptions per capita, and bits per capita. The results demonstrated that individuals participate and financially contribute more to live-streams with smaller audiences and greater moderator activity. While gender was not a significant factor in individual participation per capita, subscriptions per capita, or bits per capita, female streamers garnered audiences seven-times larger than male streamers and financially benefited more from moderator activity, earning 9 cents more per viewer in subscriptions and 3 cents more per viewer in bits. Similarly, while content diversity was not related to participation per capita, subscriptions per capita, and bits per capita, streams with greater diversity in content drew smaller audiences.

These findings indicate how SLSS streamer factors may motivate or discourage viewers' use, demonstrating the generalizability of past online community research while also highlighting key tradeoffs in individual engagement for streamers and designers to consider. While overall viewership or quantifiable metrics are understandably a key performance indicator

for streamers and designers alike, Chapter 2 demonstrates that the quality of viewers' experience may be a better indicator of community health and engagement. Overall, there is no one-size formula when it comes to motivating more individual contributions, however, it is important to consider how different factors may differentially affect participation and commitment.

Chapter 3 examined the relationships between active participation, passive participation, and financial commitment in an SLSS to individuals' structural, relational, and cognitive social capital in addition to parasocial relationship with a streamer to further understand how their use relates to psychological well-being. The results showed that social interaction ties explained the positive relationship between active participation and psychological well-being. Actively posting or commenting in the live-stream's Chat may facilitate the development of social relationships with other viewers who may in-turn provide social support that may benefit individuals' psychological well-being. Structural social capital also explained the positive relationship between financial commitment and psychological well-being, indicating that paying for a premium or more exclusive membership provides access to social relationships that may provide social support and well-being benefits, similar to individuals paying membership in a fraternity or sorority. Considering the financial model of SLSSs where streamers are directly supported by viewers via subscriptions and donations, financial contributions may provide tangible and emotional support to a streamer (Wohn et al., 2018). However, given the strong association between active participation in online communities and financial commitment or paying for premium services (Oestreicher-Singer & Zalmanson, 2009), future research should closely track viewers' journey from passive participants to active contributors in Chat to committed subscribing members to better understand and target viewers with incentives that may motivate active participation and promote the development of social relationships.

This chapter explored social capital as a social resource, capturing its three distinct dimensions that are more suited towards capturing dynamics within an online content community (Jeong et al., 2020). Additionally, the chapter explored the role of parasocial relationship on psychological well-being. While prior SLSS research have found PSR associated with enjoyment (Wulf et al., 2020), continued viewing intention (Lim et al., 2020), and emotional, instrumental, and financial support (Wohn et al., 2018), this chapter demonstrated its lack of influence towards individuals' psychological well-being. PSR or asymmetric relationships with a mediated performer do not supplement “real” or substantive social interaction ties when it comes to receiving social support or well-being benefits.

Taken together, the dissertation reviewed existing literature, drawing from prior research in online communities and SLSSs and collecting data using a mixed-methods approach to empirically and comprehensively examine SLSS use from the streamer-level antecedents that motivate contributions to the social resources and well-being outcomes associated with each interaction behavior. It explored the influence of design heuristics on motivating contributions, as well as the role of social capital and parasocial relationship in providing benefits to psychological well-being. Despite there being a variety of factors that may influence a variety of communities, this dissertation demonstrates that a sustainable and healthy community is composed of socially engaged individuals who can derive sustainable and healthy benefits from their membership.

4.2. Implications for the Research Field

The dissertation demonstrates the importance of combining a variety of methods when researching SLSSs. While behavioral data provides insight into the dynamics of social systems at large, combining them with another source of data, such as surveys, can enrich our

understanding of these observations by providing insight into the mechanisms at play. In using both observational data and self-report data, the dissertation explored the constructs of participation and financial commitment -- seemingly mundane interaction behaviors on SLSSs -- and demonstrated their greater contributions to communities at large as well as to the health of individual users. Researchers should therefore employ a variety of methods in order to gain a comprehensive perspective of the macro and micro influences of social interactions in SLSS communities.

