DIGITAL GAMES AND MENTAL HEALTH

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DIGITAL GAMES AND MENTAL HEALTH

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Editorial: Digital Games and Mental Health

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Editorial on the Research Topic

Digital Games and Mental Health

Over the last decade, there has been a growing interest in the relationship between mental health and digital games. This discussion has recently returned to the forefront of public discourse with the World Health Organization's (WHO) decision to classify Gaming Disorder (GD) in their new diagnostic manual. While concerns about digital games and mental health often revolve around their potential to exacerbate pre-existing symptomatology (e.g., depression or anxiety), the addition of the GD reflects concerns that games themselves may be detrimental to mental well-being.

The move has also prompted criticisms that the WHO's decision may not be well-grounded in data but rather motivated by politics (the WHO has acknowledged being under pressure from "Asian countries") or moral panic. Alongside these discussions a new line of research examining how video games can be valuable tools for self-exploration and positively influence mental well-being has also emerged. Through in-game narratives and in-game mechanics, video games are beginning to be recognized as potential tools for fostering psychological growth. These potentials are worthy of examination, in terms of unintentional learning (e.g., fostering psychological growth within games not explicitly designed to do so) as well as intentional game design (e.g., the development of games for mental health).

Interest in the links between mental health and digital games are not limited to player effects but also, game design. Over the last few years, there has been a growing concern about the ways in which mental illness is portrayed in digital game content and how that can impact society's perception of mental health. For example, a 2016 study found 24% of their analyzed games depicted one more mentally ill character, with 69% of them acting violently and in line with a homicidal maniac trope (Shapiro and Rotter, 2016). Notably, the depictions of mental illness in games are not just portrayed through game characters, but settings and game mechanics (e.g., sanity meters) as well (see Dunlap, 2018 for an overview). This has led to growing concerns that stereotyped portrayals of mental illness may contribute to the stigmatization narrative of mental health challenges within society through cultivating new beliefs and/or reinforcing harmful stereotypes. In particular, the stigma that surrounds mental illness has been found to be largely generated and shaped by labeling and stereotyping, which often comes from media messages (Stuart, 2006; Ma, 2017).

These concerns have also, at least partially, contributed to a now a growing community of developers creating games to specifically reflect mental health challenges such as anxiety, depression, and posttraumatic stress disorder (so-called, "deep games"; Rusch, 2017) in more

nuanced ways. However, little is known about how the design of these kinds of serious games impacts the developers who create them or the players who engage with them. More research is needed to understand how "deep games," which are created as spaces of symbolic conflict, liberation, and transformation, impact mental health.

This special issue on Digital Games and Mental Health examined the intersection between mental health and digital games within gaming communities and the gaming industry and aligned across three broad themes: uses and effects research, game design, and game adjacent spaces. The articles in each of these themes are briefly discussed below.

USES AND EFFECTS RESEARCH

There are several articles in this collection that discuss classic uses and effects research for video game use and mental health. This includes an examination of the broader interactions between physical and mental health and their impact on problematic internet use (Chao et al.), what individual and contextual differentiate between beneficial and harmful outcomes within players of the same game (Mandryk et al.) and the impact of game transfer phenomena for dysfunctional playing behaviors (de Gortari and Gackenbach).

Additionally, there are several articles that would fall generally under "uses and effects" that outlined experimental designs where games were used directly as a mental health intervention. This includes work evaluating the impact of exergame based intervention for older adults (Li et al.), the potential for commercial video games as intervention for depression among youths (Poppelaars et al.), games as a direct intervention tool for mental health support (Světlák et al.), how avatar customization in digital games could be used as an intervention tool for anxiety (Pimentel and Kalyanaraman), and the potential for digital games to shift societal stereotypes around mental illness (Ferchaud et al.).

GAME DESIGN

Game design is another area of exploration in this special issue, looking at new frontiers for design as well as discussing challenges and solutions within more traditional design paradigms. This includes examining how existential transformative game design can promote authenticity and tap into games' transformative potential (Rusch and Phelps), a discussion of the challenges of using biofeedback as an intervention in virtual environments (Brammer et al.) and recommendations for implementing gamification for mental health and well-being (Cheng).

GAME ADJACENT SPACES

Game adjacent spaces received a significant amount of attention within this special issue. With the rise of online communities and online streaming, these areas of interest continue to grow in importance within the realm of game studies. This includes a discussion of innovative ways to implement crisis intervention and mental health support in game adjacent spaces (Carras et al.), their impact on viewers mental health (de Wit et al.), and how out-of-game factors, such as parental worry, can impact in-game factors (Lieberoth and Fiskaali). Deviant verbal and behavioral actions that take place within games and games adjacent spaces were also evaluated, including the first comprehensive taxonomy of these behaviors (Kowert).

CONCLUDING THOUGHTS AND FUTURE DIRECTIONS

We hope that the discussions about digital games and mental health brought to the forefront in this special issue helps to open up broader discussions about digital games as intervention tools, mindful game design, and the uses and effects of games beyond the games themselves. The work within this collection highlights the err in the assumption that games are inherently trivial—-games are an art form that tackle serious subjects and can have significant impact on one's life, including their mental well-being.

Research in this area has historically been mired in presumptions that games are "bad," particularly the now largely defunct fears about "violence" in such games. The stigmatization of games continue with efforts such as the WHO's "gaming disorder" diagnosis (despite the lack of empirical support). It is important that we set aside these cultural assumptions and better understand the nuances of who may benefit or not benefit from games, under what circumstances, and how some games can be better designed to address the mental health needs of some individuals.

Ultimately, like most media technologies (and art in general), video games are not bad or evil, but how we choose to use them can have a differential impact on differing folks. On balance, we find them to be more likely a source for good than bad and hope that the research included here will help guide those curious about how some games may serve to aid in our understanding of mental health.

AUTHOR CONTRIBUTIONS

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Reactions to Problematic Internet Use Among Adolescents: Inappropriate Physical and Mental Health Perspectives

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Although numerous studies have examined the factors influencing problematic Internet use (PIU), few studies have investigated the interactions between inappropriate physical and mental health (e.g., cyberbullying, Internet pornography, and Internet fraud) as factors facilitating PIU and examined the moderating effect of community bond. Thus, this study analyzed the moderating role of community bond in the relationship between cyberbullying, Internet pornography, Internet fraud, and PIU. Using a cross-sectional survey, adolescents were surveyed through self-report questionnaires. A total of 5,211 responses were received from participant students at 60 senior high schools in Taiwan. Statistical analyses were performed using structural equation modeling. The results indicated that cyberbullying, Internet pornography, Internet fraud, and community bond have significant positive effects on PIU. Community bond has a significant moderating effect in the relationship between cyberbullying, Internet fraud, and the PIU of adolescents. Parental Internet attitude and behavior were found to significantly moderate the relationship between inappropriate physical and mental health, community bond, and PIU. The results suggest that public health and education policies should focus more on adolescents who require additional assistance. Furthermore, school policies could be more informed in regard to relevant psychosocial variables and patterns of Internet use. Finally, this study may serve as a reference for parents, schools, and government education authorities.

Keywords: community bond, problematic Internet use, inappropriate physical and mental health, mental health, structure equation model (SEM)

INTRODUCTION

Since the 1990s, the increasing prevalence of the Internet has made this technological tool central to everyday life and changed how people interact and communicate (Błachnio and Przepiorka, 2016; Kaya and Bicen, 2016). Simultaneously, the Internet has become an action situated in the digital context (Musetti and Corsano, 2018) for socializing, academic research, acquiring new information, entertainment, and healthcare concerns. Consequently, research in this area has grown rapidly, particularly over the last decade. Appropriate Internet use, notably through facilitating social communication and access to information and knowledge, may be beneficial for the development

and mental health of individuals and causes positive outcomes for the large majority of users. However, the multifunctional nature of the Internet also causes negative behaviors. If overused, the Internet may hinder development, damage mental health and social functioning, and even cause addiction.

The different terms for and definitions of Internet addiction share the common aspect of negativity toward the individual. However, problematic Internet use (PIU) specifically means that an individual uses the Internet excessively resulting in negative outcomes, and clinical judgment is required to determine whether an individual is addicted. Moreover, cognitive–behavioral researchers often use PIU to describe the middle of the problem severity continuum and stress the benign and moderate qualities of its related negative outcomes (e.g., truancy). By contrast, addiction researchers consider Internet addiction to be at the upper end of the continuum, involving serious negative life outcomes (e.g., marriage failure, dropping out of school, and losing a job) (Tokunaga, 2014; Pontes et al., 2016). In recent years, few studies have explored the relationship between cyberbullying, Internet pornography, and Internet fraud and PIU. Past research indicates that cyberbullying, Internet pornography, and Internet fraud have become negative activities on the Internet and may have an impact on mental health. Therefore, this study proposed a novel notion: the impact of inappropriate physical and mental health on PIU. However, despite many researchers acknowledging PIU as a critical problem among adolescents (Spada, 2014; Dunbar et al., 2017; Lai and Kwan, 2017; Wartberg et al., 2017; Musetti et al., 2020), controversy remains regarding the boundary between PIU and Internet addiction. For the sake of consistency in this study, we employed the more conservative term problematic Internet use instead of Internet addiction.

Adolescents, for whom the Internet is an indispensable part of their daily life, are the most significant PIU-risk group (Lam, 2015; Öztürk and Özmen, 2016; Faghani et al., 2020; Sela et al., 2020). According to several epidemiological studies (Moreno et al., 2013; Mihara et al., 2016; Lai and Kwan, 2017; Wartberg et al., 2017), the prevalence estimates of PIU vary widely. Globally, the reported prevalence estimate of adolescents with PIU has ranged from 0.8% in Italy to 26.7% in Hong Kong (Kuss et al., 2014; Mihara et al., 2016; Wartberg et al., 2017). Although the number of relevant studies is limited, the prevalence estimate of PIU appears to be higher in Asian countries than in others (Kuss et al., 2014; Wartberg et al., 2017). Mihara et al. (2016) conducted a nationwide survey in adolescent participants who were randomly selected from schools in Japan. A total of 100,050 students were randomly selected from junior and senior high schools. The estimated prevalence rate of PIU was 7.9%, and PIU was more prevalent in female than male students (9.8 versus 6.2%) and differed among countries. A similar pattern has also been identified in Taiwan, one of Asia's leading economies. According to a representative national sample, approximately 10.6–15.3% of university students are addicted to the Internet (Lin et al., 2011; Wu et al., 2015). In conclusion, the estimated prevalence of PIU is relatively high, especially in Asia. PIU has become a serious public health concern that is recognized worldwide, and greater attention must

be paid to adolescents' PIU (Lai and Kwan, 2017; Wartberg et al., 2017). To address the potential harm of PIU to adolescents' mental health, parents, teachers, and numerous other parties require additional information.

In the past decade, information and communication technologies (ICTs) have drastically changed the manner in which individuals and social groups communicate, interact, and exchange information. The negative nature of these online activities can damage and distort adolescents' mental development (Kor et al., 2014; Arora, 2016; Lazuras et al., 2017). Many previous studies have indicated that cyberbullying, Internet pornography, and Internet fraud may negatively affect multiple aspects of adolescents' mental health and behavioral problems (Kor et al., 2014; AlBuhairan et al., 2017; Allen et al., 2017; Lazuras et al., 2017; Moreno-Fernández et al., 2017; Savage and Tokunaga, 2017).

In the last decade, PIU has received attention from researchers, schools, and parents. Family functioning, parent–child relationships, family relationships, and parental socioeconomic backgrounds are known to be connected with the risky behaviors of adolescents and have been a focus of many studies (Pontes et al., 2016; Lai and Kwan, 2017; Wartberg et al., 2017; Musetti et al., 2020; Sela et al., 2020). Numerous studies have examined the effects of these four factors on individuals' behavior. Musetti et al. (2020) research indicates that adolescents who feel lonely in their relationships with parents and emotionally detached from them manifest more PIU. They argued that adolescents' lack of perceived parental support may exposes the adolescents to unpleasant emotions, thereby enhancing compulsive–impulsive Internet use as a maladaptive coping strategy (Musetti et al., 2020). Yen et al. (2009) suggested that a lower level of parental monitoring is statistically associated with PIU in adolescents. Nevertheless, no existing study has attempted to investigate the possible effects of parental Internet behavior, parental attitude toward Internet use, and Internet cognition on adolescent PIU. Therefore, further investigation is required into the effects on PIU of cyberbullying, Internet pornography use, and Internet fraud, as well as the interaction effect on PIU of community bond, cyberbullying, Internet pornography use, Internet fraud by parental Internet behavior, parental attitude toward Internet use, and Internet cognitive status.

To summarize, PIU has become a significant problem worldwide, especially among adolescents. The effect of adolescents' inappropriate physical and mental health, such as cyberbullying, Internet pornography use, and Internet fraud, on PIU is a critical topic to be discussed. The current study attempted to construct a theoretical model that can predict and explain the effects of adolescent PIU and also empirically tested the model. Researchers have reported that PIU has become a critical public health problem worldwide, especially adolescent PIU (Lai and Kwan, 2017; Wartberg et al., 2017); however, no empirical study has explored the effects of inappropriate physical and mental health (e.g., cyberbullying, Internet pornography use, and Internet fraud) on PIU. To fill this gap, the current study developed a measurement scale for use with senior high school students (including vocational high school students) in Taiwan. The questionnaire survey method was adopted to determine how

inappropriate physical and mental health affect adolescent PIU. Therefore, the purposes of the present study were as follows: (1) to investigate one primary antecedent (cyberbullying, Internet pornography use, and Internet fraud) for PIU; (2) to examine whether cyberbullying, Internet pornography use, Internet fraud, and community bonds moderate or predict PIU; and (3) to examine the effects of parental Internet attitudes, such as parental use of the Internet, parental restrictions on Internet use, and parents' evaluation of the Internet's influence on their children, on PIU. In this context, the research questions of this study were defined as follows: (1) Can inappropriate physical and mental health, such as cyberbullying, Internet pornography use, and Internet fraud, significantly predict PIU? (2) How does the community bond moderate the effects of cyberbullying, Internet pornography use, and Internet fraud on PIU? (3) How do parental Internet attitudes and behaviors, such as parental use of the Internet, parental restrictions on Internet use, and parents' evaluation of the Internet's influence on their children, affect the PIU in adolescents? The results are expected to enhance scholarly understanding of PIU and adolescents' inappropriate physical and mental health, such as cyberbullying, Internet pornography use, and Internet fraud to provide references for parents, schools, and government education authorities and to elicit the effects of psychology education and related problems.

LITERATURE REVIEW

Problematic Internet Use

The concept of Internet addiction was first introduced by Young (1998) in a study for the American Psychological Association. Young (2004) defined Internet addiction as an impulse control disorder that does not require an intoxicant, which makes it a behavioral addiction similar to gambling addiction but different from alcoholism. Internet addiction is now a well-known term but lacks standardized diagnosis. Musetti et al. (2016) point out that the Internet addiction disorder (IAD) proposed by Young (1996) was formulated before the development of Internet as intended in current society. In addition, it was not clearly defined, and the structure is too broad and general to make a definite diagnosis (Musetti et al., 2016). Therefore, many researchers have used numerous terms and definitions to depict the status of addicts, including virtual addiction, compulsive computer use, Internet dependence, pathological Internet use, and problematic Internet use (PIU) (Spada, 2014; Wong et al., 2015; Dunbar et al., 2017; Lai and Kwan, 2017; Faghani et al., 2020).

Shapira et al. (2000) described PIU as when an individual cannot control their urge and increasing tension to access the Internet, which finally causes feelings of pain or dismay and negative life consequences. Davis (2001) indicated that PIU refers to the problematic use of the Internet by an individual for a specific purpose (e.g., online gaming, online sex, and online gambling). PIU has been defined as a lack of the strength to limit Internet use despite severe negative outcomes in daily life (Tam and Walter, 2013; Spada, 2014). Douglas et al. (2008) defined PIU as an individual's inability to control their impulse to overuse the Internet, which in turn leads to feelings of distress and functional impairment of daily activities. Lai and Kwan (2017) defined PIU as excessive use of the Internet that causes disturbances or harm to the individual. Accordingly, in this research, PIU is defined as an unhealthy (non-clinical) use of the Internet that negatively influences an individual's daily life.

Inappropriate Physical and Mental Health
Cyberbullying

Cyberbullying is a growing phenomenon that potentially affects the daily lives of numerous adolescents worldwide and raised concern among the public. The prevalence of cyberbullying victimization among adolescents has been estimated to range between 8 and 40% (Savage and Tokunaga, 2017). Consequently, cyberbullying among adolescents has gained considerable global attention (AlBuhairan et al., 2017; Lazuras et al., 2017; Savage and Tokunaga, 2017; Camerini et al., 2020). Several studies have indicated that cyberbullying may negatively affect multiple aspects of adolescents' mental health (e.g., causing depression, social anxiety, suicide, and low self-esteem) and behavioral problems (e.g., deterioration of relationships between family members and a decrease in grades) (Dredge et al., 2014; AlBuhairan et al., 2017; Lazuras et al., 2017; Savage and Tokunaga, 2017; Camerini et al., 2020). A survey by Ditch the Label (2016) discovered that people who have been bullied are almost twice as likely to bully others; 44% of young people who have been bullied experience depression; and 33% of those who have been bullied have suicidal thoughts. Based on the above discussion, the rise in cyberbullying has been facilitated by the ease of producing online content, the ability to post messages anonymously, fast and widespread dissemination, and the absence of the pressures associated with face-to-face communication. The evolution of this new form of bullying deserves the attention of researchers because it causes great harm to bullied adolescents and affects their personality development.

Internet Pornography

The Internet provides a wealth of information and possibilities for adolescents; however, like in any other areas of life, potential dangers and risks also exist. The easy access to and abundance of pornographic content online may increase anxiety about the harmful influence of Internet pornography on adolescents (D'Orlando, 2011; Hald et al., 2013; Kor et al., 2014; Allen et al., 2017); thus, the multitude of pornographic websites and their potentially negative consequences have attracted public concern. Consequently, research on Internet pornography has become much more popular. Internet pornography is different from other forms of pornography because of its accessibility and privacy, as well as its often being available at no cost (Kor et al., 2014). Advances in ICT have not only made pornography more accessible but may have also accelerated the societal acceptance of pornography use (D'Orlando, 2011; Kor et al., 2014). Children and adolescents are the most frequent users of ICT in a family. However, mental problems have been associated with frequent use of pornography (Hald et al., 2013). Therefore, the exposure of children and adolescents to Internet pornography is especially worrying because it can cause negative psychological problems in the development of

such individuals and stimulate higher acceptance of sexual permissiveness, as well as lead to sexual activity at an early age, sexual compulsivity, pornography addiction, and engagement in risky sexual behavior (Hald et al., 2013; Kor et al., 2014; Allen et al., 2017). Although Internet pornography has gained much attention from scholars, little actual research has been conducted. A large proportion of existing research has empirically examined the effects of numerous determinants on students who access pornography and who have problematic pornography use (Allen et al., 2017; Brown et al., 2017). Hald et al. (2013) asserted that mental problems have also been linked to frequent access to pornography. To our knowledge, no empirical study has directly examined the relationship between Internet pornography and PIU. Therefore, this study aims to understand the effect of Internet pornography on PIU in adolescents.

Internet Fraud

Information technology has advanced rapidly in recent decades, along with the rapid growth in the number of Internet users. Although the Internet provides numerous benefits and has changed society positively, it has also created a space in which criminals can operate, created new avenues for criminal pursuits, and facilitated new forms of victimization (Vahdati and Yasini, 2015; Arora, 2016). Furthermore, although fraudulent commercial transactions have long been a problem, advances in the Internet have transformed their dynamics and provided numerous alternative methods for conducting criminal activity online (Aleem and Antwi-Boasiako, 2011). Therefore, Internet users may become victims of Internet fraud, sometimes without even being aware of it. Internet fraud differs from traditional fraud in that the Internet is the instrument with which the crime is committed and can be used to commit more complex variations of traditional crimes. Internet fraud is one of the forms of computer crime that is increasing in prevalence most rapidly. Internet fraud refers to fraud schemes that take advantage of one or more feature of the Internet to commit a crime (Vahdati and Yasini, 2015). These features can be websites, email, message boards, or chat rooms. As a relatively new form of crime, Internet fraud affects the daily lives of numerous people. Internet fraud can occur in multiple forms (Aleem and Antwi-Boasiako, 2011; Vahdati and Yasini, 2015; Arora, 2016; Moreno-Fernández et al., 2017), such as advance fee fraud schemes, credit or debit card fraud, spoofing and phishing, spam, and Internet auction fraud. Among these, Internet auction fraud is the most ubiquitous type of Internet fraud (Aleem and Antwi-Boasiako, 2011; Vahdati and Yasini, 2015; Arora, 2016). Although Internet fraud has become a matter of global interest and importance and gained much attention from scholars, little research has been conducted, and literature is sparse. A large proportion of existing research that has explored the effects of Internet fraud has often only discussed financial losses and the factors affecting Internet fraud (Aleem and Antwi-Boasiako, 2011; Vahdati and Yasini, 2015; Arora, 2016; Moreno-Fernández et al., 2017). To our knowledge, no empirical study has directly examined the relationship between Internet fraud and PIU. Accordingly, in this study, we investigated the influence of Internet fraud on PIU among adolescents.

Community Bond

Online social networking sites (SNSs) have become one of the most popular activities for people accessing the Internet and form a part of youths' identity. Studies (Barker, 2012; Ceglarek and Ward, 2016) have asserted that adolescents use the Internet and SNSs to explore, shape, and grow their social identities through social interactions and self-presentation. The rapid growth of SNSs has been followed by the development of many different social networking platforms, such as online communities. Online communities are a relatively new way of building relationships between remote individuals. Many researchers have acknowledged the potential of online communities and the significant roles they play in different areas (Fiedler and Sarstedt, 2014; Ivaturi and Chua, 2019; Tsai and Hung, 2019). Online communities and SNSs enable people to meet friends; meet new people; exchange ideas, videos, and pictures; and even engage in commercial economic activities. When individuals are described as members of a community, it makes them feel good, and they feel a strong sense of attachment to the entire community. Teo et al. (2003) point out that experienced members who have devoted more time to build relationships and have become the most engaged users because of their interests and knowledge are the major participants in these communities.

From the perspective of interpersonal relationship research, when adolescents participate in online communities, the direct contact between adolescents and other members leads to strong interpersonal bonds, which reinforce group cohesion (Buchan et al., 2006; Fiedler and Sarstedt, 2014). Therefore, the participation of adolescents in online communities contributes to the development of interpersonal relationships, establishment of long-term relationships with new members, and establishment of a collective identity through mutual sharing. When the identity of adolescents' online community is established, not only more new information from online communities are obtained but also group cohesion is reinforced. Based on the above discussion, this study argued that when adolescents obtain cyberbullying, Internet pornography, and Internet fraud-related information in the online community, the community bond can positively moderate the impact of cyberbullying and Internet pornography on adolescents' PIU. In addition, the online community provide many new methods of Internet fraud. Therefore, this study argued that community bonds can negatively moderate the impact of Internet fraud on adolescents' PIU.

MATERIALS AND METHODS

Research Model

The present study examined whether cyberbullying, Internet pornography use, Internet fraud, and community bond moderate or predict PIU. The hypothesized model were constructed using (1) the exogenous variables (cyberbullying, Internet pornography use, and Internet fraud), (2) the endogenous variable (PIU), and (3) the moderator variable (community bond). The hypotheses are numbered and illustrated in the proposed path model in **Figure 1**.

FIGURE 1 | Research framework.
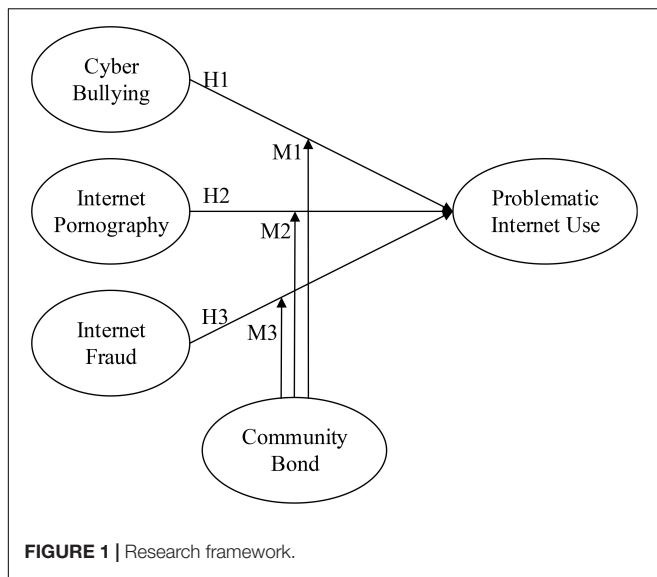
Research Hypotheses

The following hypotheses were proposed:

H1: Cyberbullying has a significant effect on PIU.
H2: Internet pornography use has a significant effect on PIU.
H3: Internet fraud has a significant effect on PIU.
M1: The relationship between cyberbullying and PIU is moderated by level of community bond.
M2: The relationship between Internet pornography use and PIU is moderated by level of community bond.
M3: The relationship between Internet fraud and PIU is moderated by level of community bond.

Measurement Tool Development and Validation

The questionnaire comprised previously published multi-item scales with favorable psychometric properties. In addition to the review of pre-existing survey instruments from the literature, interviews were reviewed during the pilot study to identify context-specific details that warranted inclusion. The instrument was developed after a thorough review of several relevant studies on cyberbullying, Internet pornography use, Internet fraud, community bond, and PIU. The measurement items were modified to fit the adopted context of adolescent Internet usage behavior. This development followed the recommendations of MacKenzie et al. (2011) and the development procedures suggested by Devellis (2016) for standard psychometric scales. The measurement instrument for the questionnaire comprised 35 items measuring the four sections: (a) the cyberbullying, Internet pornography use, and Internet fraud scales; (b) the community bond scale; (c) the PIU scale; and (d) sociodemographic data questions. The first three sections used 4-point Likert scales (ranging from 1 strongly disagree to 4 strongly agree and 1 never to 4 always) to examine respondents' perceptions of cyberbullying, Internet pornography use, and Internet

fraud. The fourth section used a nominal scale to collect respondents' basic sociodemographic information. The variables examined in the sociodemographic section included age, gender, high school grade, parental use of the Internet, parental restrictions on Internet use, parental involvement in adolescent Internet use, and parental evaluation of the Internet's influence on the individual.

Cyberbullying Scale, Internet Pornography Scale, and Internet Fraud Scale

The cyberbullying construct was measured with three items adapted from Lazuras et al. (2017) and Savage and Tokunaga (2017). The Internet pornography construct was measured with five items adapted from several previous studies (Kor et al., 2014; Allen et al., 2017; Brown et al., 2017). The measurement items for the constructs of Internet fraud (seven items) was adapted from the measurements developed in various relevant studies (Vahdati and Yasini, 2015; Arora, 2016). Items were rated on 4-point Likert scales. In the pilot test, we collected data from 1,884 senior high school students in central Taiwan. The cyberbullying, Internet pornography, and Internet fraud constructs showed high reliability: 0.65 for cyberbullying, 0.92 for Internet pornography, and 0.87 for Internet fraud. The results showed that the coefficients for three constructs were higher than the minimum required value of 0.6 (Hair et al., 2010). Based on the reliability analysis results, the scales used in this study were satisfactory in terms of measuring the constructs of interest.

Community Bond Scale

The community bond measurement comprised seven items and was adapted from the studies of Teo et al. (2003), Buchan et al. (2006), Fiedler and Sarstedt (2014), and Tsai and Hung (2019). Items were rated on 4-point Likert scales. In the pilot test, the alpha coefficients for all items measured ($\alpha = 0.88$) were higher than the minimum required value of 0.6 (Hair et al., 2010). Based on the reliability analysis results, the scales used in this study were satisfactory in terms of measuring the constructs of interest.

Problematic Internet Use Scale

The PIU measurement comprised six items and was adapted from the measurements developed by Shapira et al. (2000), Douglas et al. (2008), Lai and Kwan (2017), Wartberg et al. (2017), Faghani et al. (2020), and Musetti et al. (2020). Items were rated on 4-point Likert scales. The pilot test demonstrated high reliability with a Cronbach's α of 0.84 and higher than the minimum required value of 0.6 (Hair et al., 2010). Based on the reliability analysis results, the scales used in this study were satisfactory in terms of measuring the constructs of interest.

Sample and Descriptive Statistics

In the Taiwanese education system, children enter elementary school when they are 7 or 8 years old and complete this stage of their education by age 13 or 14. They then enter junior high school for 3 years followed by a further 3 years at senior high school. All three stages of education are compulsory. The years spent at junior high school are termed the 7th, 8th, and 9th grades, and those spent at senior high school

(including vocational high school) are termed the 10th, 11th, and 12th grades.

This study was large scale and cross-sectional and used stratified single-stage cluster sampling. As part of the selection process, Taiwan was divided into regional blocks, and schools were randomly selected from each block. To avoid sampling bias toward any regional block, stratified sampling was performed using regional blocks as the strata. Based on the sampling frame, 60 senior high schools were selected, and three to four classes were randomly selected from each school. As a preliminary step, a teacher working in academic affairs at each high school was contacted to ensure their cooperation. This study adopted a quantitative survey and utilized mail and face-to-face interviews with high schools that were willing to distribute the survey. The teacher explained the questionnaire to the respondents. Data collection took ∼8 months. A total of 7,500 questionnaires were sent out simultaneously. All responses to the self-report instruments were collected during a regular school day in classrooms and in the presence of the class teacher. All participants of this study were students enrolled in the sample schools, and participation was voluntary.

A total of 7,034 questionnaires were returned, of which 1,823 were excluded because of excessive missing data, such as "don't know" or "not applicable" answers, unspecified gender or grade, or inconsistent answers. Finally, a total of 5,211 respondents were included, and their data were analyzed. The response rate was 74.1%. Of the total 5,211 usable responses, 2,942 were from senior high school students, and 2,269 were from vocational high school students. The average age of the participants was 17.31 years [standard deviation (SD) = 0.95 years]; 54.5% were female and 45.5% were male. Regarding parental Internet use, 70.6% of the sample population indicated that their parents did use the Internet. Moreover, 53.6% indicated that their parents restricted their Internet use. Regarding parental involvement in adolescent Internet use, 54.7% indicated no involvement. For parents' evaluation of the Internet's influence on their children, 56.0% indicated both positive and negative effects. **Table 1** shows the demographic and parent Internet usage characteristics of the sample.

RESEARCH RESULTS

Structural equation modeling has the following benefits: it provides explicit modeling of measurement error, it estimates both direct and indirect relationships between latent variables, and it provides various indices of global model fit. The research hypotheses of this study were tested using partial least squares (PLS) regression with SPSS 18.0. PLS regression is component-based and employs a least squares estimation procedure. The psychometric properties of the variable measurement scales were also analyzed and missing data managed through list-wise deletion. This study used the measurement model to specify the relationships between the observed variables (manifest variables or indicators) and latent variables (constructs measured).

Depicting a model that contains moderators with PLS differs from traditional representations of the same research model. In a PLS model, the moderator (in this construct, treatment of personality traits) is an independent variable with a direct path to perceived benefit. Following the suggestion of Chin et al. (2003), these interaction measurement variables were calculated by multiplying every indicator in the moderator by every indicator in the independent variable. Conceptually, the interaction constructs (cyberbullying × community bond, Internet pornography use × community bond, Internet fraud × community bond) are depicted as having a direct path to perceived benefit. Additionally, this study used PLS to analyze the research model.

Measurement Model Evaluation

Using PLS analysis, the composite reliability (CR) and average variance extracted volume (AVE) can assess the reliability and validity of the structural model, respectively. Accordingly, this study followed the recommendations of Bagozzi and Yi (2012) and selected the three most commonly used future evaluation indicators, which reflected the measurement mode. The three evaluation indicators were as follows: (1) item loadings (λ) and reliability coefficients (Cronbach's alpha), (2) CR coefficients, and (3) AVE (Fornell and Larcker, 1981; Chin, 1998; Jöreskog and Sörbom, 2005; Hair et al., 2010; Bagozzi and

TABLE 1 | Profiles of respondents (N = 5,211).

Demographics/level	N	Percentage	Demographics/level	N	Percentage
Gender			Parental restrictions on Internet use		
Male	2,371	45.5	Yes	2,793	53.6
Female	2,840	54.5	No	2,418	46.4
Year in high school			Parental involvement in adolescent Internet use		
First	1,731	33.2	Yes	2,361	45.3
Second	2,001	38.4	No	2,850	54.7
Third	1,479	28.4	Parental evaluation of the Internet's influence on you		
Parental use of the Internet			Positive influence	389	7.4
Yes	3,677	70.6	Both	2,917	56.0
No	1,534	29.4	Negative influence	749	14.4
			No influence	1,156	22.2

TABLE 2 | Validity and reliability.

Construct	Items	Mean	SD	Cronbach's alpha	CR	AVE	DV
Cyber bullying	3	2.40	0.77	0.655	0.812	0.593	2.542
Internet pornography	5	1.42	0.69	0.922	0.942	0.765	4.235
Internet fraud	7	1.30	0.48	0.858	0.890	0.538	2.979
Community bond	7	2.65	0.84	0.925	0.939	0.689	1.451
Problematic Internet use (PIU)	6	2.05	0.78	0.871	0.903	0.608	1.281

AVE, average variance extracted; CR, composite reliability; DV, discriminant validity. Discriminant validity = AVE/(correlation)^2, where (correlation)^2 = highest (correlation)^2 between factors of interest and remaining factors.

FIGURE 2 | Path coefficients for the research model (excluding moderator main effect).

FIGURE 3 | Path coefficients for the research model (including moderator main effect).

Yi, 2012). **Table 2** lists the indices of reliability and convergent validities for the scale.

The first indicator refers to the reliability of individual items (i.e., factor loadings) and is used to assess the factor loading of the latent variables and to test the statistical significance of each variable loading. In this study, the standardized item loadings ranged from 0.672 to 0.913, which indicated significance because all were higher than 0.60 (Hair et al., 2010). Internal consistency was assessed using the Cronbach's alpha of each multi-item factor in the model. The Cronbach's alpha ranged from 0.655 for cyberbullying to 0.925 for community bond, which suggested a high level of reliability. In addition, all constructs had a Cronbach's alpha higher than the 0.60 benchmark.

The second indicator is the CR. The higher the CR, the higher the internal consistency reliability of the potential construct variable. Fornell and Larcker (1981) asserted that CR should be ≥0.6. The obtained CR coefficients ranged from 0.812 for cyberbullying to 0.942 for Internet pornography use, all higher than the 0.6 benchmark. Thus, the reliability of the scales in this study was confirmed.

The third indicator, AVE, calculates the explanatory power of the latent variables on the measured variables. Higher AVE values indicate that the potential variables have high discriminant and convergent validities. According to Fornell and Larcker (1981), the standard value of AVE for all constructs should exceed 0.5. In this study, the constructs possessed AVE values ranging from 0.538 for Internet fraud to 0.765 for Internet pornography use, all exceeding the threshold recommended by Fornell and Larcker (1981). Finally, the results of discriminant validity (DV) are shown in **Table 2**. The values of DV ranged from 1.281 for PIU to 4.235 for Internet pornography, and all constructs were >1.0, which supported the discriminant validity, thereby indicating an appropriate level of discriminate validity (Hair et al., 2017). Overall, the constructs thus demonstrated satisfactory reliability and validity. In summary, the internal reliability and validity results were acceptable, which enabled us to proceed to an estimation of the structural model.

Testing the Moderating Effects

The purposes of the present study were to (1) determine the primary antecedents (cyberbullying, Internet pornography use, and Internet fraud) of PIU; (2) examine whether cyberbullying,
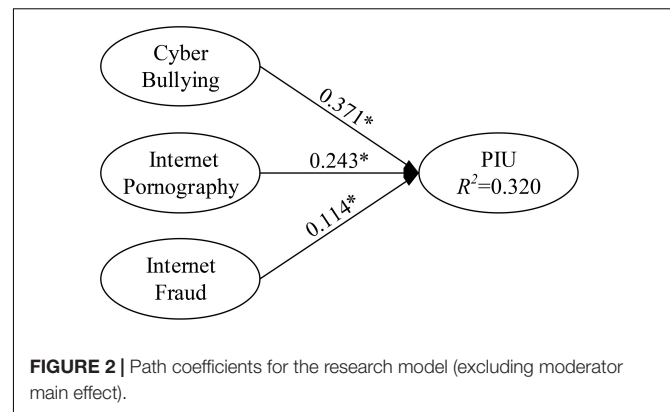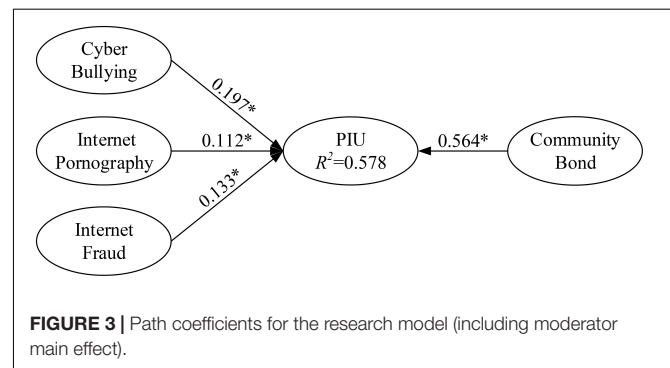
Internet pornography use, Internet fraud, and community bond moderate or predict PIU; and (3) examine the effects of parental attitudes and behaviors toward the Internet on PIU. Regarding the moderating effects of community bond on adolescent PIU, this research used PLS regression to analyze and test the main effects of community bond. The moderating effects of community bond on PIU are illustrated in **Figures 2**, **3**. For example, cyberbullying (predictor) and community bond (moderator) were multiplied to create an interaction construct (cyberbullying × community bond) for predicting PIU.

For PLS path modeling, this research followed the recommendations of Tenenhaus et al. (2005) in selecting goodness-of-fit to measure the structural model fitness. The researchers argued that the value should be ≥0.36; in the current study, the goodness-of-fit was 0.595, exceeding the baseline value. Thus, with an acceptable model fit, our measures were considered to be appropriate for the subsequent tests of the causal model and research hypotheses. Using PLS regression to estimate the path relationship between each research construct, the three hypothesized path relationships and the three hypothesized moderating effects, we discovered that four assumptions attained significance ($p < 0.05$).

To verify the analysis of the hypotheses and moderating effects, this study employed the moderator analysis method proposed by Baron and Kenny (1986). The moderating roles of community bond were determined according to the significance of the interaction terms in Model 3. Among the three hypothesized moderating effects, M2 were non-significant;

FIGURE 4 | Path coefficients for the research model (including interaction effect).

TABLE 3 | Estimation results for hypotheses.

Construct	Model 1		Model 2		Model 3	
	β	t-value	B	t-value	β	t-value
Cyber bullying → PIU	0.371*	29.828	0.197*	17.085	0.194*	17.754
Internet pornography → PIU	0.243*	16.377	0.112*	8.986	0.109*	8.009
Internet fraud → PIU	0.114*	9.325	0.133*	12.594	0.148*	12.506
Moderator effect						
Community bond → PIU			0.564*	56.309	0.558*	58.886
Interaction effect						
Cyber bullying × community bond → PIU					0.066*	6.182
Internet pornography × community bond → PIU					−0.005	0.366
Internet fraud × community bond → PIU					−0.042*	3.821
R^2						
PIU	0.320		0.578		0.583	

*$p < 0.05$.

specifically, community bond did not have moderating effects between Internet pornography use and PIU. Community bond positively moderated cyberbullying's and Internet fraud's effect on PIU (M1, beta = 0.066; M3, beta = −0.042, $p < 0.05$). As a result, community bond can be seen as the moderator of the effect of cyberbullying on PIU and Internet fraud on PIU. **Figure 4** presents the full results of the moderation analysis, including the structural path estimates and explained variances.

The structural model path analysis results for the effect of Internet misconduct on PIU were as follows: cyberbullying, Internet pornography use, and Internet fraud were a significant determinant of PIU (β = 0.194, 0.109, and 0.148, respectively). The results related to predicting PIU were consistent with the cyberbullying, Internet pornography use, and Internet fraud hypotheses that were adapted to the context; thus, hypotheses 1–3 were supported. Cyberbullying, Internet pornography use, Internet fraud, and the interaction between cyberbullying and community bond explained 58.3% of the variance in PIU (R^2 = 0.583). We also discovered that the proposed model explained a significant amount of variation in the endogenous variables. The endogenous variables exhibited strong explanatory powers of variation, which indicated the stability and robustness of the model. All estimated and standardized path coefficients (significant paths indicated with an asterisk) are indicated in **Figure 4**.

Table 3 presents the results of further investigation into the effects on PIU of cyberbullying, Internet pornography use and Internet fraud, and the interaction effect of community bond and cyberbullying (M1), Internet pornography (M2), and Internet fraud (M3) as moderated by parental use of the Internet, parental restrictions on Internet use, and parental evaluation of the Internet's influence on the individual. First, participants whose parents did not use the Internet had the highest coefficients in all critical paths of PIU and the highest explanatory ability (R^2 = 0.590) in their effects of cyberbullying on PIU. Second, participants whose parents placed restrictions on their Internet usage had the highest coefficients in all critical paths of PIU and the highest explanatory ability (R^2 = 0.587) in their effects of cyberbullying on PIU. Third, participants whose parents evaluated their Internet usage as having a positive effect had the highest coefficients in all critical paths of PIU and the highest

explanatory ability (R^2 = 0.664) in their effects of Internet fraud on PIU (see **Table 4**).

DISCUSSION

Problematic Internet use can be defined as a condition in which an Internet user lacks the will to impose restrictions on their own online behavior despite recognizing the severe negative impacts of this behavior on their daily life (Tam and Walter, 2013; Spada, 2014). PIU has become a significant problem worldwide, especially among adolescents. To our knowledge, no previous empirical study has investigated the effects on PIU of inappropriate physical and mental health such as cyberbullying, Internet pornography use, and Internet fraud. The empirical results of the present study demonstrate that cyberbullying, Internet pornography use, and Internet fraud significantly and positively affect PIU, with cyberbullying exhibiting the strongest effect. Cyberbullying among adolescent Internet users is a recognized problem worldwide (AlBuhairan et al., 2017; Lazuras et al., 2017; Savage and Tokunaga, 2017). Social media outlets such as Facebook, Plurk, and Instagram have greatly expanded the number of online outlets that are available to students. The effects of these social media outlets on daily life has risen in line with their growing use for the discussion of classwork, sharing of information, holding of online activities, engagement in retail transactions, and search for friends with shared interests and backgrounds. Moreover, these effects have increased the opportunities for and the prevalence of phenomena such as cyberbullying, Internet pornography use, and Internet fraud.

TABLE 4 | Structural equation modeling (SEM) analysis results.

Construct	Parental use of the Internet		Parental restrictions on Internet use		Parental evaluation of the Internet's influence on you			
	Yes (3,677)	No (1,534)	Yes (2,793)	No (2,418)	Positive influence (389)	Both (2,917)	Negative influence (749)	No influence (1,156)
Cyber bullying → PIU	0.189*	0.208*	0.222*	0.172*	0.144*	0.193*	0.259*	0.158*
Internet pornography → PIU	0.089*	0.161*	0.093*	0.132*	0.154*	0.109*	0.060*	0.134*
Internet fraud → PIU	0.167*	0.108*	0.133*	0.169*	0.344*	0.145*	0.089*	0.159*
Moderator effect								
Community bond → PIU	0.563*	0.545*	0.554*	0.551*	0.416*	0.558*	0.567*	0.548*
Interaction effect								
Cyber bullying × community bond → PIU	0.077*	0.039*	0.075*	0.056*	0.164*	0.060*	0.039	0.060*
Internet pornography × Community bond → PIU	−0.004	−0.008	0.003	−0.010	−0.084	−0.013	0.024	0.006
Internet fraud × Community bond → PIU	−0.051*	−0.024	−0.043*	−0.044*	−0.047	−0.033*	−0.048	−0.025
R^2								
PIU	0.582	0.590	0.587	0.582	0.664	0.565	0.563	0.587

*$p < 0.05$.

The first instances of cyberbullying within an online community are frequently overlooked or downplayed as teasing among peers. Self-awareness of cyberbullying within a community often comes only after the phenomenon has already increased significantly in scope and severity. Long-term exposure to bullying is known to affect the mentality, daily life, and PIU-related behaviors of students. In terms of Internet pornography, easy and free access to online pornographic material render this medium particularly harmful to students' physical and mental health. Moreover, the difficulties faced in self-regulating pornography use have helped make online pornography the most popular form of pornography currently accessed by students. The anonymity and privacy of general online activity provide Internet users with significant protection from outside scrutiny, allowing them to reveal and share their innermost erotic tendencies online, making pornography one of the most searched for subjects on the Internet and causing students to engage in problematic Internet or Internet pornography use. Finally, in terms of Internet fraud, online shopping and auction websites have popularized e-commerce; countless online retailers as well as adolescent entrepreneurs now market and sell products through social media at significantly discounted prices. However, students' online purchases are frequently affected by types of fraud, such as products that fall short of buyer expectations, products that are not delivered as promised, products with missing components, and products that are otherwise defective. Therefore, Internet fraud is another behavior that affects PIU. In school settings, teacher supervision largely keeps student participation in cyberbullying, Internet pornography, and Internet fraud under control. After school, however, students revert to their usual patterns of online behavior. Thus, counselors and teachers should place greater emphasis on developing effective strategies to prevent these inappropriate online behaviors. One suggestion is that students should seek assistance from their teachers and parents immediately upon encountering these behaviors. Moreover, school counselors and teachers should pay particular attention to the physical and mental health of students that have already received related counseling to prevent these students from re-engaging in these behaviors.

When participating in the online community and helps deliver emotional and practical value to individual members. The interaction effects between cyberbullying and community bond and between Internet fraud and community bond have a statistically significant effect on PIU. Moreover, community bond was found to have a significant and positive effect on PIU, indicating a positive correlation between the degree of association of students with members in an online community and consistency in its activities. Thus, participation in an online community that engages in harmful or negatively aligned activities is expected to increase PIU. However, the interaction effect between cyberbullying and community bonds shared by a student may moderate this effect on PIU. Moreover, it has been consistently shown that students with more community bonds use the distinctive characteristics of their online communities to validate the characteristics or values that they share with members of these communities. An adolescent, who upon becoming aware of a bullying incident in their online community joins in or otherwise validates this behavior out of a desire to gain the approval of this community, would be expected to have a higher level of PIU. Therefore, the findings of the present study suggest that parents and teachers pay closer attention to the behaviors and activities of students on the Internet at home and at school and that these adults work proactively to reduce the potential negative effects of students' online activities. Bullying, infrequently a short-term phenomenon, tends to have cyclical repercussions when it takes place online. The victim of a cyberbullying attack often has a desire to respond, which may encourage others to join the fray leading to a potentially long and drawn-out series of increasingly abusive and antagonistic communications. In this situation, parents and teachers can play a positive role in informing students about the mindset and attitudes necessary to appropriately handle the situation. In

addition, assistance from school administration may be sought to help further reduce the effect of cyberbullying.

The interaction between Internet fraud and community bond has a significant negative effect on PIU. As a relatively new form of crime, Internet fraud can occur in multiple forms, and it affects the daily lives of numerous people (Vahdati and Yasini, 2015; Arora, 2016; Moreno-Fernández et al., 2017). Thus, when students recognize Internet fraud as a significant problem, it may affect PIU. However, the interaction effect between the community bond of a student and Internet fraud may reduce this effect on PIU. When adolescents become aware of the severity of Internet fraud, they will search for information about new Internet fraud methods shared by members in an online community. From this information, they learn about new Internet fraud methods; thus, the effect on PIU decreases. Therefore, the results of this study suggest that, although students become aware of new Internet fraud methods on online communities, school administration should also pay close attention to stay updated on Internet frauds and communicate these to students to prevent them from being scammed.

Previous studies have pointed out that parental relationships, parent–child relationships, and parents' Internet behavior are related to adolescents' Internet use (Pontes et al., 2016; Lai and Kwan, 2017; Wartberg et al., 2017; Musetti et al., 2020; Sela et al., 2020). The results showed that with regard to the two variables "parental use of the Internet" and "parental restrictions on Internet use," having parents who were unable to use the Internet and having parents who placed time-based restrictions on Internet use most significantly altered the effect of cyberbullying on PIU. Despite the Internet's prevalence and the fact that most students are introduced to the Internet at an early age, a significantly small percentage of the students' parents was unable to use the Internet effectively. Survey results indicated that nearly 30% of the parents did not know how to use the Internet. Such lack of knowledge severely undermines the ability of parents to understand the online activities of their children and prevents them from assisting their children to resolve problems encountered online. Parents who lack Internet knowledge are thus unable to provide appropriate guidance when their child encounters cyberbullying, which increases the severity of the effect of bullying on PIU. Regarding the variable "parental evaluation of the Internet's influence on the participant," the effect of cyberbullying on PIU was identified as relatively weak when parents perceived the Internet as having an overall positive effect on their child for reasons that included parental awareness of the importance of the Internet in everyday life, the practical benefits of Internet use such as information searches and online learning, and parent–child discussions already held regarding proper Internet use and online behavior. Additionally, PIU is a family-related problem rather than a problem that adolescents should handle alone. Parents must be sufficiently cognizant of and sensitive to their own Internet and Internet-related behaviors to avoid sending non-verbal signals to their children that suggest approval of inappropriate behaviors and to better prevent their children from engaging in PIU.

CONCLUSION

The research results of this study demonstrated that cyberbullying, Internet pornography use, Internet fraud, and community bond significantly and positively affect PIU in adolescents. Additionally, community bond has a significant moderating effect on the relationship between cyberbullying, Internet fraud, and PIU. This study revealed that PIU and inappropriate physical and mental health have become serious problems among adolescents and that the planning and implementation of preventive and control measures are urgently required in Taiwan. To our knowledge, this study is the first to investigate the relationship between parental Internet attitude and behaviors and adolescent Internet usage behavior. Because of the lack of similar studies, the results of this study can be considered unique; parental use of the Internet, parental restrictions on Internet use, and parental involvement in adolescent Internet use have significant effects on PIU.

LIMITATIONS AND FUTURE RESEARCH

This study had some limitations. First, other factors that may influence PIU such as average time spent online and adolescent age were not considered. These and other relevant factors may be explored using the same model in the future. Second, relevant studies have relied on participants self-reporting their inappropriate physical and mental health such as cyberbullying, Internet pornography use, and Internet fraud, which may elicit misreporting to avoid judgment and cause common method variance. Although the present study also used a self-report inventory, the items asked participants to measure the target behaviors of other adolescents based on the respondent's actual online experiences. Third, the present research was conducted at a time when most Internet users in Taiwan were using 3G mobile telecommunications technology. Thus, the results may not be linearly extrapolated to describe student PIU in today's age of "anytime, anywhere" 4G mobile Internet. Future research may use the present research model to study adolescents in the 4G environment to describe the current effects on PIU of the three types of physical and mental behaviors; this would improve the comprehensiveness and representative nature of the model and promote the linear extrapolation of the results across mobile telecommunications technology platforms. Finally, because the present study only collected data at one point in time, no inferences were possible regarding the relationship between changes in parental Internet attitudes and behaviors and changes in the time that students spend online or the changes in PIU over time; therefore, a longitudinal study is recommended to observe these relationships.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation, to any qualified researcher.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

C-MC: data collection, concept and design, statistical analysis, interpretation of data, and writing up. K-YK: data collection, interpretation of data, and writing up. T-KY: obtaining funding, data collection, statistical analysis, interpretation of data, and study supervision. All authors wrote the manuscript together and approved the final manuscript.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.01782/full#supplementary-material

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Reducing Mental Health Stigma Through Identification With Video Game Avatars With Mental Illness

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This study examines how playing a video game featuring a player-character with mental illness can positively impact mental illness stigma. We hypothesized that interactive gameplay would positively predict transportation into the story world. Then, transportation would predict identification with the main character. This identification should then reduce stigma in two ways: by lowering stereotyping and limiting participants' desire for social distance. A two-factor, yoked experiment was designed utilizing *Hellblade: Senua's Sacrifice*, a game praised for its accurate portrayal of psychosis. The main character, Senua, suffers from psychosis and must navigate her quest along with her own mental health. Players either played the first 45 min of the game or watched gameplay footage of other participants' sessions. Transportation into the story world, identification with Senua, and the two aspects of stigma – stereotyping and social distance – were measured. Consistent with hypotheses, a structural equation model found an indirect path from gameplay to reduced social distance through first transportation and then identification. Players also reported higher levels of transportation than non-players, and that heightened transportation led to greater identification and then a lowered desire for social distance from the mentally ill. The indirect path to stereotyping was not significant. These results and implications are discussed in detail.