Additionally, the dissertation generates insights for researchers to conceptualize key constructs in novel or deliberate ways. Examining participation and financial commitment at per-capita levels can measure the average individual viewers' engagement with a community which may be a stronger predictor of community health and sustainability compared to sheer volume of viewers or comments alone. Similarly, examining psychological well-being rather than negative indicators, such as depression and loneliness, demonstrate the potential for SLSS use to generate positive outcomes that are worthy of continued examination. As findings on the relationship between use and well-being can vary widely due to different conceptualizations and operationalizations of well-being (Meier & Reinecke, 2020), researchers should carefully consider their outcomes of interest. Lastly, while many researchers have and continue to examine SLSSs in the context of parasocial relationships (Hu et al., 2017; Lim et al., 2020; Wulf et al., 2020; Wohn et al., 2018), the dissertation findings imply that PSR is not instrumental towards positive psychological functioning and well-being, and that viewers' social interactions and access to social resources should be further explored.

Dissertation findings also provide further implications for SLSS designers. While designers may prioritize increasing user engagement, they should also consider the potential

bidirectional relationship between media use and well-being. A recent study from Bekalu and colleagues (2019) found that individuals who routinely used social media and integrated its use into their social routines reported greater well-being, positive mental health, and health outcomes. In contrast, individuals who were overly reliant on and emotionally connected to their social media use, indicative of problematic social media dependency, reported decreased social well-being, mental health, and health outcomes. To better integrate SLSS use into users' social routines, designers should leverage features and interactions that support more social connections amongst viewers. While many streams are largely driven by viewers' interest and attachment in a streamer (Dux, 2018), the degree of interaction between streamers and viewers diminishes in streams with larger audiences. With access to proprietary user data, SLSS designers can implement social features that encourage interactions and relationship development amongst viewers and track subsequent user behaviors. Designers can also conduct longitudinal field experiments or A/B testing, exposing users with various histories of engagement to design features that promote small group communication, interactions, and relationships that fit within individuals' social routines.

Similarly, the dissertation findings provide implications for streamers and viewers. In order to further build their community, streamers should promote regular viewers as moderators to further aid in socializing and engaging their community. Additionally, implementing more gamification mechanics that are available to SLSS streamers may provide less active viewers alternate means of participation and further complement active viewers' Chat participation and financial commitment. Lastly, to ensure the long-term health of their members, popular streamers with large followings can direct their viewers at the end of their broadcast to less popular or newer streamers that broadcast similar content. Some SLSSs allow streamers to send

their viewers to another live channel at the end of their stream in an action often referred to as “raiding.” While raiding may seem counterproductive to the growth of a streamer’s community in deliberately sending viewers to potentially competing channels, it may help bridge niche yet similar communities into a larger network, expose viewers to similar content communities where they may experience repeated encounters and interactions with similar viewers, and help another streamer grow their community, thereby keeping individual viewers engaged and embedded in the SLSS community as a whole. In this way, popular streamers who have a large amount of social capital and financial capital can share their social capital with newer or less popular streamers to help further establish communities, interactions, and relationships amongst viewers. In the same vein, viewers should leverage their SLSS actions to social engage with others and access community social resources. Viewers can either interact to build relationships with SLSS members and/or invite their offline friends to watch their favorite streamer. As long as viewers are socially embedded in SLSS communities and actively engage with live broadcasts, they can ensure benefits to their well-being.

4.3 Future Research

Future research should consider tracking multimodal communication (Harpstead et al., 2019) across compatible platforms that are often paired with SLSSs such as Discord, Reddit, and Twitter, as well as viewers’ existing offline social ties in order to understand how SLSS use may translate to offline social capital and provide positive psychological well-benefits. As online social networks may enhance or enable individuals’ the ability to form and maintain offline social capital with existing ties (Ellison et al., 2007), active SLSS use may provide individuals with information or resources that strengthen their offline networks and interactions, thereby enhancing their psychological well-being.