Keywords: stigma, video games, transportation, identification, avatars

INTRODUCTION

Stigma is a significant problem faced by those with mental illness. Being the target of mental health stigma can lead to negative impacts on the self, such as lowered self-esteem (Link et al., 2001) and life satisfaction. Stigma can also threaten a patients' livelihood through discrimination in the workplace and in the realm of healthcare (Schulze and Angermeyer, 2003). Further, those who experience stigma – or who fear being stigmatized – are less likely to seek professional or medical help for the issues they face (Clement et al., 2015).

Due to negative and severe effects stigma can have on those with mental illness, researchers and advocates have attempted to create interventions to address the issue. However, many of these interventions can unintentionally have a boomerang effect, increasing the stigma they are attempting to reduce, either because of reactance or through the general resiliency of stereotypes (Corrigan and Penn, 1999).

Some research has suggested that embedding non-stigmatizing messages in entertainment media can increase the effectiveness of stigma reducing interventions due to the ability of narrative to bypass reactance and create links to characters that the viewer may not have interpersonal contact with (Moyer-Gusé, 2008). In this sense, video games may be uniquely positioned to deepen the connection with characters by placing the player directly into the body of a character with mental illness. Thus, rather than merely observing a character with mental illness, the player identifies with that character, feeling their thoughts, and experiencing life through the character's lens.

The present study used an experimental design combined with structural equation modeling analysis to examine experiencing a mental illness through a character in a video game narrative, which can ultimately reduce mental health stigma through transportation and identification. We conducted a two-factor experiment, in which participants either played or watched gameplay footage of *Hellblade: Senua's Sacrifice*, a game praised for its accurate and sensitive portrayal of individuals living with psychosis.

Mental Illness Stigma

Numerous paradigms and perspectives have examined stigma. One such paradigm is the social cognitive approach, which suggests that stigma signals, or cues, lead to the construction of stereotypes, leading to discriminatory patterns of behavior (Corrigan, 2000). First, someone sees a person with mental illness exhibiting some signals, such as self-harm scarring or erratic behavior. This signal cues stereotypes, such as believing that those who have mental illness are dangerous. Based on this stereotype, the stigmatizing individual may engage in discriminatory behavior, such as distancing themselves socially from the person with mental illness.

According to Link et al. (2001), stigma occurs when different components co-occur. These components are labeling differences, associating differences with negative attributes, separating the "us" from "them," and status loss/discrimination. Essentially, the stigmatized individual is recognized as being different and thus has stereotypes assigned to those differences. These stereotypes can result in the stigmatized individual being discriminated against in various ways, including a desire by the non-stigmatized group to distance themselves from the stigmatized individual, who makes up an out-group.

Stigma can have incredibly damaging effects on the stigmatized individual. Discriminatory behavior can result not only in social scorn but also loss of opportunities, including being released from employment (Rüsch et al., 2005). Further, stigma can be internalized, such that the individual holds stigmatizing beliefs about themselves. This can also be seen in that individuals with mental illness have been found to have lower rates of self-stigma in countries or regions that have less stigmatizing attitudes toward mental health (Evans-Lacko et al., 2013).

Further, since mental illness can be invisible, the stigmatized individual can shy away from behaviors that would mark them as a person with mental illness, which includes seeking professional help. Numerous studies have suggested that self-stigma and perceived stigma can both act as barriers to

seeking help (Barney et al., 2006; Schomerus and Angermeyer, 2008; Eisenberg et al., 2009). Because of the negative impact of stigma, numerous researchers have explored how to reduce stigma through mass media. These interventions typically act as public service announcements or various methods of interpersonal contact with individuals suffering from mental illness and have had mixed success (Heijnders and Meij, 2006; Corrigan et al., 2012; Griffiths et al., 2014; Niederkrotenthaler et al., 2014).

In a study, Clement et al. (2013) showed that mass media interventions could potentially reduce prejudice against those with schizophrenia and major depression in a small to medium range. However, in terms of discrimination, there is still more research to do. Importantly, Clement et al. (2013) examined mass media interventions generally, including public service announcements, pamphlets, and brochures. They did not explore the role of commercial entertainment media in reducing stigma.

Research into the role of entertainment in reducing mental illness stigma has been mixed. Ritterfeld and Jin (2006) found that being entertained by a sensitive portrayal of mental illness led to higher educational value and thus stigma reduction. However, these positive effects only occur when the content is not stereotypical, else stigma can increase (Wahl and Lefkowits, 1989). For example, Rubenking and Bracken (2015) found that those who watched stigmatizing portrayals of mental illness reported greater stigma than did those in a control condition, who in turn reported greater stigma than those watching a sensitive portrayal. Thus, portrayals of mental illness need to be sensitive and nuanced if they are to reduce stigma and have positive societal effects.

Video games offer a unique avenue into the study of stigma reduction. While some research has suggested that contact – even non-face-to-face contact – with mentally ill individuals can be effective in reducing stigma, video games offer the opportunity to take contact further by handing the player direct control of the mentally ill character. While some gaming research has explored how playing with diverse others can decrease out-group bias (Adachi et al., 2014), less has been done to explore how experiencing gaming narratives with out-group members – in this case, someone with mental illness – can decrease bias, particularly.

Transportation

When someone encounters a story, they may in some cases begin to feel as though they are themselves inside the world created by that narrative. Transportation theory (also described as narrative engagement or absorption) describes this process (Green and Brock, 2000). According to Green and Brock (2000), transportation occurs when a reader, viewer, or player disengages from the real world, and cognitive abilities are devoted to processing the story world. The world within the story becomes so salient that the outside world falls away while the individual focuses completely on the world created by the narrative.

Transportation is an effective mechanism for creating attitudinal change. The Extended Elaboration Likelihood Model (E-ELM) suggests that transportation into a narrative can result in positive responses to embedded persuasive messages, particularly by suppressing counterarguing against those

messages (Slater and Rouner, 2002). Further, "based on identification and transportation's ability to absorb audience members and encourage them to reevaluate their current perspectives and schemas, such experiences may be able to motivate viewers to positively reformulate their understanding of stigmatized others" (Chung and Slater, 2013). Essentially, those who become transported into a narrative surround themselves with events related to the target of stigmatization, thus forcing them to confront the nature of the stigma.

Of course, video games have an added advantage to other media in increasing transportation. Whereas, books force the reader to imagine the story world, and movies only show the narratives, video games allow players to explore on their own, deciding where they go and when. Additionally, players can embody their character in these spaces. Gee (2008) argues that video games can be used as a simulation of the human experience of embodied cognition. Players inhabit virtual characters, taking these characters on as surrogates and acting as though this character's goals are their own. He further argues that digital characters have virtual minds and bodies and that when players inhabit these characters, they take these virtual minds and virtual bodies on as their own. Players use information from both the narrative and the game world itself to infer the state of their avatar's mind and body. Players use this information to explain their characters' actions within the virtual world.

This additional sense of control and the experience of embodying a character heighten transportation by easing the transition from the outside world to story world, while placing control over the story and its reality directly into the hands of the player (Green et al., 2004). Based on this line of reasoning, we propose:

> *Hypothesis* 1: Playing a video game rather than watching will lead to an increase in transportation.

Of course, transportation is only possible when there is a narrative – and thus necessarily characters – to explore. Narratives in video games, while similar to traditional narratives, differ in that in most cases players take a direct role in controlling the actions of their character rather than being a passive observer. This could take the form of making choices which affect the narrative of the game, or in cases where narrative choice is not present, players still actively experience the story by leading the character along the journey, thereby exploring the world created by the video game by directly interacting with it.

Identification

Identification, as discussed by Cohen (2001), refers to an imaginative process wherein an individual takes on the thoughts and perspectives of media characters. In essence, users adopt the media persona's characteristics for the duration of the experience. While identifying with a character, individuals expand their own self-concept to include the media character, thus feeling as though they are one with the media character (Hefner et al., 2007).

This process of identification fundamentally differs between interactive and non-interactive media. In non-interactive media,

such as books and film, the characters are distinct from the user, while the user may take the character's perspective, they also realize that the character is a separate entity with their own thoughts, feelings, and behavior. This characterization of the identification is considered dyadic, as the user and the character form a dyad (Klimmt et al., 2009).

When the medium is interactive, however, the relationship between player and character is far closer in social distance. The player controls the character's movements and actions, and sometimes even their words or feelings. Thus, the player truly feels as though they and the character they control are one entity, occupying a monadic relationship (Klimmt et al., 2009).

Of course, identification with the avatar presupposes that the player is transported into the story world in the first place. Becoming absorbed into a narrative allows players to bring themselves into the story and thereby experience the events of the plot alongside the characters. According to Slater and Rouner (2002), the degree to which a user takes on the perspective of the character highly depends on the degree to which the user can experience the story vicariously *through* the character. As the player and character travel through the plot together, the player is better able to take on the thoughts, feelings, and behaviors of the character in question. According to Green et al. (2004, p. 318), "central to the process of identification is the adoption of a character's thoughts, goals, emotions, and behaviors, and such vicarious experience requires the reader or viewer to leave his or her physical, social, and psychological reality behind in favor of the world of the narrative and its inhabitants." Thus:

> *Hypothesis* 2: Transportation will positively predict identification.

Identification is also an important factor for stigma reduction through narrative means. In particular, being able to take on the perspective of a stigmatized character allows the user to humanize the stigmatized group. Chung and Slater (2013) found that perspective-taking specifically predicts the social acceptance of stigmatized groups. Igartua (2010) also found support for this link between identification and attitudinal change.

According to Moyer-Gusé (2008), identification can cause acceptance of story-related beliefs primarily because users lose part of their own self-concept while encompassing the other, lessening the likelihood that users will counter-argue the message. As users take on the perspective of the character, their own perspective – which may be skeptical of the message – is ignored. Further, identifying with characters who are in some way different from the user can serve to increase empathy about the real-world groups to whom those characters belong (Slater and Cohen, 2017). Additionally, identifying with a character from a stigmatized group helps to blur in-group, out-group distinctions, thereby reducing negative thoughts, feelings, and behaviors toward that group (Chung and Slater, 2013). Based on this line of theorizing and the idea that stigma consists of both stereotyping and the desire to separate from the stigmatized individual:

> *Hypothesis* 3a: Identification will negatively predict stereotyping toward those with mental illness.

Hypothesis 3b: Identification will negatively predict the desire for social distance from those with mental illness.

MATERIALS AND METHODS

Participants

Participants were recruited from a subject pool at a large university in the Southeastern United States. In exchange for their participation, individuals received course credit. The subject pool pulled from students in communication courses, including large introductory classes featuring students from a variety of majors.

A total of 207 participants completed the questionnaire. However, seven participants turned in missing data for the mediating variables of interest (e.g., failing to answer questions about identification or transportation) and were excluded. Additionally, one participant missed an entire section of the questionnaire and was excluded. A missing value analysis indicated eight values missing. These values were found to be missing completely at random (MCAR) according to Little's MCAR test, $\chi^2 = 285.05$, $df = 253$, $p = 0.075$. Because of the low number of missing cases and the fact that they were considered to be MCAR, expectation-maximization was utilized to impute missing data. This resulted in a total N of 198. Participants ranged in age from 18 to 35, with a mean age of 20.42. Participants were mostly White (71.7%), followed by Hispanic/Latino (20.7%) and Black (13.1%), with participants able to choose more than one ethnicity. The majority (66.7%) were female, with 32.8% identifying as male and one participant identifying as neither male nor female.

Design and Stimulus

The study design was a two-condition, randomized design comparing treatment and control and was approved by Florida State University's Institutional Review Board prior to its being conducted. After recruitment undergoing the informed consent process, participants were assigned to one of two conditions: a treatment condition where they played a video game featuring a protagonist with mental illness, and a control condition where they merely watched someone else play the same game. The first thing that participants were shown when starting the game was the following disclaimer:

> Warning: This game contains representations of psychosis. People with experience of psychosis as well as professionals in psychiatry have assisted in these depictions. Some may find these depictions disturbing, including those who, themselves, may have had similar experiences. If you would like to find out more about psychosis and mental health difficulties visit: www.hellbladehelp.info. This game also includes violent scenes that some may find distressing (Ninja Theory, 2017).

The conditions were fully yoked; that is, participants who watched gameplay footage were watching recordings of other participants in the study. Therefore, there should not be differences in the amount of story consumed between the two conditions. Upon completion of either a playing or viewing session, participants took a survey on their assigned computer that included the measures described below.

The video game chosen for the study is *Hellblade: Senua's Sacrifice*. Set in an age of Vikings, *Hellblade* follows the title character, Senua, on a vision quest (Ninja Theory, 2017). Developed along with neuroscientists and those who experience psychosis, *Hellblade* places depictions of mental health issues centrally in its story as Senua battles for the soul of her departed lover (Ninja Theory, 2017). Senua herself suffers from psychosis and must contend with her own mental illness along with the challenges presented by her quest. *Hellblade* has been recognized for these depictions, winning a *BAFTA* award for "Game Beyond Entertainment" and a *The Games Award* prize for "Games for Impact" (Ninja Theory, 2017).

Hellblade was designed in conjunction with noted neuroscientist and mental health experts and people suffering from psychosis, with the express intention of creating an accurate and respectful depiction of the types of hallucinations common to those suffering from psychosis (Fordham and Ball, 2019).

A case study of *Hellblade*, done by (Fordham and Ball (2019, p. 8) found the game incorporated psychosis throughout both the narrative and gameplay aspects of the game. For instance, the game utilized binaural 3D microphones to give the illusion that the protagonist is hearing voices from different directions, leading experts in auditory hallucinations to argue that the game "is one of the best representatives of these experiences."

Thus, through its thoughtful development and critical acclaim, *Hellblade* is uniquely positioned to help depict mental health issues.

Independent Variable

The independent variable, in this case, is the manipulation of either playing the above-described video game or simply viewing gameplay footage of the game. If assigned to the playing condition, participants were asked to play the game on a PC in the lab for approximately 45 min, with their gaming performance recorded. Those assigned to the viewing condition watched the recorded footage of other participants playing. Recordings were done locally on computers in the lab, viewed and then removed from rotation when new gameplay recordings became available. In this way, the participants, both creating and viewing the recordings, as well as the recordings themselves, were randomly assigned.

Measures

All items were measured using seven-point Likert-type scales ranging from 1 (Strongly Disagree) to 7 (Strongly Agree) unless otherwise noted. While measures were adapted and not used verbatim, we only altered items enough to make them fit the context of the game. For example, when asking about identification, we inserted Senua's name so that participants could visualize the character as they answered the questions. **Table 1** shows means and standard deviations for all measured variables.

TABLE 1 | Means and standard deviations for all variables.

Variable	M (1–7)	SD
Identification	2.59	1.18
Transportation	4.09	1.30
Stereotyping	3.00	0.93
Desire for social distance	2.74	1.18
Contact with mentally ill	4.02	1.21
Perceived difficulty	3.92	1.97

Dependent Variables

Stigma against those with mental illness was measured in two ways. First, nine items adapted from Cohen et al. (2018) assessed the degree to which individuals would stereotype those with mental illness (adapted from Corrigan et al., 2006). Items included "Those with mental illness are to blame for their own problems" and "Those with mental illness will NOT recover or get better." These items were used instead of other validated scales because they best fit the context of the present study. The resultant index was found to be reliable with a Cronbach's alpha of 0.82.

Additionally, the desire for social distance from those with mental illness made up the second dimension of stigma. Six items were taken from Martin et al. (2000). The items used on the scales asked participants' willingness to engage in certain behaviors. Items included "How willing would you be to spend an evening socializing with a person described as having a mental health problem?" and "How willing would you be to make friends with a person described as having a mental health problem?" The created index was reliable (α = 0.89).

Mediating Variables

Transportation was measured utilizing narrative engagement scale of Busselle and Bilandzic (2009). The transportation scale created by Green and Brock (2000) was not utilized in the study because it tends to work best for written narratives, due to the specific items on the scale (Bezdek and Gerrig, 2017). The narrative engagement scale consists of 12 items, including "During the game, my body was in the room, but my mind was inside the world created by the story" and "The story affected me emotionally" (α = 0.87).

Identification was measured with 16 items adapted from Player Identification Scale of Van Looy et al. (2012). Sample items include "If I could become like Senua, I would" and "Senua is an extension of myself." The scale was found to be reliable with a Cronbach's alpha of 0.93.

Covariates

Given that difficulty may have an effect on the dependent or mediating variables, it is important to measure participants' perceived difficulty of the game and control for its effect in the model. The perceived difficulty was measured using a single item created for the study: "This game was difficult."

Research has suggested that personal contact can reduce stigma (Alexander and Link, 2003; Couture and Penn, 2003). Therefore, we also measured contact utilizing eight items

from Trute et al. (1989). These items included "I have received some formal education regarding mental health" and "I currently have or in the past have had professional help for mental problems" and were reliable with a Cronbach's alpha of 0.71.

RESULTS

To test the proposed model, a structural equation model was constructed in two stages. First, a measurement model was calculated utilizing all variables of interest (e.g., experimental condition, transportation, identification, social distance, stereotyping, along with difficulty and contact). All items within subscales in the model (e.g., items predicting wishful identification, similarity identification, and embodied presence in the avatar identification scale) were correlated with one another. Additionally, all items with very low factor loadings (e.g., <0.40) were dropped, resulting in the removal of the entire narrative understanding subscale of the narrative engagement scale and one item from the stereotyping scale. While the resultant model had significant Chi-square, χ^2 = 1696.005, df = 969, p < 0.001, other indicators of model fit pointed toward an adequate fit, RMSEA = 0.06, 90% CI (0.06, 0.07), standardized RMR = 0.09. See **Table 2** for factor loadings.

Then, the structural model was constructed. This model exhibited adequate fit as well, Chi-square, χ^2 = 1843.960, df = 1,028, p < 0.001, RMSEA = 0.06, 90% CI (0.06, 0.07), standardized RMR = 0.11. As shown in **Figure 1**, playing the game (as opposed to watching) increased transportation, which increased identification. Identification then *decreased* the desire for social distance. The same pattern did not hold for stereotyping, however.

One potential concern here was that, although players encountered relatively few enemies in the first portion of the game, violent combat was a part of the experience. This violence is a typical stereotype for those with mental illness, which may have implications for how the stereotyping variable behaved. To check for this, we removed one item from the model about those with mental illness being dangerous; this change did not alter the results. As a result, we have reported the original model with the violence item variable included.

DISCUSSION

The goal of this study was to examine how playing video games featuring characters suffering from mental illness may ultimately reduce stigma through transportation and identification.

Consistent with the hypothesized model, playing a video game was associated with an increase in transportation. Those who played the game reported greater feelings of being lost inside the story world than did those who merely watched gameplay. This feeling of being totally involved in the world of the story appears to have increased the connection players felt with the main character. As they were able to move around and explore the world in Senua's shoes, they were able to get a better feel for

TABLE 2 | Final CFA factor loadings.

Label		Loadings
Contact with mental illness ($\alpha = 0.71$)		
C1	I have lived or worked close to a mental health facility.	0.43
C3	I am currently working with or in the past have worked with a coworker having mental health problems.	0.53
C5	I currently have or in the past have had professional help for mental problems.	0.49
C6	A member of my family currently has or in the past has had mental problems.	0.56
C7	I have received some formal education regarding mental health.	0.45
C8	I have read factual information or seen factual TV programs concerning mental health.	0.43
Transportation ($\alpha = 0.86$)		
T4(R)	I found my mind wandering while the game was on.	0.52
T5(R)	While playing, I found myself thinking about other things.	0.53
T6(R)	I had a hard time keeping my mind on the game.	0.59
T7	During the game, my body was in the room, but my mind was inside the world created by the story.	0.75
T8	The game created a new world, and then that world suddenly disappeared when the game ended.	0.52
T9	At times during the game, the story world was closer to me than the real world.	0.61
T10	The story affected me emotionally.	0.61
T11	During the game, when a main character succeeded, I felt happy, and when they suffered in some way, I felt sad.	0.70
T12	I felt sorry for some of the characters in the game.	0.43
Identification ($\alpha = 0.93$)		
I1	Senua is similar to me.	0.71
I2	Senua resembles me.	0.76
I3	I identify with Senua.	0.81
I4	Senua is like me in many ways.	0.86
I5	Senua is an extension of myself.	0.83
I6	I would like to be more like Senua.	0.65
I7	If I could become like Senua, I would.	0.66
I8	Senua is an example to me.	0.81
I9	Senua is a better me.	0.70
I10	Senua has characteristics that I would like to have.	0.58
I11	When I am playing, it feels as if I am Senua.	0.54
I12	I feel like I am inside Senua when playing.	0.54
I13	In the game, it is as if I become one with Senua.	0.55
I14	When I am playing, I am transported into Senua.	0.51
I15	When playing, it feels as if Senua's body becomes my own.	0.56
I16	In the game, it is as if I act directly through Senua.	0.50
Stereotyping ($\alpha = 0.82$)		
S1	Those with mental illness are to blame for their own problems.	0.44
S2	Those with mental illness are dangerous.	0.84
S3	Those with mental illness are morally weak.	0.66
S4	Those with mental illness are unpredictable.	0.62
S5	Those with mental illness are reckless.	0.77
S6	Those with mental illness engage in high risk behaviors.	0.62
S8(R)	Those with mental illness make important contributions to society.	0.46
S9(R)	Those with mental illness live a good and fulfilling life.	0.46
Desire for social distance ($\alpha = 0.89$)		
SD1(R)	How willing would you be to…move next door to a person described as having a mental health problem?	0.81
SD2(R)	…make friends with a person described as having a mental health problem?	0.86
SD3(R)	…spend an evening socializing with a person described as having a mental health problem?	0.84
SD4(R)	…have a person described as having a mental health problem start working closely with you?	0.86
SD5(R)	…have a group home for people described as having a mental health problem?	0.46
SD6(R)	…have a person described as having a mental health problem marry into your family?	0.81

(R) Indicates a reverse-coded item. Cronbach's alphas indicate reliability after items low-loading items were dropped. Chi-square, $\chi^2 = 1696.005$, $df = 969$, $p < 0.001$, RMSEA = 0.06, 90% CI (0.06, 0.07), and standardized RMR = 0.09.

her thoughts, feelings, and behaviors. This heightened identification seems to have led to a reduction in desire for social distance from mentally ill others. These results are especially meaningful, given that Senua's mental illness is psychosis, an illness that is hugely stigmatized, more so than other illnesses such as depression or anxiety. It seems that, by experiencing life as someone afflicted with this disorder, players were able to incorporate the mental

illness to their own self-concept through the process of identification, therefore, reporting less desire to keep those with mental illness away. Notably, the measurement for social distance did not specify a diagnosis, indicating that playing as a character with this illness helped with perceptions of mental illness overall.

These results did not hold for stereotyping, which is another critical aspect of stigma. Identifying with Senua was not associated
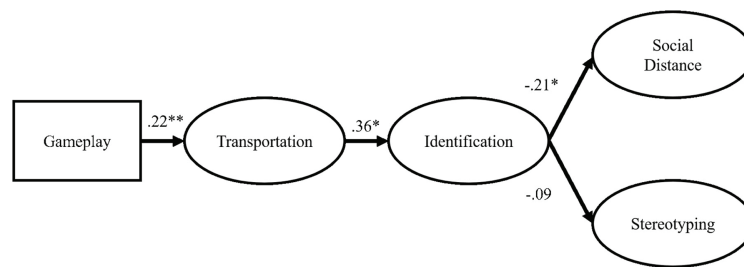
FIGURE 1 | SEM path model. Items and covariates (i.e., difficulty and contact) are not pictured here. Paths represent standardized regression weights. *$p < 0.05$, and **$p < 0.01$.

with changes in held stereotypes about mental illness. This is a somewhat counterintuitive finding since stereotyping is often found to be easier to shift than the desire for social distance (see Hoffner and Cohen, 2012; Wong et al., 2017). A possible explanation is that, when individuals incorporate a character's attributes – in this case, mental illness – as part of their own self-concept through identification, this expansion of the self to include the other in the in-group does not necessarily limit the possibility of stereotyping that new perception of the in-group. In other words, even though participants can take on Senua's thoughts, attitudes, and behaviors as though they were the players', they may still stereotype their own self-concept. Interestingly, removing the stereotyping items related to violence did not change the overall model as reported. These results indicate that something other than violence is driving the stereotyping result. The specific mechanisms by which stereotyping may be lowered must be further explored in future study.

Additionally, transportation into the narrative appears to be a strong predictor of identification. This finding is consistent with previous literature, such as the model proposed by Brown (2015). Becoming personally involved in the narrative allows participants to become involved with the lives of the characters at play. Given that, as Green et al. (2004) argue, identification requires the individual engaging with the narrative to adopt the character's motivation, actions, behaviors, and experiences, the findings of this study support this conceptualization.

It is important to note that identification was not, on average, particularly high ($M = 2.69$, $SD = 1.18$). As Chung and Slater (2013) found, it seems possible that fostering a sense of identification with a member of a highly stigmatized group is difficult. That said, even this low level of identification was significantly associated with lower levels of desire for social distance. Moreover, the results could also indicate that the identification may have different outcomes when the participants are watching the game instead of playing. The participants who watched might not have the same experiential value of identification compared to those who played. This condition may mirror the experience of watching gameplay videos online; the watcher is not directly interacting with the character but is forced into a further layer of distancing brought on by the presence of a third party – the player. According to Zillmann, "at least in non-interactive entertainment such as watching television – media users keep a distance

between themselves and a character on the screen," as cited in (Hefner et al., 2007, p. 40), which was supported here.

Participants who watched Hellblade: Senua's Sacrifice may not have had the opportunity to identify themselves with the character, at least not to the same degree as those who played the game; this could be due to the game itself. "Hellblade: Senua's Sacrifice" is a game that is not categorized as, e.g., an action game, simulation game, war game, or e-sports game, etc. Those who watched maybe have not been motivated since the purpose of the game is different from the best selling and the most played video game. "When identifying with a character or role offered by the game, players change their self-concept by adopting relevant attributes of the character, for instance, they perceive themselves as more courageous, heroic, and powerful during identification with a soldier" (Hefner et al., 2007, p. 39).

Theoretical Implications

The results of this study hold critical theoretical implications, particularly in the realm of mental illness stigma. Whereas, some preliminary work has begun to explore the role of entertainment media in stigma reduction, the current study extends this work by explicitly focusing on video game contexts. In essence, playing narrative-heavy video games seems to be a potential method to reduce social distancing, mainly through engagement and identification.

There are also implications for the study of entertainment media, particularly in narrative processing. By controlling a non-stereotypical character in a rich narrative space, participants reported an increased sense of transportation into the narrative constructed by *Hellblade*, and thus possibly feeling a stronger connection to Senua. These findings highlight the unique ability of video games to foster this sense of transportation – and thus, identification – through the interactivity afforded by the medium. This work offers an important step in further exploration of video games for social good.

Practical Implications

Given that participants played a commercially available game and still showed a slight reduction in social distancing, it seems that video games can reduce stigma as long as the portrayal shown in the game is not stigmatizing. Great care was taken

by the development team to ensure their portrayal of psychosis was accurate and sensitive. As a result, players who controlled Senua on her quest showed a reduction in the social distance aspect of stigma.

This finding is important for two reasons: first, it illustrates that commercially available games can affect change in comparison to simply watching, even when that may not be the developers' primary purpose. Second, the results of this study may help create games designed explicitly for stigma reduction in the future.

Furthermore, it is also important to mention that some players are interested in watching others playing video games. According to Kaytoue et al. (2012, p. 1181), "casual players were found to prefer watching professional gamers rather than playing the game themselves." If the players show skills during the game and prove to have professional/expertise (game-related skills), they will have a more enjoyable experience (Pietruszka, 2016). This may not be the case in this study since some participants struggled by not knowing how to play the game. However, given that the game in question is the competitive type of game usually shown in eSports, perhaps individuals who watch these types of games may have different motivations (Sjöblom and Hamari, 2017). The results of our study indicate that, while individuals may be interested in watching gameplay footage, actually playing the game seems to be key for reducing stigma.

The results of this study show important implications for anti-stigma campaigns. Notably, it seems that having individuals being able to interact with a narrative space while taking on the role of a character suffering from a severe mental illness is able to ultimately reduce the desire to distance themselves from those with mental illnesses more generally. Thus, video games like the one utilized in this study may function as an anti-stigma intervention. While these results are preliminary in that it is unclear whether they would function the same way with different populations, they show early promise for the development of future campaigns.

The use of video game interventions like *Hellblade* may be useful in delivering anti-stigma messages primarily because they are not specifically designed to do so. In other words, the game was developed for commercial and aesthetic applications, not for the explicit purpose of reducing stigma. Thus, the game, and other games like it, may be less likely to activate reactance in players (see Moyer-Gusé, 2008); as additional studies replicate the findings shown here, the viability of various types of games as stigma-reduction interventions will become more apparent. Future study should be devoted to the power of commercial entertainment to bypass reactance in audience members.

LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

Of course, there are limitations to the current study that must be discussed. First, the selection of the game itself may have proved to be a challenge for participants who do not often play video games. The game does not have a dedicated tutorial

and does not show participants how to use controls or where to go. Thus, there may have been some confusion for participants, making it somewhat difficult for them to play the game. Future research should replicate the results found here with other games with varying degrees of difficulty, particularly if the creation of interventions is the goal.

Further, a student sample was utilized for this study. Thus, the results cannot necessarily be generalized to a more general population. Future studies should bring in participants from various demographics to ensure that the results hold for other populations.

Another potential limitation for this study is that we only examined the short-term impacts of the video game as a potential intervention. As a result, we have no way of knowing whether the effects found here are persistent. Future studies should further explore with long-term follow-ups to determine the persistent effectiveness of video games as stigma-reduction interventions.

Finally, participants in this study only played the first 45 min of the game; this was done to ensure that even beginning players would be able to pick up the story and the game's controls. However, this represents only the beginning of Senua's journey, which sees her come to terms with her own mental illness toward the end of the game. Effect sizes may have been larger had participants undergone the entire journey with Senua. Thus, future studies should vary the character's progression, possibly exploring both self-acceptance and self-stigma through the character, as these different types of journeys may have an impact on stigma reduction.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Florida State University Institutional Review Board. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

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How Passion for Playing World of Warcraft Predicts In-Game Social Capital, Loneliness, and Wellbeing

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Playing digital games can nurture wellbeing by helping players recover from daily stressors, cope with life's challenges, practice emotion regulation, and engage in meaningful social interaction; however, this same leisure activity can also result in problematic gaming (i.e., harmful play at the expense of healthy behaviors), and social isolation that damages wellbeing. Research consistently demonstrates that the value or harm of gaming on wellbeing cannot be determined solely from whether and how much people play, but rather depends on contingent factors related to the player, the game, and the gaming context. In this paper, we aim to model contingent factors that differentiate between beneficial and harmful outcomes within players of the same massively multiplayer online role playing game (MMORPG). We model how passion for gaming—defined as a strong desire to engage in a beloved activity that is enjoyed and valued, in which time and energy is invested, and that ultimately integrates into a person's identity—affects loneliness and wellbeing. We employ the dualistic model that divides passion into harmonious passion (HP)—characterized by a balanced and authentic relationship with the beloved activity, and obsessive passion (OP)—characterized by preoccupation and inflexible persistence toward the loved activity. We sampled 300 frequent World of Warcraft (WoW) players, recruited from online forums, and used structural equation modeling (SEM) to investigate the effects of their passion for playing WoW on in-game social capital, loneliness, and wellbeing. We demonstrate that HP for playing WoW facilitates in-game social capital (both bridging and bonding), combats loneliness, and increases wellbeing, whereas OP also builds social capital, but these social ties do not combat loneliness, and OP is directly associated with increased loneliness. Further, the positive effect of HP on wellbeing is mediated through an increase in bonding social capital and a resulting decrease in loneliness. Our findings highlight that passion orientation is important for characterizing the relationship between gaming and wellbeing. We contribute to the conversation on combating problematic gaming, while also promoting digital gaming as an appealing leisure activity that provides enjoyment, recovery, and meaningful social interaction for the millions of gamers who benefit from its captivation.

Keywords: passion, social capital, loneliness, wellbeing, social games, benefits, problematic gaming

1. INTRODUCTION

Digital gaming is quickly becoming a leading leisure activity among a broad range of demographics; in 2019, approximately two thirds of the global online population played digital games (Newzoo, 2019). Gamers play on dedicated gaming consoles and on personal computers in their homes, but also on tablets and smartphones out in the world, and in dedicated gaming spaces (Entertainment Software Association, 2019). Research has demonstrated that people play digital games as a leisure activity to experience enjoyment (Boyle et al., 2012), escapism (Grove et al., 2016), immersion (Jennett et al., 2008), and challenge (Denisova et al., 2020), but gaming also provides more than just a pleasurable pastime. Playing digital games has also been shown to nurture wellbeing by helping players recover from daily stressors (Reinecke, 2009; Collins et al., 2019), repair noxious moods (Bowman and Tamborini, 2012), cope with life's challenges (Iacovides and Mekler, 2019), and practice emotional regulation (Granic et al., 2014). In addition to these benefits to the individual player, gaming has also been shown to be socially motivated for both adults (Frostling-Henningsson, 2009) and youth (Ferguson and Olson, 2012). The majority of adult gamers in 2019 played in multiplayer mode with others for an average of 4.8 h per week online and 3.5 h per week in person because they feel that video games help them connect with friends and family (Entertainment Software Association, 2019). For example, Williams et al. (2006) show that World of Warcraft (WoW) players use the game as a platform to maintain existing relationships, form new ones, and even to find romantic partners.

This rise of social gaming coincides with a timeframe in which an increasing lack of social connectedness has been identified as a threat to our wellbeing (OECD, 2020). The need to form lasting and caring relationships and the feeling of belonging are fundamental human needs (Baumeister and Leary, 1995; Deci and Ryan, 2000), but the social connectedness of people has declined over the past decade with the share of people who have relatives or friends they feel that they can count on to help in a time of need having fallen across many developed nations (OECD, 2020). Good social embeddedness is key for overall health and wellbeing; research has shown that when people feel socially excluded, they are subject to impaired executive functioning (Baumeister et al., 2002) and an increased tendency toward hostile cognitions, including the interpretation of ambiguous situations in a threatening way (DeWall et al., 2009). Loneliness is a major contributor to reduced wellbeing, with estimates suggesting that people who feel isolated have a 30% increased risk of mortality (Holt-Lunstad et al., 2015). To help address the more than 9 million residents who often or always feel lonely in the UK, a Minister of Loneliness was appointed in 2018 (Holt-Lunstad et al., 2015). The prevalence of loneliness is highest among 18–30 year olds (Holt-Lunstad et al., 2015)—the same age range of adults with the highest proportion of gamers (Entertainment Software Association, 2019).

Given the increasing prevalence of multiplayer digital games as a leisure activity, in a context of decreasing social embeddedness, researchers have started to consider whether the social relationships that are established and enacted through digital games help or harm social aspects of wellbeing, including loneliness and feelings of isolation. Recent studies have demonstrated that digital games—played both in-person and online—can facilitate social interactions that are vital for our social well-being, for example, by connecting us to others (Dabbish, 2008; Hernandez et al., 2014), helping us maintain existing relationships (Wohn et al., 2011), facilitating trust development with strangers (Depping et al., 2016; Depping and Mandryk, 2017), and even combating loneliness (Depping et al., 2018); however, the same mechanics, games, and gaming contexts that foster social closeness in games can instead lead to toxic game environments (Chen et al., 2009; Kwak et al., 2015) or displace offline relationships (Zhong, 2011), resulting in feelings of social exclusion (Shores et al., 2014).

The potential value or damage that results from social game play can have a great impact on players, but existing contrasting evidence makes it challenging to reconcile the potential benefits and harms of social play on wellbeing. Further, research consistently demonstrates that effects of social play on wellbeing cannot be determined simply from whether and how much people play, but instead depends on a variety of contingent factors, such as how satisfied the individual player is with their life (Przybylski et al., 2009), at what time of day they tend to play (Lemola et al., 2011), and what types of games they choose (Depping et al., 2018). In the context of social play, the role of contingent factors in determining the benefits or harms is still not well understood. Little research has teased out these relationships in the context of social gaming. The problem is that *without an understanding of how these contingent factors influence player wellbeing, we could be encouraging social play with the intention of helping players, but actually harm them; conversely, we might discourage social play to protect players that would actually benefit greatly from participating in game-based social interactions*. There are a variety of contingent factors that might affect the social value of digital game play, including factors related to the player characteristics, the game features, and the experience of play itself (Johnson et al., 2013). When we discuss the impact of social play on wellbeing, we must think beyond simply whether or not people play with others, but rather consider the quality of that social interaction. When considering the quality or value of social interactions, we can turn to the well-established construct of social capital, which helps us situate game-based social interactions in a broader theoretical grounding of the value of social ties.

1.1. Social Capital in Games

The social capital framework formalizes the value of social ties, framing social networks as resources that when fostered, will return value to an individual in the form of social support and personal information sharing that benefits wellbeing (Putnam, 2000). The social capital framework differentiates two kinds of relationships: bridging ties and bonding ties (Putnam, 2000). Bridging ties broaden the social horizon of the holder as they expose us to different world views, opinions, and resources (Putnam, 2000; Williams, 2006b); bridging ties are characterized as tentative relationships that may lack depth but make up for it in breadth. In contrast, bonding ties refer to strong

relationships in which people feel emotional and social support. Bonding ties are characterized by relationships with less diversity but stronger personal connections, and which provide strong, reciprocated, and substantive emotional support (Putnam, 2000; Williams, 2006b). Social capital is generally associated positively with outcomes related to psychological wellbeing (Putnam, 2000; Williams, 2006b).

Researchers have considered the quality of in-game relationships through the framework of social capital within World of Warcraft (Steinkuehler and Williams, 2006; Williams et al., 2006; Cole and Griffiths, 2007), Second Life (Huvila et al., 2010), and Counter-Strike (Jansz and Martens, 2005; Jansz and Tanis, 2007). Early research (conducted between 2005 and 2010) showed that relationships enacted within these games are capable of generating social capital, but generally agreed that social gaming was more likely to lead to bridging ties than bonding ties (Steinkuehler and Williams, 2006; Williams et al., 2006; Huvila et al., 2010). Subsequent research (conducted between 2011 and 2015) started to investigate how in-game social capital is formed by considering the motivations of players (Shen and Williams, 2011; Domahidi et al., 2014), their play duration and frequency (Shen and Williams, 2011; Domahidi et al., 2014; Kowert et al., 2014a), their physical and social proximity (Trepte et al., 2012), and the intensity of their in-game communication (Shen and Williams, 2011). Recent work (conducted after 2016) further investigated the properties of the game community itself, demonstrating that games requiring interdependence between players and communities with lower toxicity build both bridging and bonding ties (Depping et al., 2018). Finally, Perry et al. (2018) investigated the locus of relationship formation (i.e., whether the gaming relationships were online friends, strangers, or physical world friends) within Destiny players and showed that playing with online and physical friends built bonding ties, whereas playing with online friends and strangers built bridging ties. This research considered not only the type of relationship between players, but also considered how social capital is affected by the type of *engagement* that players had with Destiny, using the Dualistic Model of Passion.

1.2. Dualistic Model of Passion

Passion is defined as a strong desire to engage in a beloved activity that is enjoyed and valued, in which time and energy is invested, and that ultimately integrates into a person's identity (Vallerand et al., 2003; Lalande et al., 2017). The passion that people have for activities in their life (e.g., leisure, work, study) affects their engagement with those activities. In a series of studies and within the context of a variety of activities (e.g., work, study, music, sports), Vallerand et al. (2003) explored how passion for an activity develops and manifests, resulting in the Dualistic Model of Passion (DMP). In their work, they discuss how when we engage in an activity, and come to value it, we internalize it and adopt it as part of our self-identity (Vallerand et al., 2003). This process of internalization differentiates simple enjoyment of an activity (or intrinsic motivation to engage with it, Deci and Ryan, 2000) from activities that have become an enduring part of our identity; e.g., gaming as a pleasurable pastime vs. a passion for gaming that has resulted in identification as a "gamer." The

DMP further suggests that a developing passion can manifest in ways that are more harmonious or more obsessive (Vallerand et al., 2003). When people are harmoniously passionate about an activity, they describe it positively, and engage in it freely, authentically, and in balance with other activities or goals in their lives. Obsessive passion also describes activities that we have a strong desire to engage in, but instead desire is characterized as a preoccupation—an uncontrollable urge that is in conflict with other activities and goals and which leads to the neglect of those other pursuits (Vallerand et al., 2003).

Outside of videogames, there is consistent evidence that harmonious passion is associated with increased positive outcomes (e.g., self-development, social interaction, satisfaction with life, vitality) and some evidence that it is also associated with decreased negative outcomes (e.g., negative affect). Conversely, obsessive passion has been found to be consistently associated with increased negative outcomes (e.g., overuse of media, academic burnout, negative affect) and there is also some evidence of decreased positive outcomes (e.g., vitality). The positive impacts of harmonious passion and negative impacts of obsessive passion have been found across contexts including series watching, facebook use, music, sport and work (Vallerand et al., 2006; Lalande et al., 2017; Tóth-Király et al., 2019). The pattern has been found to be equivalent with respect to videogames, with harmonious passion associated with positive outcomes including skill development, motivation to relax and recreate, post-play energy, life-satisfaction and mental health (Przybylski et al., 2009; Tóth-Király et al., 2019), and obsessive passion related to problematic use of videogames, motivation to procrastinate, and post-play tension (Przybylski et al., 2009; Tóth-Király et al., 2019). However, as with other domains, a harmonious passion for videogames has not always been found to be associated with reduced negative outcomes and obsessive passion has not always been shown to be related to reduced positive outcomes. Specifically, Tóth-Király et al. (2019) did not find an association between harmonious passion and decreased overuse of videogames nor did they find any reductions in self-development and social interaction related to obsessive passion.

A recent development in the field is the consideration of passion as a quadripartite construct (Schellenberg et al., 2019). While previously, researchers treated obsessive and harmonious passion independently, the quadripartite model allows for simultaneous consideration of these constructs with people being considered as having pure harmonious passion (high on HP low on OP), pure obsessive passion (high on OP low on HP), mixed passion (moderate to high levels of both HP and OP), and no passion (low levels of both HP and OP). Among undergraduate students considering their favorite activity, pure HP was found to predict the highest levels of global health and psychological wellbeing, while pure OP predicted the lowest levels of both (Schellenberg et al., 2019). Mixed passion and a lack of passion both predicted better outcomes than pure OP. The same pattern was found with respect to passion for study and academic burnout (Schellenberg et al., 2019). With specific regard to passion for videogames, the pattern was largely consistent with pure HP predicting the best and pure OP predicting the

worst outcomes in terms of physical health symptoms (e.g., carpal tunnel, dry eyes) (Schellenberg et al., 2019).

1.3. Gaming and Wellbeing

Although they entertain us, digital games also offer an opportunity for improving wellbeing, for example by improving emotion regulation (Granic et al., 2014), offering recovery from stress or boredom (Reinecke, 2009; Bowman and Tamborini, 2012), building self-esteem (Bessière et al., 2007), and promoting mindfulness (Collins et al., 2019). Games also allow us to explore difficult emotions (Olson et al., 2008), and help us cope with changing life situations (Iacovides and Mekler, 2019); however, when used as a coping strategy, gaming may also thwart productivity, which creates an obstacle to wellbeing (Iacovides and Mekler, 2019). Wellbeing is also harmed when gaming is associated with addictive behavior (Van Rooij et al., 2011; Griffiths et al., 2012), a lack of control over play behavior (Mandryk and Birk, 2017), or a compulsion to play (Przybylski et al., 2009). However, the lines between engagement and addiction are often blurred, spawning recent efforts to disentangle high passion for gaming that results in beneficial engagement or damaging addictive behavior (Charlton and Danforth, 2007, 2010; Deleuze et al., 2018). The blurred relationships between gaming and its outcomes, which are both beneficial and harmful, has prompted significant research and discussion around the idea of problematic gaming.

The World Health Organization introduced "gaming disorder" as a diagnostic classification into the ICD-11 (World Health Organization, 2018), and while "internet gaming disorder" is not included in the DSM-5 (American Psychiatric Association, 2018), it has been identified as a condition of interest that warrants further clinical research. A gaming disorder is defined as "a pattern of gaming (...) characterized by impaired control over gaming, increasing priority given to gaming over other activities to the extent that gaming takes precedence over other interests and daily activities, and continuation or escalation of gaming despite the occurrence of negative consequences" (World Health Organization, 2018). This characterization of gaming as a disorder has sparked controversy as game scholars (e.g., Griffiths et al., 2016; Aarseth et al., 2017) have raised concerns surrounding its definition, the lack of supporting clinical data, and questions on whether problematic gaming should be viewed as a disorder in itself or as a coping mechanism for a different underlying problem (Kardefelt-Winther, 2014a). Still, problematic gaming has been associated with a range of harms to our physical (e.g., sleep deprivation, day-night reversal, malnutrition/dehydration, seizures), psychological (e.g., depression, anxiety, suicide), and vocational (e.g., impaired work and academic performance) wellbeing (McLean and Griffiths, 2013; Mitchell et al., 2015; González-Bueso et al., 2018; Bányai et al., 2019; O'Farrell et al., 2020). Wellbeing can also be harmed through exposure to toxicity in online gaming, especially when players engage in anonymous and impersonal interactions. Toxic behavior in multiplayer games often takes the form of harassment through verbal abuse (Foo and Koivisto, 2004); however, toxicity is also expressed through any behavior that harms team cohesion,

such as negative attitudes toward teammates, refusing to help your team, purposefully losing, or not participating (Chen et al., 2009; Kwak et al., 2015). Toxic behavior not only affects a player's game experience (Shores et al., 2014), but has been shown to thwart the development of in-game social capital (Depping et al., 2018), and also harm wellbeing by leading to depression, anxiety, and even suicide (Kwak et al., 2015). A 2015 study found that 52% of Massively Multiplayer Online Role Playing Game (MMORPG) players had been victims of cyberbullying (Ballard and Welch, 2015). Beyond the exposure to toxicity experienced in online gaming, researchers have also questioned the potential social harms caused by investing in online in-game relationships, at the expense of offline relationships in the physical world.

Early research into the social impact of gaming suggested that online social capital developed through games does not transfer into the physical world (Huvila et al., 2010; Zhong, 2011; Kwak et al., 2015); however, only a few studies have directly investigated the relationship between in-game interactions and offline social embeddedness. Williams conducted a series of studies within the WoW context (Steinkuehler and Williams, 2006; Williams et al., 2006; Shen and Williams, 2011), and reported that higher gaming frequency had a negative impact on offline social capital (Williams, 2006a), while Huvila et al. (2010) found that social capital built within Second Life does not converge with offline social capital. Kowert et al. (2014a) found that gaming frequency seems to be negatively associated with the quality and size of offline social circles. Together, these findings suggest that players who develop in-game relationships spend less time and energy fostering their offline relationships (Kraut et al., 1998; Shen and Williams, 2011; Domahidi et al., 2014; Kowert et al., 2014a) and that in-game social ties might be the broader and weaker "bridging" ties that do not provide the same level of social support provided by in-person relationships (Steinkuehler and Williams, 2006; Williams, 2006a,b; Williams et al., 2006; Huvila et al., 2010; Shen and Williams, 2011; Domahidi et al., 2014); however, these studies have not measured the effects that displacing offline relationships with online ones or investing in bridging ties through gaming have on an individual's loneliness or wellbeing.

Other studies have suggested that digital games—played both in-person and online—can foster the social interactions that are vital for our social well-being. Stereotypes about the antisocial, lonely gamer have long been shown to be inaccurate (e.g., Kowert et al., 2014b; Schiano et al., 2014) and researchers are finding that players view games as a social medium on which they want to form and maintain friendships (Steinkuehler and Williams, 2006; Kowert and Oldmeadow, 2015). Importantly, it has recently been demonstrated that these in-game relationships give out-of-game value to players. For example, Trepte et al. (2012) found that both bridging and bonding social capital built in esports clans was positively associated with offline social support (advice, assistance, and listening). Depping et al. (2018) found that interdependent and benevolent gaming communities facilitated both bridging and bonding capital in games, and that both were associated with reductions in loneliness (and bridging with increases in relatedness satisfaction).

Previous research into the value of social gaming has suggested that players devoting time to engaging in game-based social interactions, or forming and maintaining relationships through social gaming, may result in either value and harm. Most research has explored the nature or characteristics of social play, often by using the theoretical framework of social capital, yet very few studies have explicitly measured its benefits or harms to the wellbeing of players in operationalizations of social embeddedness, such as offline social support (e.g., Trepte et al., 2012), satisfaction of relatedness (e.g., Depping et al., 2018), or loneliness (e.g., Depping et al., 2018). When considering how problematic gaming is facilitated or how the wellbeing of players is affected by play, answers often take the form of *"it depends"*: gaming is not good or evil, but its value depends on the person playing, the game played, and the complex interactions that involve the gaming context (Johnson et al., 2013). One of these important factors of the gamer and their context is their passion orientation—is their passion for gaming an authentic relationship in balance and harmony with other life aspects or is it characterized by preoccupation and an inflexible persistence? And does this passion orientation affect the value of social ties established through social play? And finally, how do these social ties established through passionate play affect the wellbeing of players? In the end, are passionate social gamers more or less lonely?

1.4. The Present Study

In this paper, we model several contingent factors that differentiate between beneficial and harmful outcomes within players of the same massively multiplayer online role playing game (MMORPG). We surveyed 300 World of Warcraft (WoW) players, recruited online from fan forums, asking about their passion for playing WoW, their WoW-based social capital, their loneliness, and overall wellbeing (in addition to demographic factors and gaming behaviors). Our goal was to model how passion for playing WoW builds in-game social capital, and

then translates into out-of-game experiences of loneliness and wellbeing.

1.4.1. Hypothesized Path Model
The path model (see **Figure 1**) was derived from the literature, with support for several hypotheses along with other tested paths.

1.4.1.1. Direct effects
The first hypothesized paths (H1) are concerned with the relationships between passion and social capital. Based on the evidence seen in Perry et al. (2018) that HP leads to both types of social capital, we propose that:

> *H1a. Harmonious Passion will be positively associated with in-game Bonding social capital.*
> *H1b. Harmonious Passion will be positively associated with in-game Bridging social capital.*

In contrast, we expect that obsessive passion will not be associated with in-game bridging or in-game bonding capital, based on Perry et al. (2018) not having observed these relationships in the context of Destiny. However, because our gaming context is different (WoW), we still test these relationships in the model. Even if a player is obsessively passionate about WoW, they still might reap the benefits of social play. Further, recent work using a quadripartite model of passion (Schellenberg et al., 2019) shows that although HP and OP vary independently, players with mixed passion (high in both HP and OP) can have similar experiences to those with pure passion (either HP or OP). There may be an association; however, we have no guidance on the direction of the association, thus these hypotheses are exploratory, rather than confirmatory.

> *H1c. Obsessive Passion will be associated with in-game Bonding social capital.*
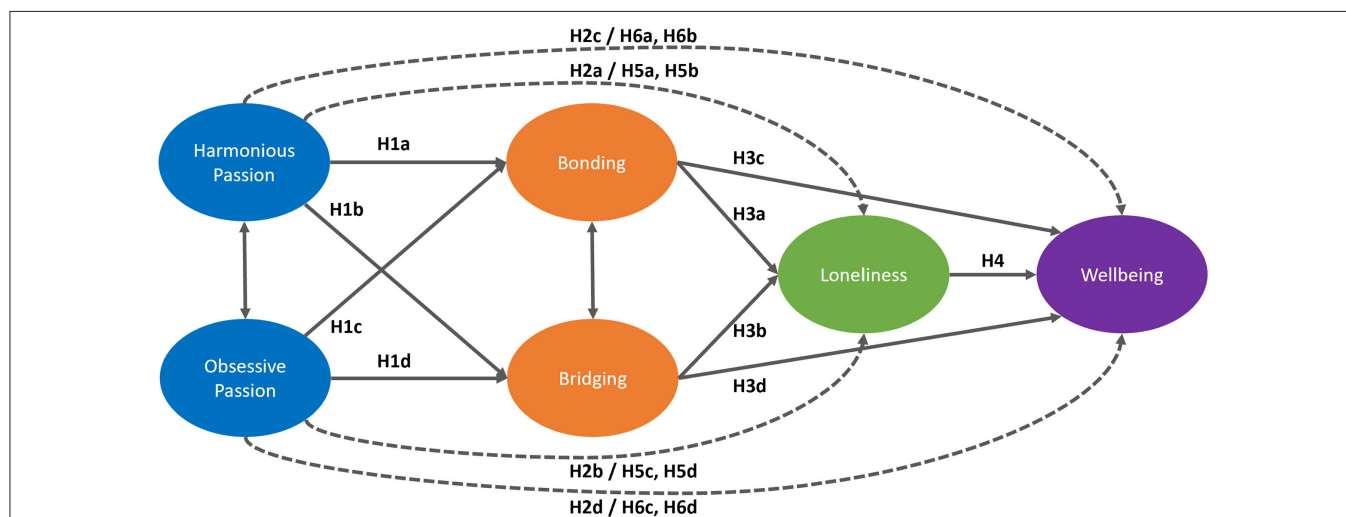> *H1d. Obsessive Passion will be associated with in-game Bridging social capital.*

FIGURE 1 | The hypothesized Structural Equation Model. Error terms for the measured items are not shown. Dashed lines indicate that we assumed direct and indirect effects for these paths.