Future research should also examine a variety of communities across different SLSSs to validate these findings. As the relationship between streamers and viewers exist within specific and complex subcultures (Harpstead et al., 2019), viewers in each of these communities may be differentially motivated to contribute and may also experience different well-being outcomes related to their use. Future research should either comparatively examine various content communities and various SLSSs to better understand how users may be motivated toward participation.

Lastly, future research should consider employing a variety of methods and measures to discern the most effective features or factors that promote participation while also ensuring the development of social interactions, relationships, and positive psychological well-being. SLSS researchers should explore the use of social network analysis (SNA) to quantify the relationship and interactions between individuals within a social structure. With SNA, researchers can understand how closely individuals are connected with one another, and their potential access to social resources and capital. SNA can also paint a larger picture of SLSS networks, demonstrating how social resources such as viewers flow from one streamer to another during or after (via raiding) a broadcast and how viewers are connected by comments, friendships with other viewers, content categories, streamers, or other factors. Additionally, more fine-grain methods such as eye-tracking may provide insight into viewers' engagement and how viewers switch between passive viewing, active participation, and financial donations. Indeed, user engagement in SLSSs may be more complex than prior social media research conceived, with synchronous communication affording an additional behavior beyond passive and active use and viewers' financial contributions. Bründl (2018) identifies "co-active" behavior that occurs between users who co-experience content together. In essence, when one viewer interacts and

another reciprocates, individuals are not just actively participating, but co-actively participating which may be an important distinction when examining antecedents and outcomes of viewer engagement. In fact, Bründl (2018) found that co-active behavior was more influential on users' willingness to pay for premium experiences in SLSSs than either passive or active participation. This focus on reciprocal behavior may shed light on how to encourage viewer contributions that promote the well-being of SLSS communities and its members.

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Appendix

Table of SEM Analysis with Employment Status added as a Control Variable (N = 257)

	Structural Social Capital	Relational Social Capital	Cognitive Social Capital	Psychological Well-being
	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
Direct				
Active Participation	0.564 [.384, .733]	0.16 [.023, .286]	0.149 [.011, .264]	0.122 [.019, .226]
Financial Commitment	0.288 [-.013, .620]	0.333 [.146, .542]	0.151 [-.022, .359]	-0.041 [-.292, .136]
Passive Participation	-0.13 [-.27, .012]	0.151 [.032, .273]	0.054 [-.05, .165]	-0.037 [-.128, .055]
Structural Social Capital				0.061 [-.028, .152]
Relational Social Capital				-0.006 [-.135, .110]
Cognitive Social Capital				0.005 [-.122, .135]
Indirect				
Active x Structural				0.034 [-.012, .097]
Active x Relational				-0.001 [-.026, .02]
Active x Cognitive				0.001 [-.019, .026]
Financial x Structural				0.017 [-.004, .073]
Financial x Relational				-0.002 [-.051, .038]
Financial x Cognitive				0.001 [-.021, .031]
Passive x Structural				-0.008 [-.034, .002]
Passive x Relational				-0.001 [-.027, .016]
Passive x Cognitive				0 [-.008, .015]
Covariates				
Time Spent	0.008	0.007	0.012	-0.007

	[0, .018]	[-.002, .015]	[.004, .02]	[-.014, -.001]
Perceived Offline Social Support	0.015 [.001, .028]	0.011 [.001, .021]	0.003 [-.007, .014]	0.041 [.032, .051]
Education	-0.053 [-.155, .056]	-0.111 [-.188, -.030]	-0.039 [-.112, .041]	0.101 [.034, .166]
Health	0.027 [-.09, .148]	0.145 [.045, .246]	0.066 [-.024, .154]	0.267 [.188, .351]
Sex	0.093 [-.089, .314]	0.228 [.084, .390]	0.139 [-.031, .289]	0.022 [-.110, .156]
Employment	0.045 [-.029, .123]	0.026 [-.039, .082]	0.002 [-.059, .057]	0.017 [-.033, .066]
R Squared Estimate	0.272	0.257	0.15	0.485

Note. Values in the square brackets indicate the 95% confidence interval for each correlation.