H2 is concerned with the relationships between passion and our outcome variables of Loneliness and Wellbeing. Based on existing research (in both videogame and other contexts) showing increased negative outcomes associated with obsessive passion and increased positive outcomes associated with harmonious passion, we generated H2b and H2c. While the other paths (decreased positive outcomes associated with obsessive passion and decreased negative outcomes associated with harmonious passion) have been found less reliably, based on the work of Przybylski (Przybylski et al., 2009) and Schellenberg (Schellenberg et al., 2019), we generated H2a and H2d.

H2a. Harmonious Passion will be negatively associated with Loneliness.
H2b. Obsessive Passion will be positively associated with Loneliness.
H2c. Harmonious Passion will be positively associated with Wellbeing.
H2d. Obsessive Passion will be negatively associated with Wellbeing.

H3 is concerned with the relationships between social capital and our outcomes of loneliness and wellbeing. As previously discussed, there is some dissent on whether in-game social capital translates into reduced loneliness and improved wellbeing; however, many of the studies that suggest this do not explicitly test these relationships empirically. Based on Depping et al. (2018), who found that both in-game bridging and bonding social capital decreased loneliness, we assumed that in-game social capital (both bridging and bonding) would be negatively associated with loneliness and positively associated with wellbeing.

H3a: In-game Bonding social capital has a negative association with Loneliness.
H3b: In-game Bridging social capital has a negative association with Loneliness.
H3c: In-game Bonding social capital has a positive association with Wellbeing.
H3d: In-game Bridging social capital has a positive association with Wellbeing.

Based on a wealth of research that suggests there is significant harm to our wellbeing when we experience social isolation and loneliness, we hypothesized that:

H4: Loneliness has a negative association with Wellbeing.

1.4.1.2. Mediated effects
We expect that social capital built from harmonious passion is associated with loneliness. Based on Depping et al. (2018), who showed that both bridging and bonding social capital reduced loneliness, and Perry et al. (2018) who showed that HP builds social capital, we assume that the proposed effect of harmonious passion on loneliness is mediated by in-game social capital. We consider mediation effects as indirect effects. As such, we propose:

H5a. There is a negative indirect effect of Harmonious Passion on Loneliness through in-game Bonding social capital.

H5b. There is a negative indirect effect of Harmonious Passion on Loneliness through in-game Bridging social capital.
H5d. There is a positive indirect effect of Obsessive Passion on Loneliness through in-game Bonding social capital.
H5d. There is a positive indirect effect of Obsessive Passion on Loneliness through in-game Bridging social capital.

Finally, we assume that the positive effect of harmonious passion on wellbeing is caused by its positive effect on social capital and therefore its effect on loneliness. We assume social capital built from Harmonious Passion will be positively associated with wellbeing and expect that:

H6a. There is a positive indirect effect of Harmonious Passion on Wellbeing through in-game Bonding social capital and Loneliness.
H6b. There is a positive indirect effect of Harmonious Passion on Wellbeing through in-game Bridging social capital and Loneliness.
H6c. There is a negative indirect effect of Obsessive Passion on Wellbeing through in-game Bonding social capital and Loneliness.
H6d. There is a negative indirect effect of Obsessive Passion on Wellbeing through in-game Bridging social capital and Loneliness.

2. MATERIALS AND METHODS

To test our assumed model, we gathered data by surveying WoW players, a game that has been used in the earlier research on social capital (Williams et al., 2006) and might therefore be well suited for investigating the contingent factors that lead to positive or negative outcomes.

World of Warcraft (WoW) is a popular Massively Multiplayer Online Role-Playing Game (MMORPG), which had an estimated 5 million players in 2019 (Statista Research Department, 2016), but 12 million active players at its peak in 2010 (Peckham, 2013). WoW is a persistent multiplayer game world in which players can create their own in-game representations, known as a "character" or "avatar," through which they interact with the digital world as well as with other players. Players can customize their character's appearance, personality, and talents, and can "level" their character (maximum level = 120) by participating in various challenges, which unlock new abilities and equipment. WoW features built-in systems to associate with other players, including through factions and guilds. Additionally, WoW provides activities that can be broadly classified as Player vs. Environment (PvE; players fight together against virtual enemies) or Player vs. Player (PvP; players fight each other). These activities can be played in a group, or solo, and players can selectively engage in or ignore these different aspects of the game. WoW players have multiple ways to socialize. Players have access to different chat channels, such as guild chats, party chats, trade chats, zone chats, nearby chats that only the players in a specific area can see, and direct chats in which one can privately whisper with a certain player. Additionally, non-verbal communication techniques allow players to communicate strategies by drawing instructions on the in-game map, alerting others by pinging, or

through player emotes. As described in the introduction, the rich social interactions available within the game have made WoW the subject of broad study.

2.1. Survey Design and Measures

We implemented a survey system using an existing framework (Johanson, 2020). Participants connected to a website that was hosted on our servers and guided them through the survey. First, participants provided informed consent and then answered questionnaires about their demographic background and play behaviors and experiences as follows:

Gaming Expertise: We assessed general gaming attitudes and expertise with several questions. Participants reported their current and previous average play times by selecting one of five pre-defined categories (from "Never" to "Every Day"), genres they enjoy playing, changes in recent and future schedules that affected regular play behavior, and identity as gamers on a 10-point scale, which has been previously shown to correlate highly with a 60-item questionnaire on gaming identity (Mandryk and Birk, 2017). In terms of WoW-specific measures, participants reported their expertise on a 50-point scale from 1 (= "Novice") to 50 (= "Expert") and provided links to armories on worldofwarcraft.com for their main and alternative characters.

Passion: We used Vallerand and colleagues' Passion Scale (Vallerand et al., 2003) to measure passion. We adapted the questionnaire to refer to playing WoW, e.g., "Playing World of Warcraft is in harmony with the other activities in my life." In the resulting scale, participants reported their harmonious (6 items, $\alpha = 0.800$) and obsessive passion (6 items, $\alpha = 0.826$) for playing WoW on 7-point scales from 1 (= "Not true at all") to 7 (= "Very true").

Social Capital: We adjusted the Internet Social Capital Scales (ISCS) (Williams, 2006b) to measure bridging (10 items, $\alpha = 0.934$) and bonding (10 items, $\alpha = 0.897$) social capital. All items were measured on 7-point scales from 1 (= "Strongly disagree") to 7 (= "Strongly agree"). Instructions and items were adapted to refer to WoW, e.g., "Interacting with people from World of Warcraft makes me feel like part of a larger community." As such, participants reported bridging and bonding social capital for in-game relationships within WoW.

Loneliness: We used the revised UCLA Loneliness Scale (Russell et al., 1980) to measure the participants' experience of loneliness with 19 items, answered on a 4-point scale. Participants answered how often they felt the way described in each statement, e.g., "There are people I feel close to." (1 = "Never," 2 = "Rarely," 3 = "Sometimes," 4 = "Often"). The scale had excellent internal consistency ($\alpha = 0.930$).

Wellbeing: We employed the World Health Organization Five Wellbeing Index (WHO-5) (World Health Organization, 1998; Topp et al., 2015) to measure the participants' wellbeing. It uses five items, e.g., "I have felt cheerful and in good spirits," rated on 6-point scales from 1 (= "All of the time") to 6 (= "At no time"). The scale was recoded for easier interpretation in a way that higher scores correspond to higher wellbeing. The internal consistency was good ($\alpha = 0.853$).

Gaming-Related Explicit Motives: We also gathered a number of items related to their motives for gaming; however, this scale was under development, has yet to be validated, and we do not report further on this data in this manuscript.

2.2. Participants

We recruited active WoW gamers by advertising on several WoW-related forums, including: www.warcraftpets.com, www.wow-petopia.com, www.icy-veins.com, www.wowhead.com, and www.mmo-champion.com. Following best practices (Mandryk, 2016), the third author posted all of the recruitment materials as she is an active WoW member, has a level-120 ranked character, is visible in posting on forums, and provides credibility and trust to potential participants (in contrast to the other authors who are not active in the online WoW community). She also shared the survey link via twitter and Discord. To compensate participants for their time, we offered five random draw prizes of WoW game time cards (each equivalent to 6 months of play).

We received 319 responses from participants. After filtering out negligent responses (see section 2.3), we retained data from 300 participants (261 men, 38 women, 1 prefer not to answer) aged 18–66 ($M = 30.7$, $SD = 7.7$). In terms of frequency of play, the majority (70%) played WoW daily, whereas 28% played a few times per week; 1.7% played a few times per month and 0.3% played a few times per year. Our participants had high expertise with the game ($M = 42.1$, $SD = 7.2$ on a 50-point scale), and rated themselves as an average of 8.2 ($SD = 2.0$) on a 10-point scale of gamer identity. In sum, our sample consisted of expert and frequent WoW players, who identified as gamers and were predominantly men.

2.3. Data Analyses

We first re-coded all reverse-coded items and calculated the means and standard deviations (SD) for each scale's subconstructs for each of the 319 respondents. In line with best practices for online data collection (Meade and Craig, 2012; Buchanan and Scofield, 2018), we filtered out responses that did meet threshold quality criteria. First, we removed 3 participants who completed the survey too quickly, defined as less than 1.5 s per item on the UCLA, ISCS, Passion, or GREM surveys, indicating a lack of attention to the items. Second, we removed 3 people who had zero variance on any of the same four surveys, indicating that they simply clicked the same response (e.g., "strongly agree") throughout. Third, we removed 7 people using a variance filter (Meade and Craig, 2012; Buchanan and Scofield, 2018), defined as people whose standard deviations of responses on a subscale were more than two standard deviations above mean variance on 2 or more subscales (from HP, OP, Bonding, Bridging, Loneliness, and Wellbeing). This pattern of responses indicates that participants were clicking randomly, yielding large variance for a subscale on which responses should be relatively consistent. Finally, we removed 6 people who indicated their age as under 18 or equal to 120 ($n = 2$), which is the highest value accepted by our system. This filtering process removed 19 participants (5.96%) and left 300 valid responses.

2.4. Structural Equation Modeling (SEM)

SEM was completed in JASP v 0.12.2, using Lavaan syntax (Rosseel, 2012; JASP Team, 2020) and the MPlus Emulation. We used ordinal items and accordingly used robust DWLS estimation (The lavaan Project, 2016; Gana and Broc, 2019). We estimated one structural equation model, in which Bridging and Bonding Social Capital were used to directly predict Loneliness and Wellbeing, Loneliness predicted Wellbeing, and Bridging and Bonding were directly predicted by HP and OP, which also were used to directly predict the outcome variables. OP was allowed to covary with HP and Bridging with Bonding (see **Figure 1**). All variables were estimated using manifest item scores (six for each of HP and OP, ten for each of bridging and bonding, nineteen for loneliness, and five for wellbeing).

3. RESULTS

In **Table 1**, we present the means, standard deviations, and correlations for the variables included in the model. In addition, **Figure 2** shows histograms for all constructs to illustrate distribution of responses.

3.1. Structural Model Fit

We examined the fit of our hypothesized model. Following recommendations (Bollen and Long, 1993; Hu and Bentler, 1999; Kenny, 2020), we used a variety of model fit indices with the chi-square statistics, incremental fit index (IFI), comparative fit index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). Overall, the indices suggested satisfactory fit [IFI = 0.975, CFI = 0.975, $\chi^2_{(1469)}$ = 3254.570, $p < 0.001$, χ^2/df = 2.22, RMSEA = 0.064, SRMR = 0.077].

3.2. Path Analysis

We explored the hypothesized relationships between constructs with direct and indirect effects, and report unstandardized path coefficients, denoted by β.

3.2.1. Direct Effects

Figure 3 shows direct effects in our model.

3.2.1.1. Effects of passion on in-game social capital

In our model, harmonious and obsessive passion were only slightly and non-significantly associated ($\beta = 0.035$, $p = 0.173$). As hypothesized (H1a & H1b), the results show that harmonious passion was positively associated with in-game Bonding social capital ($\beta = 0.604$, $p < 0.001$) and in-game Bridging social capital ($\beta = 0.798$, $p < 0.001$). Similarly, obsessive passion had a significant positive effect on in-game Bonding social capital (H1c, $\beta = 0.140$, $p = 0.025$) and in-game Bridging social capital (H1d, $\beta = 0.157$, $p = 0.004$), albeit with smaller effects.

These results confirm H1a, H1b, H1c, and H1d.

3.2.1.2. Effects of passion on loneliness and wellbeing

Our model confirmed the hypothesized effects of passion on loneliness and wellbeing only in part. As expected, harmonious passion was negatively associated with loneliness ($\beta = -0.307$, $p < 0.001$) and positively associated with wellbeing ($\beta = 0.315$, $p = 0.002$). In line with expectations, obsessive passion has a positive association with loneliness ($\beta = 0.270$, $p < 0.001$), while its effect on wellbeing was not significant ($\beta = 0.007$, $p = 0.912$).

Thus, H2a, H2b, and H2c were confirmed, but we did not find support for H2d.

3.2.1.3. Effects of in-game social capital on loneliness and wellbeing

We tested direct effects of social capital on our outcome variables. First, our model confirmed a positive relationship between Bonding and Bridging social capital ($\beta = 0.232$, $p < 0.001$). In line with earlier work (Depping et al., 2018), our results show a negative association between Bonding social capital and loneliness (H3a, $\beta = -0.315$, $p < 0.001$). On the other hand, there was a positive relationship between Bridging social capital and loneliness (H3b, $\beta = 0.194$, $p = 0.029$), which lies in contrast to earlier work, in which bridging social capital decreased loneliness (Depping et al., 2018), and is the opposite of what our hypotheses predicted. The model showed significance of the direct effect of in-game Bonding social capital on wellbeing (H3c, $\beta = -0.192$, $p = 0.020$), while the effect of in-game Bridging social capital on wellbeing was not significant (H3d, $\beta = 0.026$, $p = 0.798$).

TABLE 1 | Means, standard deviations, and correlations for harmonious (HP) and obsessive passion (OP), in-game bonding (Bonding) and bridging (Bridging) social capital, loneliness, and wellbeing.

						r		
	M	**SD**	**HP**	**OP**	**Bonding**	**Bridging**	**Loneliness**	**Wellbeing**
HP	4.505	1.175	–					
OP	2.342	1.198	0.091	–				
Bonding	3.556	1.602	0.383***	0.129*	–			
Bridging	4.828	1.190	0.513***	0.160**	0.571***	–		
Loneliness	1.981	0.603	−0.232***	0.167***	−0.269***	−0.113	–	
Wellbeing	3.930	1.013	0.266***	−0.093	0.100	0.100	−0.576***	–

*p < 0.05, **p < 0.01, ***p < 0.001.
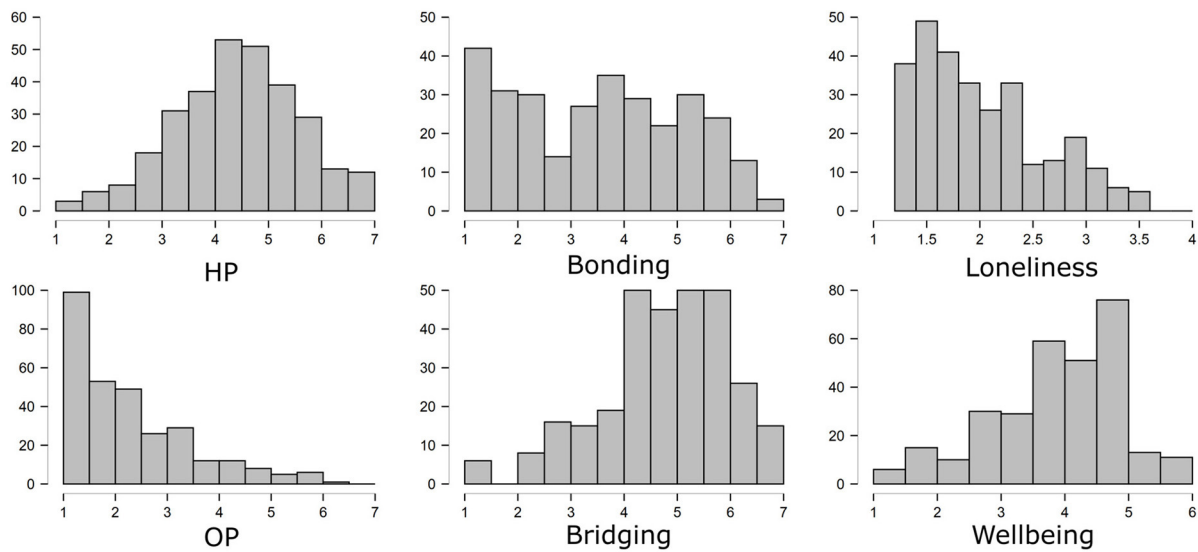
FIGURE 2 | Distributions for harmonious (HP) and obsessive passion (OP), in-game bonding (Bonding) and bridging (Bridging) social capital, loneliness, and wellbeing.
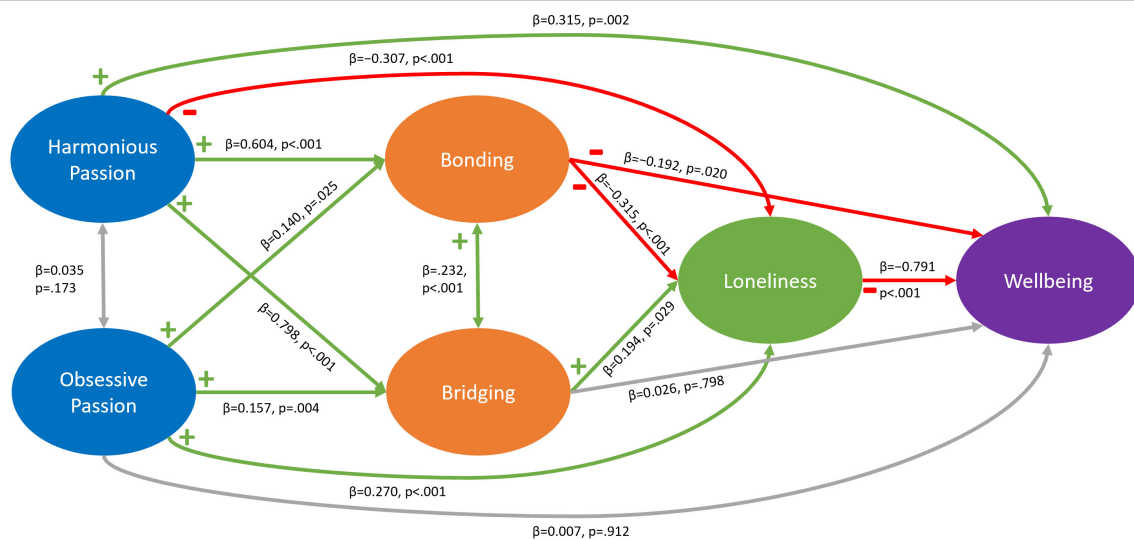
FIGURE 3 | Direct effects for hypothesized paths. β denotes unstandardized coefficients.

As such, we confirm H3a and H3c, but find no support for H3d. For H3b, we found the opposite relationship to be significant, thus we cannot confirm H3b.

3.2.1.4. Effects of loneliness on wellbeing

Our model confirmed H4 about the relationship between loneliness and wellbeing; we show a strong negative relationship between loneliness and wellbeing ($\beta = -0.791, p < 0.001$).

We confirm H4.

3.2.2. Mediated Effects

3.2.2.1. Mediation of effects from passion to loneliness through social capital

As passion affected social capital, which was associated with loneliness, we were interested in whether the effect of passion

on loneliness is mediated by social capital. We tested these effects as hypothesized in H5a & H5b, but also tested the same effects for obsessive passion (H5c & H5d). Our model showed a significant negative indirect effect of harmonious passion on loneliness through in-game Bonding social capital (H5a, $\beta = -0.190, p < 0.001$), while the effect through in-game Bridging social capital was positive and significant (H5b, $\beta = 0.155, p = 0.033$). This suggests that there is a partial mediation of the effect of harmonious passion on loneliness through social capital while direction seemed to depend on the type of social capital: bonding decreased loneliness while bridging seemed to increase it. The effects had the same direction but were smaller for the marginally significant indirect effect of obsessive passion through Bonding on Loneliness (H5c, $\beta = -0.044, p = 0.046$) and the not significant effect through Bridging (H5d, $\beta = 0.030, p = 0.094$).

As such, our results suggest that social capital might mediate the effects of passion on loneliness, mostly for harmonious passion and through Bonding.

Thus, we confirm H5a, H5b, and H5c. We do not find support for H5d. See **Figure 4** for an overview.

3.2.2.2. Mediation of effects from passion to wellbeing through social capital and loneliness

Finally, we were interested in the mediation of the effect of passion on wellbeing. We calculated the indirect effects of passion (Harmonious and Obsessive) on wellbeing mediated by in-game social capital (Bonding and Bridging) and loneliness. The model showed that the indirect effect of harmonious passion through

Bonding and Loneliness ($\beta = 0.150$, $p < 0.001$) was positive and significant (H6a). On the other hand, the indirect effect of harmonious passion on wellbeing through in-game Bridging social capital and loneliness was negative, albeit marginal in significance (H6b, $\beta = -0.122$, $p = 0.036$). For obsessive passion, significance was not reached for the indirect effects through Bonding and Loneliness (H6c, $\beta = 0.035$, $p = 0.053$) and through Bridging and Loneliness (H6d, $\beta = -0.024$, $p = 0.096$). This suggests that the positive effect of harmonious passion on wellbeing is partially mediated by social capital, mostly through Bonding, and a resulting decrease in Loneliness. On the other hand, the role of Bridging social capital might be more complicated, potentially harming wellbeing even for harmonious
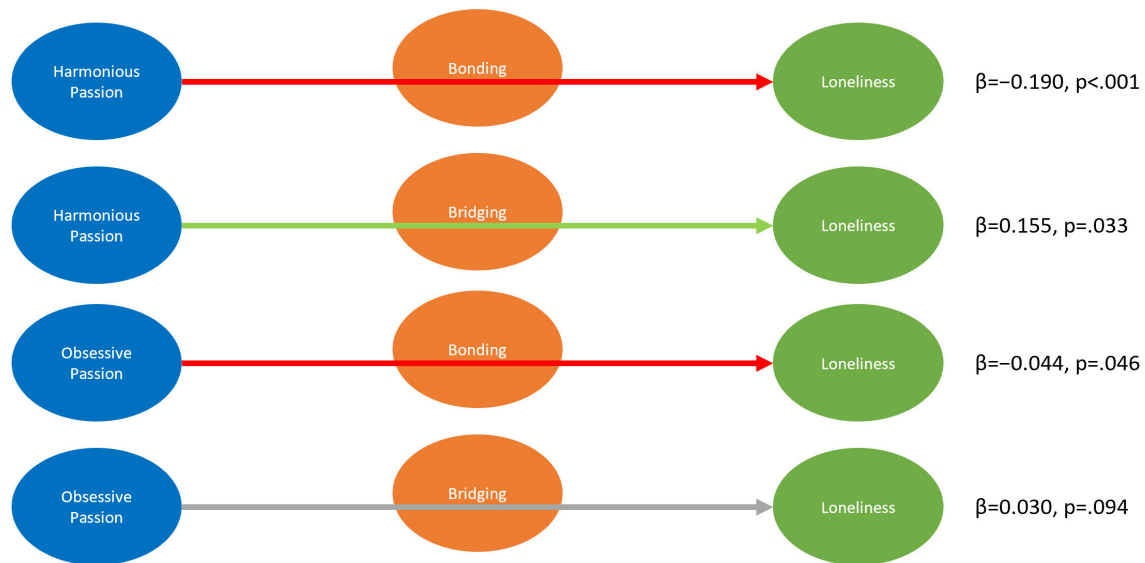
FIGURE 4 | Indirect Effects from Passion on Loneliness mediated by Social Capital. β denotes unstandardized coefficients.
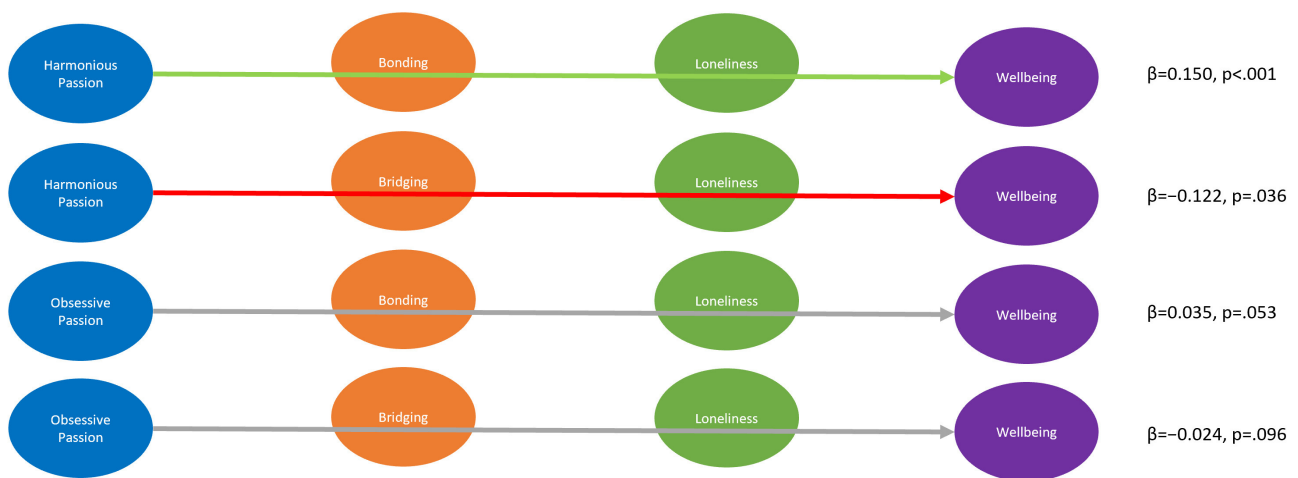
FIGURE 5 | Indirect Effects from Passion on Wellbeing mediated by Social Capital and Loneliness. β denotes unstandardized coefficients.

passionate play. However, this and the effects for obsessive passion remain inconclusive due to marginal significance and therefore suggest further research.

Thus we confirm H6a, but cannot confirm H6c or H6d. For H6b, we found a significant effect in the opposite direction, thus cannot confirm H6b. See **Figure 5** for an overview.

4. DISCUSSION

We summarize the results, contextualize them within literature, and discuss implications and limitations.

4.1. Summary of Results
Our results can be summarized as follows:

- Passion for WoW is positively associated with both types of in-game Social Capital, with Harmonious being the stronger predictor than Obsessive Passion
- Harmonious Passion for WoW decreases Loneliness and increases Wellbeing
- Obsessive Passion is associated with higher Loneliness, but not directly associated with Wellbeing
- Loneliness is negatively predicted by Bonding Social Capital but positively by Bridging Social Capital
- Bonding Social Capital has a negative direct effect on Wellbeing, while Bridging Social Capital does not directly predict Wellbeing
- Wellbeing is negatively predicted by Loneliness
- Indirect effects suggest that Harmonious Passion increases Wellbeing by building Social Capital (mostly through Bonding), and reducing Loneliness.

4.2. Explanation, Comparison, and Implications
4.2.1. On Passion for WoW
Our results provide additional evidence of the importance of passion in understanding the impacts of videogame play on the wellbeing of players, and highlight the potential of passion as a way to both maximize benefit and minimize harm for players. As expected, our results confirmed the pattern seen in prior work in which OP is associated with increased negative outcomes (i.e., loneliness, H2b) and HP is associated with increased positive outcomes (i.e., wellbeing, H2c). Interestingly, in terms of the less consistently confirmed complementary paths, we found support for one of our hypotheses but not the other. Specifically, we found that HP was associated with a reduction in loneliness (H2a) consistent with Schellenberg (Schellenberg et al., 2019) and colleagues (who found a reduction in negative physical symptoms) and Przybylski and colleagues (Przybylski et al., 2009) who found a reduction in post-play tension. However, we found no association between OP and wellbeing, which is consistent with previous work finding OP was not related to self-development nor social interaction (Tóth-Király et al., 2019). Overall, while there is increasingly strong evidence that HP increases positive and OP increases negative outcomes, it is not yet clear under which circumstances and for which outcomes, HP reduces negative and OP reduces positive outcomes. Results are

inconclusive and depend on context and what outcome measures are chosen; further research is needed.

Consistent with the research of Perry et al. (2018), who explored passion and social capital in the context of Destiny, we found further support for HP being associated with increased social capital (both bridging and bonding; H1a, H1b). However, in contrast to their findings, we also found OP to be associated with social capital (H1c, H1d), albeit as a much weaker relationship than that found for HP, as evidenced by the relative beta values. While it seems clear from both of these studies that HP is preferable in terms of players benefiting from social connections (both in terms of deep bonds and broader connections), OP may in the context of some games also be associated with beneficial social relationships. However, it is worth highlighting that in explicitly testing the mediated effects in our study, the indirect paths of HP through social capital to the outcome measures were consistently significant, whereas the indirect effects from OP were not.

We also found that, surprisingly, bonding social capital has a direct, negative relationship with wellbeing. This could either be an overestimated null effect given the p-value and estimations for coefficient, whose 95% CI [−0.350, −0.030] is close to including 0. Alternatively, it might be possible that players who have strong in-game social ties might do so at the expense of other activities that also increase wellbeing. Following the indirect effects (H6a & H6b), this negative and direct effect might be counteracted by the strong positive effect of HP on wellbeing through its decrease in loneliness and resulting effect on wellbeing. Further, the strong and positive direct effect of HP on wellbeing and negative direct effect on loneliness reinforce that a harmonious passion for games is associated with increased positive outcomes and decreased negative ones. Together, our results suggest that players who have high harmonious passion for WoW could have resulting benefits on wellbeing through strong bonding social ties within the game and a resulting decrease in loneliness, while we require further research to disentangle the factors under which bonding social capital affects wellbeing.

4.2.2. Is Bridging Capital Harmful in WoW?
Although we found that HP builds both bridging and bonding social capital, bonding is associated with a reduction in loneliness, whereas bridging is associated with increasing it. Further, the indirect effects from HP to loneliness and wellbeing through bonding and bridging reinforce the beneficial effects of bonding capital in that the paths from HP through bonding improve wellbeing and reduce loneliness, whereas the paths through bridging (although weaker and marginally significant) reduce wellbeing and increase loneliness. Why might bridging harm social wellbeing while bonding helps? Players communicate during play using a variety of mechanisms, but also use third-party tools (e.g., Discord) to communicate both synchronously and asynchronously out of the game, sometimes about the game itself and sometimes about non-game-related topics. It is possible that in-game bonding capital is more likely to lead to out-of-game interaction than in-game bridging capital, which might, in turn, provide more social connectedness; however, further work needs to be conducted. Additionally, bridging social capital

may not benefit players in terms of affecting their loneliness and wellbeing, but may have other types of social benefits to players, (e.g., widened perspective, global awareness), which we did not measure in our study.

Our results on how in-game bridging capital is associated with social connectedness contrast those of Depping et al. (2018), who found that both in-game bridging and bonding capital built in a broad gaming community decreased loneliness, and those of Trepte et al. (2012), who found that both bridging and bonding social capital built in esports clans was positively associated with offline social support (i.e., advice, assistance, and listening). A potential explanation is that our data was gathered in the context of a specific game (World of Warcraft) and these prior data were gathered in the context of a gaming community and esports clan (respectively) and not tied to a specific game or game genre. It is possible that *bridging* social capital built in WoW is less effective at facilitating social connectedness offline than bridging capital built through other types of games. Further, due to our cross-sectional study design, we cannot infer causality, and it may just be that players who are lonely engage in WoW game features that facilitate building bridging capital. There has been some suggestion that gamers who are high in social anxiety, i.e., a persistent fear of situations in which individuals are exposed to unfamiliar people or to possible scrutiny and negative evaluation by others (Spence and Rapee, 2016), are preferentially attracted to MMORPG games compared to other genres, such as first-person shooter games (Park Jeong Ha, 2016). Investigating further, Dechant et al. (2020) found that MMORPG players who expressed in-game social anxiety tended to avoid high-challenge and highly-social activities in game, but participated in activities related to character advancement, collection, narrative and low-challenge similarly to non-anxious players (Dechant et al., 2020). When considered in light of our results, MMOPRG players who experience social anxiety within games avoid activities that are more likely to build bonding social capital (socializing and working together to overcome a challenging activity), instead focusing on activities that are likely to build bridging social capital (collecting items and engaging in low-challenge activities). In the context of our study, bridging social capital does little to combat loneliness, and may actually exacerbate experienced isolation, putting players with social anxiety (who seem to be preferentially attracted to MMORPGs) at greater risk of harm. The relationships between the player, the game, and the context of play (Johnson et al., 2013) are complex and differentially affect how gaming affects wellbeing; further research is needed to disentangle these complex interdependencies.

Although the role of bridging capital in facilitating or reducing harm remains uncertain, in all cases of prior work and the present study, bonding social capital built in games was constantly and positively beneficial in offline outcomes, suggesting that in-game interactions do have out-of-game benefits to the social wellbeing of players.

4.2.3. Obsessive Passion as a Compensatory Response

Our mediation findings highlight that it is the social connections being made through videogaming that influence a person's

loneliness. For players who are obsessively passionate about World of Warcraft, social connections are still formed and maintained, resulting in both bridging and bonding capital. And the bonding capital built from obsessive passion for WoW even marginally reduces loneliness, although it does not strongly translate into wellbeing. However, this indirect reduction in loneliness is not nearly as strong as the direct and positive effect that higher obsessive passion has on loneliness. Our findings suggest that WoW play that is not in harmony with the rest of life can lead to problematic outcomes in terms of social isolation and wellbeing, and that gamers should be aware of their obsessive passion if they wish to avoid the harmful isolating effects of videogaming. Which raises the question, how does obsessive passion for gaming develop and how can it be reduced?

Previous work on the dualistic model of passion (Lalande et al., 2017) has suggested that obsessive passion for an activity is more likely to develop when that activity is the primary means through which a person's psychological needs for competence, autonomy and relatedness (Deci and Ryan, 2000) are satisfied. In other words, a person may begin to compensate for the lack of need satisfaction in other important domains by focusing on the need satisfaction offered through videogame play. In such situations, the person may become over-reliant on videogames and potentially lose control over their playing habits, thus developing obsessive rather than harmonious passion for gaming. Although not tested explicitly, our results can be interpreted in a way that is consistent with Lalande et al. (2017) notion of obsessive passion as a compensatory result. This compensatory context is a potential explanation for our pattern of results, as while we observe that both types of passion lead to social capital, in the case of obsessive passion, the ultimate outcome was increased loneliness. It may be that in our sample, the participants showing greater obsessive passion were doing so in the context of a lack of need satisfaction (including the satisfaction of relatedness) from other sources, and a resulting over-reliance on videogames for building social connections paradoxically limits their effectiveness for this very purpose.

This compensatory response theory is also supported by recent evidence in the context of online gaming. Kowert et al. (2015) used longitudinal data to test whether negative psychosocial outcomes are a cause or a consequence of online videogame play, and found greater support for the notion that players engage with online games to compensate for pre-existing social difficulties than the notion that engaging in online play results is psychosocial harms. Snodgrass et al. (2018) tested the "rich get richer" and "poor-get-poorer" notion of online gaming, which suggests that psychosocially vulnerable individuals erode their wellbeing in online contexts (Kardefelt-Winther, 2014b), whereas healthy individuals prosper in online contexts (Snodgrass et al., 2014). Looking specifically at the wellbeing of MMORPG players, Snodgrass et al. (2018) find that players can compensate for their loneliness through more intensive online videogame involvement, but, as with our results, only when their play allows them to build meaningful social relationships. Snodgrass et al. (2018) go further to suggest that

the outcomes for lonely players might depend on how they play—during regular intensive online play, they have the opportunity to bond with others; however, more casual online play may not allow them to signal their mastery, making them less likely to connect socially and thus reinforcing their loneliness. Further, Di Blasi et al. (2020) demonstrate that problematic WoW playing can be a compensatory response for unfulfilled needs, devalued inner selves, or coping with painful mental states for players with vulnerable narcissism. Although Kowert et al. (2015), Snodgrass et al. (2018), and Di Blasi et al. (2020) do not consider passion for gaming, their general findings are consistent with those of Lalande et al. (2017) and Przybylski et al. (2009) in that problematic game use is not simply a factor of game dosage or gaming interest, but is dependent on the gamer's wellbeing outside of the gaming context. Players are more likely to develop obsessive passion when they rely too heavily on a single context (such as videogames) to satisfy their needs (Lalande et al., 2017)—our findings support that where problematic play is occurring (in terms of harmful effects on social connectedness), we should seek to increase harmonious passion and reduce obsessive passion, which may be possible by introducing players to alternative sources of need satisfaction.

We did not make assumptions regarding psychological needs satisfaction of our players, either through videogames or other aspects of life, and did not gather these data; in future work, we will explicitly investigate this potential compensatory response as an explanation for how the two passion orientations both build social capital in games, but that only the social capital built though harmonious passion benefits players' by combating loneliness.

4.2.4. The Social Benefits of Harmonious Gaming

Not all gaming is created equal; the same game, gamer, or gaming context can lead to play that is a restorative and stress-reducing activity and which fosters social connections, or can lead to play as a problematic and isolating endeavor. By unpacking the role of passion in the building of in-game social capital, and it's resulting effects of loneliness and ultimately wellbeing, our findings have implications for gamers and gaming as a pastime.

These results are consistent with other research (e.g., Williams et al., 2006; Yee, 2006; Cole and Griffiths, 2007; Depping et al., 2018), which suggests that the relationships formed through videogames can be just as important and impactful as those formed in non-game settings. For players whose passion for WoW is in balance with other activities in their lives, gaming provides in-game social opportunities that have out-of-game benefits to social connectedness, which is one of the biggest threats to wellbeing in developed nations. As has been expressed by others previously (e.g., Trepte et al., 2012; Depping et al., 2018; Kowert and Kaye, 2018; Perry et al., 2018), it is past time to throw away the stereotype of gaming as a lonely and socially-isolating activity, and embrace the tangible benefits that can be provided by social gaming as a collective leisure endeavor.

The Entertainment Software Association's (ESA) report on the essential facts about the computer and video game industry in 2019 (Entertainment Software Association, 2019) notes that compared to average Americans, gamers in the USA are as likely to get the same amount of sleep at night, vacation internationally, exercise, go camping or hiking, be civically engaged, have a creative hobby, play an instrument, be vegetarian, and meditate regularly. Gaming as a hobby is neither good nor bad, and the answer of whether gaming leads to harm depends. In our work, we show that it depends on harmonious passion, which is needed to build social capital, combat loneliness, and improve wellbeing. Harmonious passion is about an activity being in balance with the rest of a person's life. Considering the aforementioned ESA report, it is clear that gaming is often part of a balanced life. And when it is (in the context of WoW), massively passionate players benefit greatly through the relationships they form and maintain, and the social connections that those relationships provide.

4.2.5. Limitations and Future Work

Although we provide new insights into the relationships between passion orientation, social capital, and loneliness, our study has several limitations that should be addressed by future research.

This study examined our research questions only in a single game. As such, our findings might be limited to the specifics of WoW and its natural population of gamers. It might be that specific game features affect how players engage with the game and with other players, for example, by facilitating bridging social capital more so than bonding social capital for specific types of players. The relationships between constructs that we model might be specific to WoW, might not generalize well to other games, and therefore should be replicated in a different game context. Other multiplayer game genres (e.g., Multiplayer Online Battle Arenas, Battle Royale) have very large player bases, and very different competition structures and communication channels, suggesting that future work needs to examine these game genres specifically.

Further, our sample was quite biased in terms of gender and play expertise, likely resulting from the sampling approach of posting the survey on WoW forums. The majority of our players identified as men who played WoW daily and reported high expertise. As such, we cannot estimate how well our results replicate for players who do not identify as men and our results might be specific to seasoned WoW players who have an existing passion for, and social ties within, the game. Related, our sampling method did not yield respondents who were low in both HP and OP, limiting us from exploring the quadripartite model of passion described in section 1.2; we have data from participants with pure OP, pure HP, and mixed passion, but not from those with no passion. A new player with lower passion and social capital within the game likely would have a different experience, which could lead to different results. While likely reflective of the active player base for WoW, the results might be specific to our sample and not reflect how these constructs interact for other player groups in WoW, other MMO games, or even other game genres. This echoes the previously stated need for replication within another context, but also with another population within WoW.

In this paper, we specified a model for the relationship between the passion, social capital, loneliness, and wellbeing constructs. While our modeling approach was guided by hypotheses derived

from earlier research, there was no existing model that combined all these constructs. As such, even if the majority of individual paths are grounded in literature, the model might be considered exploratory in the context of some paths, e.g., for the effect on obsessive passion on social capital, and for the analysis of the interactions between modeled constructs, such as the mediation effects of social capital and loneliness for the effects of passion on wellbeing. This calls for more confirmatory research examining the relationship between passion, social capital, loneliness, and wellbeing.

We conducted a cross-sectional study, in which we measured all constructs at the same time. While we modeled directed paths based on earlier research that guided our hypotheses, we cannot infer causation. Our findings suggest how passion, social capital, loneliness, and wellbeing might be connected for players of WoW by applying and confirming assumed theoretical relationships that make sense for our data. However, our results cannot confirm the causal path, which suggests the need for further experimental or longitudinal research that can demonstrate causality.

In this paper, we investigated how harmonious and obsessive passion might be used to differentiate between positive and negative outcomes of play. However, passion for games (similar to other activities) does not exist in isolation. As noted in the discussion on obsessive passion as a compensatory response, it might be possible that our results were affected by external factors that lead to different types of passion for play. In the context of problematic gaming, factors such as demography, life circumstances, or even underlying personality disorders (Di Blasi et al., 2020) or mental health concerns, such as anxiety or depression (Mandryk and Birk, 2017), have demonstrated relevance. As such, future research that investigates how passion for games is built will help further understand how passion interacts with other individual characteristics, underlying pathologies, and contexts to affect the outcome of play.

4.3. Conclusions

Gaming as a hobby continues to evolve and the demographics of who engages in videogames shifts and changes as gaming becomes more accessible through new devices for playing (e.g., smartphones), mechanisms to purchase games (e.g., online application stores), and opportunity to engage differently with game content through spectator and fan-based interaction (e.g., watching streamers or esports tournaments). Social play—playing with others in person or online—continues to gain popularity, with players joining their friends, family, colleagues, or strangers in joint play. These social interactions have been suggested to both benefit players by fulfilling our fundamental needs of belonging and relating to others, but have also been suggested to be an impoverished form of social interaction that harms players by displacing richer in-person interactions. Recent work consistently shows that neither of these interpretations tells the entire story, and that whether social play results in benefits or harms depends on a variety of contingent factors related to

the player, the game, and the gaming context. In this paper, we aim to understand the role of several of these contingent factors in a popular social game by modeling the relationships between passion orientation (harmonious and obsessive), social ties (bridging and bonding), loneliness, and wellbeing.

Our work shows that harmonious passion for WoW is associated with increased bonding capital, reduced loneliness, and improved wellbeing, whereas obsessive passion for WoW also builds social capital, but that these social ties do not have out-of-game benefits to players, and may even result in poorer outcomes. Further, we differentiate the effects of bridging and bonding ties, which again further contributes to the conversation on how the quality of in-game social interactions matters. We demonstrate that passion orientation is important for characterizing the relationship between gaming and social wellbeing, showing that being massively passionate for a social game can provide tangible benefits to social wellbeing, established through in-game social ties, so long as that passion is in harmony with other aspects of the player's life. Our work supports the nuanced perspective that digital gaming can be both a problematic activity that may require intervention, and an appealing leisure activity that provides enjoyment, recovery, and meaningful social interaction for the millions of players who benefit from its captivation.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by The Behavioural Research Ethics Board at the University of Saskatchewan. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

RM led the research, gathered the dataset, formulated the hypotheses, helped analyze the data, and wrote/edited the paper. JF formulated the hypotheses, analyzed the data, and wrote and edited the paper. AA helped gather the dataset, and edited the paper. DJ formulated the hypotheses, helped analyze the data, and wrote/edited the paper. All authors contributed to the article and approved the submitted version.

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Play Mode Effect of Exergames on Subthreshold Depression Older Adults: A Randomized Pilot Trial

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Background: Subthreshold depression is a common mental disorder in late life. Increasing studies have supported the positive effects of exergames to subthreshold depression. The current study aims to investigate how play mode potentially affects exergames' effects on subthreshold depression among older adults.

Method: A between-group experiment was carried out to compare the effect of exergames with different play modes. Fifty-two Singaporean older adults with subthreshold depression were randomly assigned into two conditions, and performed either single-player or multiple-player Nintendo Wii Tennis exergames for 6 weeks, while the key variables of depression, social support and loneliness were measured at both pre- and post-study period.

Results: Findings from path analysis suggested that older adults in multiple-player exergames experienced lower levels of loneliness, and further more reduction on subthreshold depression, when compared to those in single-player exergames. Although social support was not affected by play mode, the significant relationship among social support, loneliness, and depression was found in the context of exergaming.

Conclusion: This study not only provides additional insight into a possible causal association lining play mode and health outcomes of exergames, but also opens the discussion of how to optimize antidepressive effect of exergames for older adults.

Keywords: social interaction, elderly, exercise games, Wii, mental health

INTRODUCTION

Subthreshold depression, or minor depression, is generally defined as a cluster of depressive symptoms, in which the number, duration, or quality is insufficient to meet the DSM-IV criteria of major depression (Bali and Jiloha, 2008). Although being below the clinical criteria of major depression, subthreshold depression often has a much higher prevalent rate across all age groups, particularly in aging population (Meeks et al., 2011). Subthreshold depression leads to significant negative outcomes in late life, including poorer physical health and even increased mortality (Montross et al., 2008).

With the advent of interactive digital technology, exergames, which combine the digital gaming and physical exercising (Oh and Yang, 2010), has become a popular alternative to traditional exercise programs and now are increasingly used in healthcare domains (Gil-Gomez et al., 2011). Recent research has examined the positive impacts of exergames on psychosocial well-beings among older adults, including improvements in loneliness and mood (Wollersheim et al., 2010; Kahlbaugh et al., 2011), self-esteem, and positive affect (Jung et al., 2009). In a systematic review, Li et al. (2015) have confirmed that exergames have medium effect on reducing the symptoms of depression among older generations. Increasing studies (Rosenberg et al., 2010; Zhou et al., 2012) have extended the positive effects of exergames to subthreshold depression. Another study from Li et al. (2017) further implied that exergames led to greater reduction on subthreshold depression among older adults, when compared to traditional exercise. However, the lack of depth of study in this area calls for further research that explores the influential factors that may affect their anti-depressive effects.

Several game studies examined the effects of exergames factors on attitudes, performance and physical conditions (O'Donovan et al., 2012; Park et al., 2014). However, to our knowledge, there is no particular study investigating the factors that influence the exergames' impacts on depression. The current study is a pilot study with the aim to contribute to this new research domain, by investigating how one key factor in exergames – play mode – potentially affects its effect on subthreshold depression among older adults.

Play mode is an important theme in game studies. Play mode is usually categorized in video games history into two types: single-player mode (SP) and multiple-player mode (MP). SP refers to a particular game mode designed to be played by a single player, whereas MP refers to that designed to be played by two or more players simultaneously. Many previous studies investigated the effects of play mode on players' motivation, performance and in-game experience (Smyth, 2007; Peng and Hsieh, 2012; Chen et al., 2015). Player modes were also supported to affect a player's psychosocial attributes in real life, such as social support (de Kort and Ijsselsteijn, 2008; Uz and Cagiltay, 2015) and loneliness (Kahlbaugh et al., 2011). Social support and loneliness are common depression predictors supported by previous literature (Nezlek et al., 1994; Ingram et al., 1999; Singh and Misra, 2009). Hence, play mode in exergames may affect depression through the mediation effects of social support and loneliness. The below section provides the theoretical perspective for the assumptions of play mode effect on depression and related psychosocial attributes.

LITERATURE REVIEW AND HYPOTHESES

Social Support, Loneliness, and Depression

In social gerontology literature, the link between social support and depression is well established. *Buffering Hypothesis* (Cohen and Wills, 1985) is the most influential theoretical perspective on social support, which hypothesizes that social support reduces the effects of stressful life event on health through either the supportive actions of others or the belief that support is available (Lakey and Cohen, 2000). In other words, the existence of one's social network, as well as substantive interactions generated among social ties, can buffer people from negative and stressful events. Therefore, social support acts to reduce the chances of stressors and negative events that provoke depression.

A sizable number of aging studies have established the relationship between social support and geriatric depression (Verstraten et al., 2005; Lee et al., 2012; Su et al., 2012). Given that a person's social network decreases over time in late life (Antonucci, 1991), older adults receive less emotional support from social networking. This could increase the risk of depression. Barg et al. (2006) found that high adequacy of social support that older adults receive corresponds to low depressive scores. In a study with forty elderly aged 60 years and above, Patil et al. (2014) found a significant negative correlation between perceived social support and depression.

Besides the direct effect on geriatric depression, social support would also influence geriatric depression through loneliness. Loneliness refers to the subjective feeling state of being alone, separated, or apart from others (Tomaka et al., 2006). It is one of the strongest predictors of depression according to Singh and Misra (2009). Strong association between loneliness and geriatric depression was further confirmed in a large scale study (Aylaz et al., 2012). The longitudinal study of Cacioppo et al. (2006) supported that loneliness is a significant risk factor for depression among the aging population. Cohen-Mansfield and Parpura-Gill (2007) proposed a framework, *Model of Depression and Loneliness,* to examine factors influencing loneliness and depressed affect in older population. According to this framework, the reduced social contacts that occurs with age will influence loneliness, which, in turn, will affect depression. The feeling of loneliness is common for elderly people in their late life because of the lack of close family ties (e.g., living alone), impaired social support, and loss of mobility in social activities. The negative effect of social support on loneliness among older adults has found in many studies, especially on the Asian contexts (Kang et al., 2018; Chen et al., 2019). Lonely people suffer from more depressive symptoms, as they have been reported to be less happy, less satisfied, and more pessimistic (Singh and Kiran, 2013). As a result, loneliness may play a mediation role on the relationship between social support and depression among older adults.

Role of Play Mode

In video games, social support is likely to be affected by different play mode. Many researchers have examined the social support derived from video games with multiple players (Trepte et al., 2012; Zhang and Kaufman, 2016a). In contrast with those in single-player games, players in multiple-player games need to learn and apply their social skills to achieve game goals. While interacting with others, players enhance their in-game social networking and interaction in these virtual social communities.

This phenomenon is more obvious in games designed specifically for engaging cooperation and mutual assistance (Ewoldsen et al., 2012). In these collaborative games, players in a team assist each other and share successes and failures together. These social interactions strengthen group cohesion and interdependent bonds among teammates (Isbister, 2010; Banks, 2012), and foster strong feelings of virtual support and new friendships (Smyth, 2007). These virtual support and relationships in multiple-players gaming may affect and extend players' pre-existing relationships in real life (Williams, 2006). Gentile and Gentile (2008) argued that social skills learned and practiced in the gaming environment could be generalized into the real context, which may promote prosocial behavior and enhance social support in daily life. Trepte et al. (2012) has presented a large-scale study to examine the theoretical framework of how social interactions in online multiple-player gaming affected offline social support. In their study, players' social proximity and mutual familiarity during online interactions were supported to foster both online bridging social capital (people feel informed and inspired by each other) and bonding social capital (emotional support and understanding), while both social capital dimensions are positively related to offline social support.

The theoretical framework of gaming and social support provided above can be applied into the context of exergaming and older adults. It is reasonable to posit that exergames in multiple-player mode lead to higher level of social support than those in single-player mode, and the higher level of social support further results in greater reduction of depression among older adults.

Similar to social support, play mode in video games may affect loneliness through social interaction and communication among players. Li and Counts (2007) argued that MP games could actually increase communication between teammates via digital and traditional channels. Further, such game mode could create feelings of co-presence and make players feel more connected to each other (Lazzaro, 2004). The co-presence and connection to others could therefore reduce loneliness. A systematic review from Li et al. (2018) identified that playing MP exergames could improve older adults' social well-being, through increasing social bonding with their peers and grandchildren. In the study from Kahlbaugh et al. (2011), older residents received personal visits from students who played a bowling game on Nintendo Wii console with them for 10 weeks. Results showed that older residents felt less lonely than they had at the start of the study. The decrease in loneliness was perhaps not due to playing the Wii itself, but by the interactions between older participants and students. In a large sample survey study, Lee and Ishii-Kuntz (1987) indicated that doing something together with other people reduced loneliness among older adults.

As a result, compared to SP exergames, the social interactions and communication in MP exergames lead to lower level of loneliness, and thus results in greater reduction of depression among older adults.

Purposes of the Study

This study sought to build a conceptual model to address the influencing mechanism between exergame play mode and depression in old age. The model is rooted in cognitive-behavioral theories and conceptualizes depression as resulting from an interaction of social events and cognitive processes. It utilizes two key concepts, social support and loneliness, to clarify how play mode can facilitate the depression treatment in the exergaming context. **Figure 1** shows the proposed conceptual model in this study. Based on the model, five hypotheses were proposed in the specific context of exergames and subthreshold depression in late life:

H1: *Compared to SP exergames, MP exergames lead to (a) a higher level of social support; (b) a lower level of loneliness; and (c) a lower level of subthreshold depression among older adults.*

H3: *Social support is negatively associated with subthreshold depression among older adults.*

H4: *Loneliness is positively associated with subthreshold depression among older adults.*

H5: *Social support is negatively associated with loneliness among older adults.*

H6: *Both (a) Social support and (b) loneliness mediate the effect of play mode on subthreshold depression among older adults.*

MATERIALS AND METHODS

Participants

Participants were recruited from two senior activity centers located in the western and northern parts of Singapore, respectively. The center managers assisted in delivering recruitment message and approached potential participants. Generally, older adults were included in the study if they were aged 55 and above, and diagnosed with subthreshold depression in the screening section. Patient Health Questionnaire – 9 (PHQ-9; Spitzer et al., 1994) was used as a screening tool for admission into the study. Followed the scale instructions from Kroenke and Spitzer (2002), the total PHQ-9 score below "4" indicated none depression, whereas "5" to "14" indicates mild to moderate depression, and "15" to "27" indicates moderately severe to severe depression. Therefore, only participants who scored 5–14 in PHQ-9 were included in the final pool. Given that the particular interventions, participants were asked to self-report their previous experience on exergaming system. Only those with no experience or little experience (less than a few hours performance) were included in the study. Further, through self-reporting and information obtained from center managers, participants were excluded if they had the following conditions which prevent them from performing the exergame correctly and safely: (a) have serious cognitive disorders (e.g., Parkinson disease or Alzheimer's disease), (b) intellectual disability and physical limitations (severe mobile, visual, or hearing problems), (c) other depressive disorders (e.g., bipolar, dysthymic, schizophrenia), or (d) have received antidepressant medications (or other forms of depression therapies) within the last 3 months.

Based on a systematic review of Li et al. (2015) which examined the overall effect size of exergames on depression,
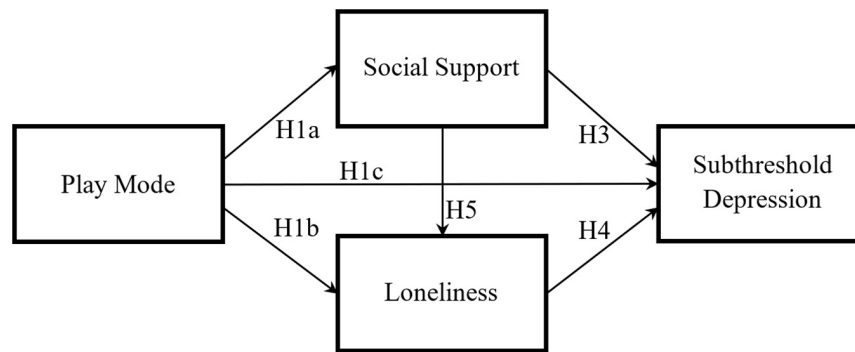
FIGURE 1 | Proposed conceptual model.

a general effect size of 0.25 was used in the current study to determine the sample size. Through the G*Power software with *a priori* analysis method, a sample of 54 participants is required in order to achieve the according general effect size with a power of 0.9 ($\alpha = 0.05$). What's more, the results of this systematic review shown that majority of previous studies used a small sample size of less than 50 participants. As a result, the current study targeted on 60 participants (30 per condition) which is slightly higher than recommended number.

In randomization process, each involved participant was labeled with a unique ID after screening, and an online tool[1] was used to generate two experimental conditions with random participant IDs. In order to avoid the interaction, these two experimental conditions in the same center were conducted in different time slots.

The ethical approval of this study was obtained from the Institutional Review Board at the university where the research team was originally from (IRB-2014-07-039). Participation in this pilot study was voluntary, and informed consent was obtained for all participants before the study. Each participant was awarded SGD$15 equivalent of shopping voucher after having completed all sessions.

Interventions

To manipulate play mode, two different exergame conditions – SP and MP – were involved in the study. Nintendo Wii Tennis was chosen as the exergame for both conditions because of two reasons. First, according to previous literatures (Gao and Mandryk, 2011; Theng et al., 2012), older adults were recommended to perform physical activities with simple and single movements because of their impaired physical and cognitive conditions. The Wii Tennis game fulfils these safety criteria and has already been used as exercise intervention for older adults in previous studies (Rosenberg et al., 2010; Maillot et al., 2012). Second, the tennis game contains both SP and MP modes, which could ensure equal comparison between two conditions.

In SP condition, participants were asked to perform the exergames individually and played against a virtual player.

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[1] QuickCalcs: www.graphpad.com/quickcalcs/randomize1.cfm

Due to practical considerations on schedule and arrangement, participants came with a group of 15 people in one session and took turns to play the exergames. Despite the group setting, each participant was instructed to play on their own and without any physical assistance from others during the gaming. The total time for a group was around 3 h in one session. In the MP condition, two participants formed a team and cooperated in the same game to play against two virtual players. Similar to SP condition, all participants in came with a group of 14 people (seven pairs of participants) and performed the exergames in one session. To balance the performance time with the SP condition, the total time for MP condition was around 1.5 h for each session. The MP mode in the study applied collaborative games but not competitive ones. Compared to collaborative mode with the shared objective, competitive mode with the personal objective may elicit anxiety and fear of failure (Wu et al., 2015). These emotions elicited in competitive games may have negative effects on depression.

Participants from both conditions performed the corresponding exergame interventions once a week for 6 consecutive weeks. During the intervention period, one or two student assistants coordinated each exergame session. They assisted in setting up the exergame and solved the technical problems occurred during the game playing.

Outcome Measures

Participants were asked to fill in two self-reported surveys at both pre-study (before the first exergame section) and post-study period (after the last exergame section). The basic demographic information of participants was collected in pre-study survey, including their age, gender, education level, living conditions, and physical health conditions. The three key variables, including subthreshold depression, social support, loneliness, were collected at both pre-study and post-study period. Trained student assistants from the research team assisted participants who had literacy and visual problems in filling the questionnaires. Both English and Chinese versions of questionnaire were used in the study. Most of the measurements were adopted from existing sources to ensure the validity. Participants selected the language version that matched their preference.

Subthreshold Depression

The PHQ-9 (Spitzer et al., 1994) is a self-administrated depression scale under the Primary Care Evaluation of Mental Disorders (PRIME-MD), which is a widely used diagnostic screening instrument in primary care. In addition to recognizing major depression, PHQ-9 is also a useful tool for detecting subthreshold depression in the general population (Martin et al., 2006). The validity and reliability as diagnostic and assessing measurements are well-established in previous studies (Kroenke et al., 2001; Löwe et al., 2004). The tool uses a four-point Likert scale (from 0 "Not at all" to 3 "Nearly every day") to measure items such as "Little interest or pleasure in doing things" or "Feeling down, depressed or hopeless." The total score ranges from 0 to 27, with a higher score indicating higher severity of depression. The Chinese version of PHQ-9 was adopted directly from the PHQ website[2] organized by Pfizer Inc. The Cronbach's α of PHQ in pre- and post-study are 0.57 and 0.70, respectively.

Social Support

Social support was measured by the perceived social support subscale from Berlin Social-Support Scales (BSSS; Schulz and Schwarzer, 2003). Good reliability of BSSS was also found among elderly population (Patil et al., 2014). The BSSS subscale comprises eight items assessing emotional and instrumental aspects of social support. Participants indicate their agreement with the statements like "I know some people upon whom I can always rely" on a four-point Likert scale, from 1 "Very strongly disagree" to 7 "Very strongly agree." The total score ranges from 8 to 56, and a higher add-up score indicates higher level of perceived social support. The Chinese version of BSSS was developed through back translations conducted by three Chinese doctoral students majored in communication studies. The Cronbach's α of BSSS in pre- and post-study are 0.87 and 0.82, respectively.

Loneliness

The University of California Los Angeles (UCLA) Loneliness Scale (Russell, 1996) is commonly used for measuring loneliness of respondents including older adults. The present study applied a short form (8 items) of UCLA Loneliness Scale (ULS-8; Hays and DiMatteo, 1987). ULS-8 consists of eight items selected according to the results of an exploratory factor analysis. The scale has high internal consistency and high correlation with the original scale and other related measures (Hays and DiMatteo, 1987). The ULS-8 was revised to suit the elderly participants in current study. The scale employs a four-point Likert scale with values ranging from 1 "Never" to 4 "Always." The total score of ULS-8 ranges from 8 to 32. No cut-off score was identified to define loneliness, but a higher score on this scale indicates a more intense feeling of loneliness. The Chinese version of the ULS-8 used in the study was developed from previous works (Chou et al., 2005; Zhou et al., 2012). The Cronbach's α of ULS-8 in pre- and post-study are 0.64 and 0.73, respectively.

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[2] www.phqscreeners.com

Statistical Analysis

Descriptive statistics of key variables were first conducted for both pre- and post-study data, following by a series of mixed analysis of variance (mixed ANOVA) to examine the interaction effects between time (pre-study vs. post-study) and play mode (SP game vs. MP game). Time was input as a within-group variable while play mode as a between-group variable. Both the descriptive statistics and mixed ANOVA tests were performed in IBM SPSS version 23.

Path analysis was then applied to test the conceptual model proposed between play mode and subthreshold depression. Path analysis is one of the most common techniques used in structural equation modeling (SEM). SEM is a family of statistical methods with a special aim to develop and test theoretical models. SEM evaluates the relationships between observed and latent variables (Hoyle, 1995). In path analysis, goodness-of-fit is first evaluated, followed by the estimation of path coefficients. Path coefficients, also known as standardized regression coefficients, determine the effects of exogenous (predictor) variables on endogenous (predicted) variables.

Different from common SEM in cross-sectional designs, the conceptual model in the current study involved a categorical exogenous variable (play mode). Bollen (1989) clarified that the inclusion of categorical exogenous variables did not violate the assumption of multivariate normality underlying the commonly used maximum likelihood method of estimation. MacCallum and Austin (2000) further indicated that one can use SEM to model the relationships of experimentally manipulated independent variables (such as dummy variables), to other variables, including covariates, mediators, and outcomes. All path analyses were conducted in Mplus version 6.0 (Muthén and Muthén, 1998).

RESULTS

Fifty-eight participants met the inclusive criteria and were involved in actual study. During the 6-week intervention period, six participants were reported to be absent in more than two sessions, due to the reasons including loss of interest (two participants), conflict schedule (three participants), or poor health condition (one participant). They were considered as drop-out and did not included in the final analysis. **Figure 2** illustrates the flow chart of the participants in the study.

Descriptive Statistics

A total of 52 participants completed both pre- and post-study surveys. The mean age of included participants was 72.12 (SD = 8.65), and 39 (75%) of them were female participants. Descriptive analysis was conducted across the two conditions on demographic characteristics and key psychosocial variables at pre-study period. **Table 1** illustrates the detailed results. Findings from t-test and Chi-square tests indicated that participants from the two conditions did not have significant differences in demographic characteristics, as well as physical and cognitive status. Furthermore, no significant group difference emerged during the pre-study period in depression [$t(50) = 0.56$, $p = 0.582$], social support [$t(50) = 1.24$, $p = 0.221$], and loneliness

FIGURE 2 | Flow chart of the participants.
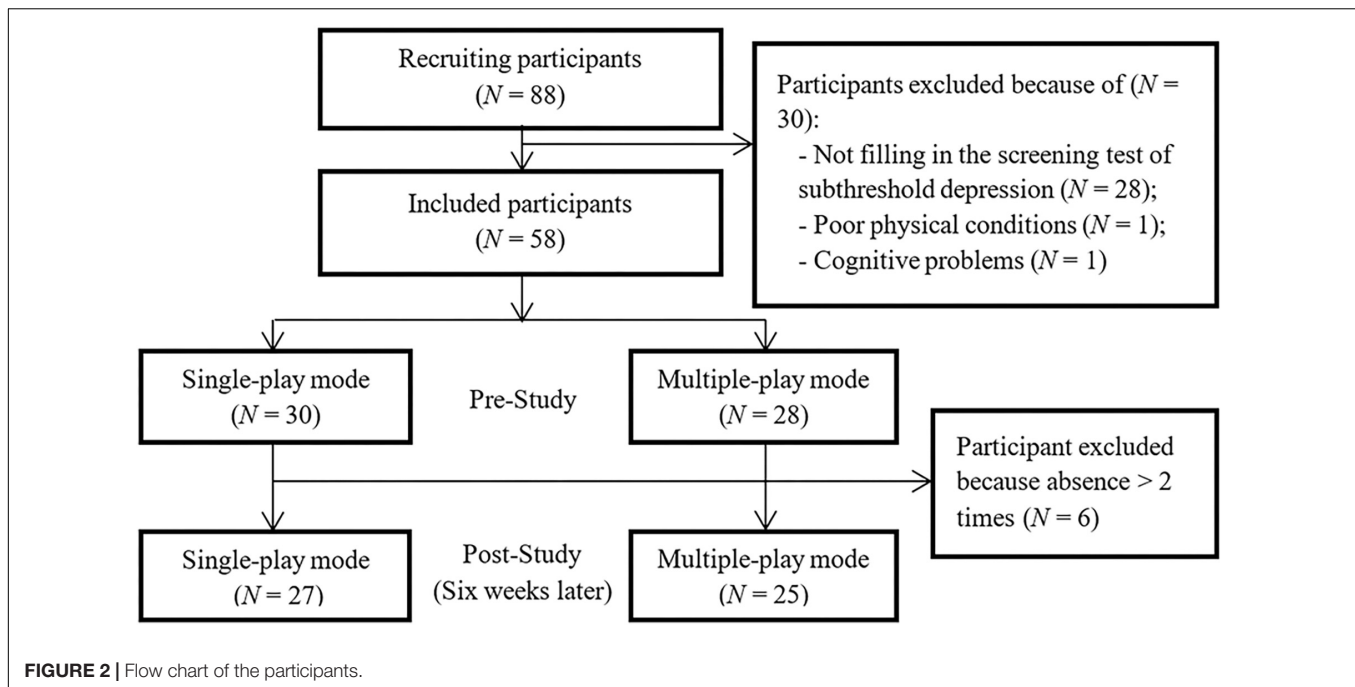
TABLE 1 | Descriptive analysis across two conditions in study two (N = 52).

	Single-player (N = 27)	Multiple-player (N = 25)	Difference across conditions
Demographics			
Age*	70.78 (8.37)	73.56 (8.88)	$t(50) = -1.16, p = 0.250$
55–64 years	5 (18.5%)	5 (20.0%)	–
65–74 years	14 (51.9%)	11 (44.0%)	–
75 years and above	8 (29.6%)	9 (36.0%)	–
Gender (Female)	20 (74.1%)	19 (76.0%)	$\chi^2(1) = 0.03, p = 1.000$
Education (≤Primary school)	19 (70.4%)	22 (88.0%)	$\chi^2(1) = 2.42, p = 0.177$
Living condition (Alone)	3 (11.1%)	8 (32.0%)	$\chi^2(1) = 3.40, p = 0.093$
Exercise frequency (≤Once per week)	9 (33.3%)	14 (56.0%)	$\chi^2(1) = 2.70, p = 0.162$
Physical Health			
Eye sight*	2.37 (0.63)	2.52 (0.77)	$t(50) = -0.77, p = 0.445$
Hearing*	2.93 (1.14)	2.92 (0.86)	$t(50) = 0.02, p = 0.983$
Mobility status*	3.04 (1.09)	2.40 (0.76)	$t(50) = 2.42, p < 0.05$
Cognitive status*	3.11 (1.01)	2.64 (0.64)	$t(50) = 1.99, p = 0.052$

*Data presented as Mean (Standard Deviation).

$[t(50) = 1.62, p = 0.111]$. As a result, participants in SP and MP can be considered as equal in demographic, physical, and psychosocial conditions. **Table 2** indicates key psychological outcomes across two conditions at both pre-study and post-study period. Findings indicates significant bivariate correlations among subthreshold depression, social support and loneliness after the intervention period.

Mixed ANOVA Results

The results of the mixed ANOVA did not show any significant interaction effects between time and play mode on social support $[F(1,50) = 2.710, p = 0.106, \eta^2 = 0.051]$, loneliness $[F(1,50) = 0.005, p = 0.944, \eta^2 = 0.00]$, or subthreshold depression $[F(1,50) = 0.802, p = 0.375, \eta^2 = 0.016]$. **Figure 3**

demonstrated the plots of the interaction effect among the three psychological variables. Despite the MP condition seemed to release more increase in social support and more reduction in subthreshold depression over the 6 weeks when compared to SP condition (Inspected from the descriptive statistics in **Table 2**), these changes were not statistically significant.

Nevertheless, there were strong significant main effects of time on all the three key psychosocial attributes, including social support $[F(1,50) = 24.152, p < 0.001, \eta^2 = 0.326]$, loneliness $[F(1,50) = 25.027, p < 0.001, \eta^2 = 0.334]$, and subthreshold depression $[F(1,50) = 117.431, p < 0.001, \eta^2 = 0.701]$. The findings indicated that the older adults had improvements on social support, loneliness, and subthreshold depression after the 6-week exergames playing. As a result, the strong effects of

TABLE 2 | Description of depression, social support, and loneliness (N = 52).

	1	2	3	Cronbach's alpha α	Total	Single-player (N = 27)	Multiple-player (N = 25)
Pre-study period							
1. Depression (PHQ-9)	–			0.57	6.63 (2.42)	6.81 (2.35)	6.44 (2.52)
2. Social support (BSSS)	−0.73**	–		0.87	39.48 (7.21)	40.67 (6.53)	38.20 (7.82)
3. Loneliness (ULS-8)	0.26	−0.09	–	0.64	13.31 (3.25)	14.00 (3.66)	12.56 (2.60)
Post-study period							
1. Depression (PHQ-9)	–			0.70	2.73 (1.95)	3.22 (1.95)	2.20 (1.85)
2. Social support (BSSS)	−0.41**	–		0.82	44.54 (5.11)	44.07 (5.19)	45.04 (5.09)
3. Loneliness (ULS-8)	0.69**	−0.34*	–	0.73	11.12 (2.49)	11.78 (2.26)	10.40 (2.57)

Data are presented as Mean (Standard Deviation).
*p < 0.05, **p < 0.01.

FIGURE 3 | Interaction effects from ANOVA results.
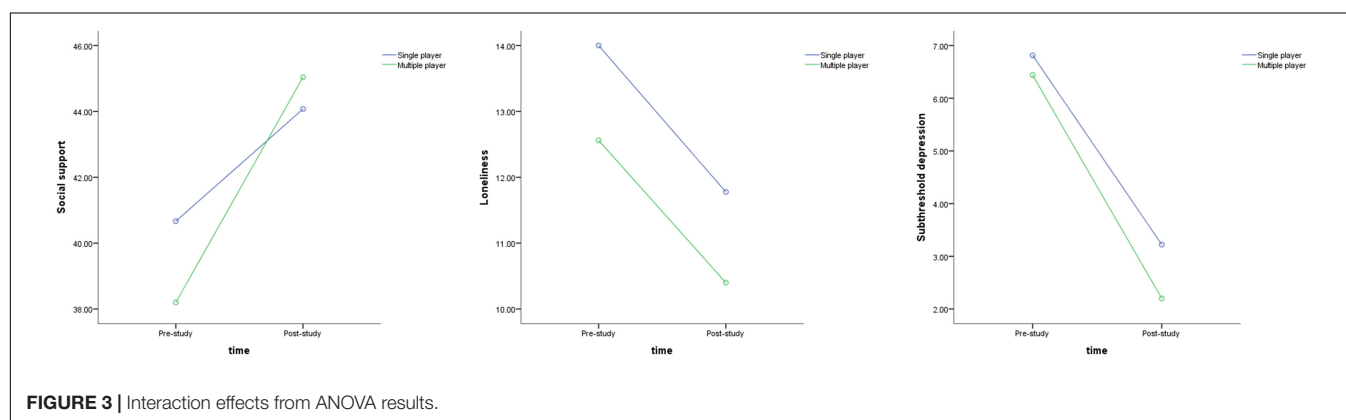
exergames were supported as a psychosocial intervention for older adults with subthreshold depression.

Model Examination

In path analysis, goodness-of-fit was first assessed through multiple fit statistics, including Chi-square test, Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). Chi-square test (χ^2) is the most basic fit statistic that compares predicted covariance matrix with observed matrix (Bentler, 2004). To reduce the effects of sample size, normed Chi-square (χ^2/df) was calculated. A value of normed Chi-square smaller than 3 indicated an acceptable fit. CFI assesses the relative improvement in fit of the researcher's model compared with a baseline model (Hu and Bentler, 1990). Values greater than roughly 0.90 may indicate reasonably good fit of the proposed model. RMSEA measures error of approximation (Steiger and Lind, 1980) with a value less or equal to 0.05 considered as good fit and 0.05–0.08 considered as fair fit. SRMR is a measure of the mean absolute value of the covariance residuals. A recommended cut-off point for SRMR is smaller than 0.08 (Hu and Bentler, 1990).

Based on the above criteria, the proposal model resulted in a good fit to data. **Table 3** shows the goodness-of-fit indices and model fit results. Estimations of path coefficient and hypotheses testing were conducted after determining the final model. **Figure 4** shows the results of the path analysis in the final model. During the hypotheses testing, significant negative effects

of exergame play mode were observed on loneliness among older adults ($\beta = −0.25$, SE = 0.12, $p = 0.042$), thereby supporting H1b. However, H1a was not supported with no significant play mode effects on social support ($\beta = 0.10$, SE = 0.14, $p = 0.488$). Consequently, compared to SP exergames, MP exergames led to more reduction in loneliness among older adults, but not in social support. A strong and significant predictive effect from loneliness was also observed on subthreshold depression among older adults ($\beta = 0.59$, SE = 0.09, $p < 0.001$). Meanwhile, subthreshold depression was also significantly affected by social support, with $\beta = −0.20$, SE = 0.10, $p = 0.047$. Thus, both H3 and H4 were supported. However, the direct effect of exergame play mode was not significant on subthreshold depression among older adults ($\beta = −0.08$, SE = 0.10, $p = 0.434$), thereby not supporting H1c. Lastly, H5 was supported by a significant path from social support to loneliness ($\beta = −0.32$, SE = 0.12, $p = 0.008$), which highlights the potential effect of social support on loneliness during exergame playing.

TABLE 3 | Goodness-of-fit indices and model fits.

	χ^2	df	p	χ^2/df	CFI	RMSEA	SRMR
Recommended values	N/A	N/A	>0.05	<3.0	>0.9	<0.080	<0.080
Proposed model	0.607	1	0.4359	0.607	1.000	<0.001	0.019

df, degree of freedom; CFI, comparative fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual.
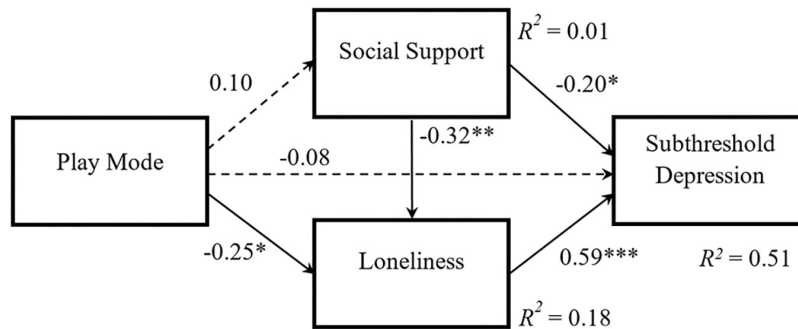
FIGURE 4 | Results of path analysis in the final model. Path coefficients are standardized. The solid line indicates a significant path with $*p < 0.05$, $**p < 0.01$, $***p < 0.001$. The dashed line indicates non-significant path with $p > 0.05$.

Following the guideline by Stride et al. (2015), the mediation tests were further conducted on Mplus with Andrew Hayes' PROCESS analysis. The mediation results indicated that play mode in exergames has a (approaching) significant indirect effect on subthreshold depression via medication of loneliness, with $\beta = -0.15$, SE = 0.08, $p = 0.055$. But the mediation role of social support was not supported in the relationship between play mode and subthreshold depression, with a non-significant indirect effect of $\beta = -0.02$, SE = 0.03, $p = 0.511$. Consequently, the results from the model examination supported H6b but not H6a.

A significant large R^2 of 0.51 ($p < 0.001$) in subthreshold depression was reported during the post-study period. This result demonstrated that 51% of the unique variance of subthreshold depression was explained by independent and mediating variables mentioned above. Generally, the findings from path analysis support the final model in which four out of the six path coefficients are statistically significant. To sum up, compared to SP exergames, MP exergames reduced subthreshold depression via the effect on loneliness. Although social support was not supported to be a significant mediator of play mode, it independently affected loneliness and subthreshold depression among older adults.

DISCUSSION

The pilot study extended the discussion of play mode from in-game experience to mental health improvements. The study also introduced this important theme into the new domain of exergames for health. First of all, the significant improvements on depression and its related attributes between pre- and post-study period have supported the overall effectiveness of exergames as an emerging depression intervention for older adults. These findings were consistent with previous exergame studies (Rosenberg et al., 2010; Chao et al., 2015). It was well established that the physical activity triggers the release of certain body chemicals (such as β-endorphins or dopamine), which consequently result in the improvement of mood and feeling of well-being (Delgado and Moreno, 2000; Brosse et al., 2002).

More importantly, the study investigated the possible effect of play mode (SP vs. MP) on subthreshold depression among older adults through a between-group controlled study. The research serves as a pioneer study to examine the factors that mediate anti-depressive effects of play mode in exergames. Overall, the proposed mediation model in the study was generally supported by the path analysis. Good model fit and high R^2 of dependent variable further confirmed the robustness of the final model. In this model, play mode was revealed to have indirect effects on subthreshold depression among older adults, which was mediated by loneliness. Accordingly, older adults who performed MP exergames experienced lower levels of loneliness, and further have more improvement on subthreshold depression, when compared to participants who performed SP exergames. The results support the hypotheses on play mode and psychosocial well-beings (H2 and H4), which are developed from previous studies (Lazzaro, 2004; Singh and Misra, 2009; Zhang and Kaufman, 2016b). The significant mediation link found in the study has further deepened the research domain of exergames and literature concerning psychosocial benefits. Several previous studies have indicated that exergames led to less loneliness and depression (Rosenberg et al., 2010; Kahlbaugh et al., 2011). The current study extended the findings by emphasizing the possible influencing role of play mode, that is, MP exergames have better effects over SP ones on alleviating loneliness and subthreshold depression.

By allowing different players to interact in a team, MP exergames could foster both virtual and real social interactions among players, thereby reducing the risk of social isolation and loneliness (Mueller et al., 2003; Staiano and Calvert, 2011). In a narrative review, Brox et al. (2011) further highlighted the importance of using MP exergames among older adults. They believed that MP exergames increased social interaction between older adults, reduced their social isolation and prevented loneliness and subthreshold depression. The current study provided important evidence to support the assumption from previous research, and confirmed the strong effects of play mode on loneliness and subthreshold depression among older adults.

However, the mediating role of social support was not supported in the study, which differed from the given expectation. Although MP exergames were assumed to increase social interaction among players (Mueller et al., 2003; Staiano and Calvert, 2011), in this study they did not lead

to higher social support than SP exergames. Social support generally consists of two major categories, namely emotional and instrumental support (Wills, 1985; Langford et al., 1997). In the context of exergaming, MP simply cannot provide better instrumental support (e.g., tangible support or real assistance in daily life) over the SP. The increased social bonding and communication in MP exergaming context may not guarantee the rise in emotional support in real life within only 6 weeks. The group setting in SP may be another possible explanation of the non-significant finding.

Although the initial model did not reflect the dependency of social support and loneliness, the final model supports the effects of social support on loneliness and subthreshold depression in exergames. It shows that social support not only has a direct anti-depressive effect, but also has an indirect effect via loneliness. While the significant relationship among social support, loneliness, and depression has been examined for long time in the general context (Chi and Chou, 2001; Singh and Misra, 2009), many recent studies are exploring this relationship in the adoption of new technologies (He et al., 2014; Chopik, 2016). For example, a cross-sectional study from He et al. (2014) indicated that social support was negatively associated with depression of Internet addicts whereas loneliness plays a mediating role. In consistent with these studies, the current study extends the significant relationship to the context of exergaming. Meanwhile, despite social support not being affected by play mode, its variances, which were probably affected by other external factors, assumed a significant role in the effects of play mode on subthreshold depression. These findings imply that social support may act as a moderator in the relationship between play mode and subthreshold depression. Future studies are needed to examine this assumption.

The current study does incur some limitations. Firstly, the small sample size and short intervention time may affect the generalizability of the key results, which was mainly caused by the difficulties in recruiting and managing older participants. Although no strict and clear criteria are required in the sample size of SEM studies, many researchers in the field recommend using more than 200 subjects (Kline, 2011; Tabachnick and Fidell, 2013). The findings of path analysis in this pilot study should be interpreted with caution. Secondly, the proposed model only involved two possible mediators. Future research may include more variables and draw a more complete picture on the influencing mechanism of play mode effect on subthreshold depression among older adults in exergaming. Thirdly, only Wii Tennis was used in two conditions, due to the lack of available exergames in the current market. The key conclusions should be further examined with the use of other suitable exergames in the future. Fourthly, the PHQ-9 scale has a low internal consistency at the baseline. This problem might be caused by the screening process where we only recruited participants with a limited range of PHQ-9. Therefore, the conclusions of ANOVA should be further confirmed in future studies. Lastly, it would be more worthwhile to test the interaction effect between play mode and other exergame factors in future studies, such as comparing SP and MP in both non-exercise games and exergames.

To conclude, the study compared the effects of SP and MP exergames, and supported that play mode was important in affecting the anti-depressive effects of exergames. The model examination presents a novel understanding of the mechanism inside this influencing process. Specifically, multiple-player exergames promoted better improvements on subthreshold depression and loneliness among older adults, when compared to single-player exergames. The study highlights several practical and theoretical implications applicable for both game design and mental health research. For serious game design, evidence from current research emphasizes the importance of designing multiple-player exergames for older adults with a healthcare purpose. Schutter and Abeele (2008) conducted a participatory design study and their findings suggested that older adults preferred multiple-player games when they were involved in the design process of digital games. Therefore, to maximize the psychosocial effects, exergames should be designed with a preference of multiple-player mode for older players, and involve more elements to increase social interactions and support. For mental health research, the findings also contribute to exiting literature by providing additional insight into a possible causal association lining play mode and subthreshold depression in exergames. Most of the previous studies examined the effects of play mode in the behaviors and perceptions, such as motivation, gaming performance, and experience (Smyth, 2007; Peng and Hsieh, 2012; Chen et al., 2015). The current study extended and tested its possible link to mental health improvements. It further inspires the theoretical discussion of play mode effect under a broader domain of exergames for mental health, such as anxiety and dementia. Following the discussion of multiple-player mode in exergames, it may also be interesting for the future study to explore who to play with, especially on the psychosocial effects of inter-generational exergames.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Institutional Review Board (IRB) of Nanyang Technological University, Singapore (IRB-2014-07-039). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

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Existential Transformational Game Design: Harnessing the "Psychomagic" of Symbolic Enactment

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This paper explores indexical symbolic enactment as a way to promote authenticity and inner balance through digital games. Drawing on research from cognitive anthropology, neurobiology, and psychology, the following presents an argument for *why* and *how* indexical symbolic enactment can impact us on a deep, unconscious level and contribute to personal transformation. It identifies four high-level guidelines that can inform existential transformative game design: (1) ritual theming (i.e., liberation, transformation, and commemoration/celebration); (2) metaphorical approach; (3) contextual mechanisms that promote a readiness for change and processing; and (4) psychological resonance. It then uses these guidelines as an analytical lens for a case study on the game *Papo & Yo* (Minority Media Inc., 2012). This analysis shows how indexical symbolic enactment can contribute to a game's transformative potential and examines missed opportunities when design decisions emphasize gameplay considerations rather than symbolic congruency and psychological resonance.

Keywords: game design, transformation, existential, symbolic action, metaphor, meaning, psychology, experiential

INTRODUCTION

How can we intentionally design for deep (in the sense discussed by Rusch, 2016), transformative gameplay experiences that contribute to a meaningful life for players? Adopting a perspective informed by existential psychotherapy, a meaningful life is one in which one has faced and accepted the inevitability of death, developed a sense for one's purpose or calling, focused on making self-directed choices that are in alignment with one's true nature, and cultivated quality connections to something beyond oneself (Existential Psychotherapy, Yalom, 1980). Further, existential psychotherapist Bugental (1990, p. 246) writes: "Viewed from an existential perspective, the good life is an authentic life, a life in which we are as fully in harmony as we can be. Inauthenticity is illness, is our living in distorted relation to our true being."

Recently, Rusch (2020) discussed in detail the various goals of existential psychotherapy and how they can inform game experience goals, while Phelps has focused on encoding "deep" meanings through experiential and proceduralized gameplay (Phelps et al., 2020). This article extends these ideas and focuses on the idea of a meaningful life from the perspective of authenticity and inner balance, and specifically on "symbolic enactment." Symbolic enactment

is an intrinsic component of pretend play and can take very banal forms, such as a banana symbolically representing a telephone. This is an iconic representation; the banana simply functions as a placeholder for another, well-understood thing. We have spoken about plenty of bananas and have rarely been transformed by it. Thus, iconic symbolic representation alone is insufficient; symbolic enactment is based instead on *indexical* symbols: objects and actions that do not refer merely to something known and easily graspable, but to intangible concepts and the psychologically ineffable. This is where the design focus is "deep," because what is enacted refers to something below the surface of physical, conscious reality. By surfacing it through symbols – actions and objects that are acted upon – we can connect with the ineffable and affect personal changes on a profound and otherwise elusive level.

Symbolic enactment in the broader sense is an inherent characteristic of ritual, theater, and games. Yet it is mostly ritual and theater that have embraced and leveraged indexical symbolism for personal transformation and growth. There is significant research on the use of ritual in psychotherapy (Parker and Horton, 1996; Kirmayer, 1999; Goodwyn, 2016). Alejandro Jodorowski's "psychomagic" poetic acts have become famous as a form of theater counseling that is based on symbolic action (Jodorowski, 2010, 2015). In digital games, however, symbolic enactment has remained largely underexplored and under-used. The Games for Change discourse has mainly focused on a kind of learning through games that favor rationality. Embodied experience (Gee, 2003) is lauded as a potent aspect of change affected through games, but mostly as a vehicle of sense-making. It emphasizes the *understanding* of whatever is represented through the ruleset (Gee, 2003). Procedural rhetoric also champions cognitive understanding by focusing on the messages and ideas expressed through rules and mechanics (Bogost, 2007). Favoring the conscious aspect of learning and change – as would be expected in our modern, rational, Western world – has limited explorations of how to address the unconscious, and the subtler, more elusive kinds of inner shifts that can be ignited by engaging in various artistic and expressive experiences such as videogames. Humans are far from being purely rational creatures. If transformative game design approaches do not take that into account, they are missing out on much of games' potential to have a real and lasting impact. However, when we stray from the currently predominant model of transformative game design (Culyba, 2018), which focuses on specific changes that are imposed on players through the game and are supposed to be clearly predictable and measurable, there are very few guidelines. We leave the well-lit path of reason and quantifiable results at our own risk.

Please note that this work is neither claiming successful treatment of mental illness through games nor recipes for the design of games as therapeutic tools. Our intention regarding an existential, transformative game design framework is to suspend the requirement for hard proof of whether a game "works" – at least for now – for the sake of exploring new opportunities for games to tap into thus far underexplored transformative potentials. Our method is to draw from a broad range of research sources, including cognitive anthropology, existential and depth psychology, neurobiology, and game design/studies, to craft an argument for how and why symbolic enactment can be psychologically powerful and how it can inform transformative gameplay experiences. Further, we identify several guidelines inspired by this research that game designers can use to design transformative games with a special focus on symbolic enactment. These guidelines then act as an analytical lens for the case study of *Papo & Yo* (Minority Media Inc., 2012) to discuss opportunities and challenges of symbolic enactment in the context of videogames. While a bit dated, *Papo & Yo* lends itself to this analysis, because (a) the game deals with an inner conflict – the emotional struggle of a boy to "let go" of the desire to save his alcoholic father, (b) it uses ritualistic/spiritual motifs in its narrative and mechanics, and (c) it was intentionally created to promote transformation and healing.

AUTHENTICITY AND THE UNCONSCIOUS

To design for authenticity, personal integrity, and inner balance, it is useful to explore what helps and hinders these feelings. Game design – as a means to evoke a specific experience, communicate a message, or promote some kind of change – is often understood as problem solving (Culyba, 2018). Yet, a basic principle of (particularly but not only depth) psychology is that the experience of an authentic life (as described by Bugental, 1990 above) depends on the alignment of *all* parts of ourselves, both the feeling and thinking self, or – as it is more commonly referred to – the conscious and unconscious mind.

In his book *Inner Work*, Johnson (1986) writes:

> The unconscious is an enormous field of energy, much larger than the conscious mind. Jung compared the ego—the conscious mind—to a cork bobbing in the enormous ocean of the unconscious (…). Deep in this unseen ocean of energy huge forces are at work. Mythical kingdoms, symbolized by the legends of Atlantis, exist there in the depths and carry on lives parallel to the daily life of our conscious minds. Centers of alternative consciousness, alternative values, attitudes, and ideas exist there like other islands in the great sea. (…) The purpose of learning to work with the unconscious is not just to resolve our conflicts or deal with our neuroses. We find there a deep source of renewal, growth, strength, and wisdom. We connect with the source of our evolving character; we cooperate with the process whereby we bring the total self together. (pp. 8-9)

Getting in touch with the unconscious and becoming accepting of its contents is a path toward a more authentic and integrated person. Apart from various psychotherapeutic methods such as active imagination (Jung, 1997), dreamwork (Jung, 2002) and sand play therapy (also invented by Jung but further developed by Kalff, 2003), an essential means of communication between, and alignment of, the conscious and the unconscious

mind since the dawn of humankind, have been myth. Existential psychotherapist May (1991, p. 15) noted: "A myth is a way of making sense in a senseless world.". This corresponds to the view of Campbell (2004, p. 3) on myth as a vehicle to "reconcile consciousness to the preconditions of its own existence; that is to say, the nature of life." Myth, *via* imagery and symbolism, speaks the language of the unconscious, acts as a map through our own unknown forests, and provides personal navigation and calibration tools (Campbell, 2004).

An example of using this kind of myth-based approach to imagery and symbolism in media is *Women Who Run with the Wolves* book of Estés (1996), in which the Jungian psychologist analyzes a range of myths based on the "Wild Woman" archetype. Her detailed dissection of stories such as *Bluebeard's Brides*, *The Seal Skin*, and *The Red Shoes* makes their symbolism apparent and explains how they exemplify common psychological patterns. *Bluebeard's Brides* appeals to honoring our instincts – if something feels "off," it probably is. *The Seal Skin* speaks to the need to "go home to ourselves." If we leave our skin behind and live a life in an environment that does not fulfill our needs, like a sea creature forced to live on land, we dry out and die. *The Red Shoes* reminds us of the value of our own creativity, of investing psychic energy into something that fulfills us rather than filling our lives with substitute pleasures that leave us constantly hungry (forever driven/dancing) and never satisfied. Each of these myths thus, from a story perspective, seeks to provide the listener with a deep sense of authenticity not purely conveyed through the story itself but also through the alignment of the narrative with subconscious elements of the human condition.

The power of myth is that it works without having to analyze it intellectually. If the recipient is in the right mindset – open to the themes the myth deals with – the symbolism and imagery within the story "resonate" and activate the recipient's imagination. This sets a transformative process in motion that is uncoerced and out of the recipient's own accord (Campbell, 1991). As Jung notes: "The auditor experiences some of the sensations but is not transformed. Their imaginations are stimulated: they go home and through personal fantasies begin the process of transformation for themselves" (Bonnett, 2006, p.27).

Myth, dreamwork, and active imagination – all of these are instruments to surface what slumbers in the depths of our unconscious: to raise awareness for potential needs, wants, desires, inner conflicts, and for and potential action. For example, myth is used in strategic and narrative psychotherapies to

(1) Join[…] with patients by accepting their initial framing of the problem; (2) work[…] within the patients' own metaphors, stories and worldview to reframe, reattribute or otherwise transform the problem; and (3) [assume] that manipulation of symbols through imaginal dialog and ritual enactments can reorganize cognitive schemas, unconscious dynamics and interpersonal interaction (Kirmayer, 1999, p. 451).

As noted by Rusch (2018, p. xix), myth provides relevant context to symbolic action in the sense that "[r]itual is simply myth enacted; by participating in a rite, you are participating directly in the myth," which is based in turn on Campbell (2004). This provides a background for recognizing the criticality of symbolic enactment as a huge change agent. This "acting" does not only refer to behavior change once an issue is conscious. At first, it refers to an action that further strengthens the dialogue with the unconscious by addressing it directly, acknowledging its messages and sending messages back to it; *symbolic* action speaks the language of the unconscious. Johnson proposes performing a ritual to honor the insights that appear through dreamwork and active imagination (Johnson, 1986). The unconscious must know that we are paying attention, and actions speak louder than words. Symbolic action has been effectively used in ritual and ritual-like performances such as poetic acts of Jodorowski (2010) in the context of psychotherapy (e.g., psychodrama) and counseling (Gilligan, 1993; Bewley, 1995; Al-Krenawi, 1999; Kirmayer, 1999; Cole, 2003). Games also have an inherent potential for symbolic enactment but there is almost no systematic inquiry of such.

ICONIC AND INDEXICAL SYMBOLIC ACTION

In exploring symbolic action in detail, the nuances of various interpretations of these concepts are critical. The following is a discussion of the terms iconic, indexical, symbol, and sign and how they are used by Peirce as well as Jung. Although Peirce's work on semiotics provides the (commonly understood) basis for these terms, Jung gives them a new spin, one that is particularly relevant for the design methodology, we propose but that differs slightly from more generalized definitions as put forward by Peirce.

There are different kinds of symbols/symbolic actions. One commonly found in pretend play is *iconic* symbolic action, wherein an icon is a sign that shares some quality or likeness with that which it represents: "icons serve to convey ideas of the things they represent simply by imitating them" (Peirce, 1998, p. 5). The stick is not the sword, the broom is not the horse, the banana is not the phone, but sword, horse, and phone are all well-known entities and stick, broom, and banana share enough likeness with them to act as placeholders during play. This kind of pretend play, however, is not deep in the sense established by Rusch (2016). Rusch notes that by modeling complex abstract concepts by way of metaphors, they have a deeper meaning beyond what they represent on the surface, thus allowing the exploration of intangible aspects of the human experience such as inner processes. The concepts "phone conversation," "horse riding," or "sword fighting" in pretend play are anchored, and usually exhaust themselves, in the physical realm and thus carry little symbolic weight. Jung does not even dignify these types of symbols with the term "symbol" – he refers to them simply as "signs" (Sharp, 1991, p. 131). He reserves the term "symbol" for representations of "metaphysical concepts" – something deeper, more elusive and essentially unknown, e.g., inner processes. He states that

The interpretation of the cross as a symbol of divine love is *semiotic*, because "divine love" describes the fact to be expressed better and more aptly than a cross, which can have many other meanings. On the other hand, an interpretation of the cross is *symbolic* when it puts the cross beyond all conceivable explanations, regarding it as expressing an as yet unknown and incomprehensible fact of a mystical or transcendent, i.e. psychological, nature, which simply finds itself most appropriately represented in the cross. (Sharp, 1991, p. 131)

To further clarify the distinction between "sign" and "symbol" in the Jungian sense, it helps to draw on Peirce's term "index." An index, according to Peirce (1998), is a sign that refers to something else by being physically connected with it, for example, sweat that indicates body heat or foot prints that indicate someone has walked this path. As such, indices themselves are not terribly deep either. But when they are not reduced to referring to something physical, and instead applied to the metaphysical, the elusive, the intangible, and the ineffable, it gets much more interesting and leads Jung to elevate a sign to a symbol. Thus, it is these kinds of *indexical symbols* that are of interest when we explore the transformational potential of symbolic enactment. Indexical symbolic action can therefore be understood as a process of projecting salient aspects of an internal landscape outward, manifesting them through physical gestures and objects that represent something otherwise abstract. The tangible, symbolic manifestation of elusive ideas now allows their manipulation in a manner that the unconscious accepts authentically as "real." "As if" becomes "as." This can have powerfully transformative effects on the performer's inner world.

The Transformative Power of Indexical Symbolic Enactment

But how can indexical symbolic enactment contribute to personal transformation directly? Goodwyn (2016), referring to Kradin, explains that psychosomatic symptoms are a failure of symbol formation:

(…) patients who remain unable to psychologize (i.e. transform into a narrative of personal meaning) their symptoms stay resistant to treatment. In this context, by "symbols" we mean concrete images/objects that are iconic and indexical signs of more abstract, difficult to verbalize, and frequently highly emotional ideas. Manipulating them in a ritual manner is a way of accessing deep emotional issues in a very physical, embodied way that cannot be duplicated by mere verbal discourse. (p. 53)

While the above also includes iconic signs, the ineffable quality of indexical symbols is still our critical concern. In psychotherapy, symbol-formation makes (otherwise intangible) psychic energy available for meaningful work and personal change. The concrete, physical enactment of elusive, psychological concepts is at the heart of experiential

psychotherapies (in contrast to talk therapies): such as psychodrama (Moreno, 2008), play therapy (Kalff, 2003), and ritual and ritual-like performances such as poetic acts of Jodorowski (2010). Anthropologists Thompson et al. (2009, p. 134) emphasize the importance of performance for any kind of transformative, symbolic work: "We suggest that the efficacy of mental practice resides in its performativity – that is, *doing* (even in the mind's eye) *makes it so*."

"To Die and Be Reborn": An Example of a Poetic Act by Alejandro Jodorowski

As an example, consider one of Alejandro Jodorowski's poetic acts, designed to help a person "who cannot free themselves from the feeling that they have failed in their professions, in love, the family, in their projects" (Jodorowski, 2015, p. 44) and, if it were not for their self-acclaimed "cowardice," would commit suicide (Jodorowski, 2015, p. 44). Jodorowski (2015, p. 44) states that a client in such a state cannot be cured and offers the shocking conclusion: "[t]he only thing left to do is die to be reborn a new person." He goes on to describe an elaborate process of symbolic death and rebirth, involving hiring a couple of collaborators who will dig a shallow pit, the consultant reading their own funeral speech, undressing, wrapping themselves in a sheet, lying in the pit and being covered with dirt by the collaborators, surrounded by 10 burning candles. When ready, the consultant says "I am ready to be reborn!" upon which the collaborators will dig them out and wash them with blessed water and give them clean, white clothes. This is followed by the consultant choosing a new name (on new business cards) and writing their old name on a piece of parchment and burying it with their old clothes in the pit, and erasing the key burdens and traces of the old life to make room for a new identity to settle in.

This poetic act is not mere pretend play. Its various symbolic actions are indexical rather than iconic; the feigned death is not about pretending to be physically dead, but it refers to the more elusive concept of letting go of an old self. The use of new names on business cards in the ritual fits with the power of names drawn from fairy tales; they can render threats harmless as in *Rumpelstilskin*! (Grimm and Grimm, 2013) or imbue a princess with life as in the *Never Ending Story* of Ende (1983). Every single step in this "identity rebooting" process has a deeper meaning that is made concrete and accessible through symbolic action.

The description of this act stems from *Manual of Psychomagic* of Jodorowski (2015), which is a collection of poetic acts he actually prescribed to his clients and which has been reported as successful by the clients themselves. What "successful" means is, of course, worthy of further inquiry, particularly if attempting to prove clinical relevance. But for the purpose of exploring these acts in theorizing models for deeper game design, this theory needs to address *why* such a bizarre performance *could possibly work at all*. You cannot *really* die and be reborn. As Thompson et al. (2009, p. 134) said, however: "doing (even in the mind's eye) makes it so."

Magical Consciousness

According to Greenwood and Goodwyn (2016), there are two kinds of consciousnesses: rational consciousness, which has become dominant in the western world, and *magical* consciousness. While the rational mind focuses on logical, causal relationships between actions and consequences, magical consciousness emphasizes analogical, associative thinking that is based on perceived, meaningful similarities between things. Our unconscious cares much less about logical relationships than about magical/associative/analogical ones and we have little control over that. Both kinds of thinking are important tools for meaning-making and much can be gained from using them in complement. Magical consciousness has received little attention in research overall, yet it is essential to understand the transformative power of symbolic action. It also plays a key role in the placebo phenomenon. While the kind of indexical symbolic enactment as exemplified through one of Jodorowski's poetic acts may sound like hocus-pocus, it is not that much different from how medical treatment began.

Originally, medicine was not based on sound knowledge of the human body or what substances could really provide cures. Instead, it began with magical thinking that led to the most absurd (from a clinical point of view) concoctions and procedures to promote health. The substance *bezoar*, for example, was believed to contain the crystallized tear from the eye of a doe bitten by a snake (Benedetti, 2009, p. 4). It was the symbolic meaning healers of the time ascribed to these substances that led to their use in treatment and belief in these meanings by patients that made such substances effective. Therefore, "[t]he history of medical treatment is basically the history of the placebo effect" (Shapiro and Shapiro, 1999, p. 13), but this does not mean such effects are the equivalent of "no therapy" (Koshi and Short, 2007, p. 13). Rather, placebo describes the psychobiological phenomenon where the body and brain anticipate and participate in clinical improvement, and placebo *responses* have been observed in a variety of mental and physical disorders (see a thoroughly referenced account of these studies in Goodwyn, 2016, p. 28).

Goodwyn (2016) explains that the key to the "magic" of its effectiveness lies in the mind-body connection. Referring to biogenetic structuralist Charles Laughlin, Goodwyn writes:

> Biogenetic structuralists (…) argue that the brain plays a fundamental part in ritual experience through its capacity to *co-create* a *cognized and highly symbolic* world—that is, one in which the mind participates through its various biological mechanisms. (p.26)

Laughlin himself explains: "The symbolic function amounts to the relationship between a sensory object and neurocognitive, neuroendocrinal, neuroimmunological, or other somatic processes intent upon this object" (quoted in Goodwyn, 2016, p.26). This means that powerful, complex physiological mechanisms are set in motion when we ascribe a special, symbolical meaning to a tangible object or process. Digging a shallow grave, laying in it and emerging from it "reborn" is thus felt on a biological

level, causing inner shifts that in turn impact the mind. Goodwyn, still referencing Laughlin, goes on to explain that symbolically rich rituals (which are most of them),

> intensify right-brain processing to produce an 'alternative reality' rich in intuitive, vivid sensory and emotional experience (1990,30-31)—types of experience that we are constantly trying to access in psychotherapy, and that are particularly difficult to access due to the typically low-ritual, abstract, and verbal nature of most psychotherapy modes. (p. 26)

Thus, symbolic acts are particularly conducive to envisioning – through the tangibility of bodily experience – new ways of being by utilizing the powerful interaction between body and mind. This idea is well represented in psychological literature and has played a key role in many aspects of psychotherapy (Benedetti, 2009, p.16). Key to the psycho-biological conceptualization of placebo is the role of symbolic meaning. From this perspective, the placebo effect can be defined as

> a change in the body, or the body-mind unit, that occurs as a result of the symbolic significance which one attributes to an event or object in the healing environment. This definition is embedded in the notion that symbols induce expectations of an outcome, thus highlighting the crucial role of meaning and expectation. (Benedetti, 2009, p. 16)

That mental images alone can induce physiological changes is particularly noteworthy in regards to the transformative power of symbolic enactment in games. You do not have to literally touch or manipulate something to reap the benefits of symbolic action. The virtual, embodied experience within a videogame, accompanied by a vivid, sensual, emotionally evocative audio-visual design can – according to the presented research from placebo studies – be highly effective.

Magical Realism and Symbolic Enactment

It is critical to note the role of magical realism in all of the above. Magical realism is, essentially, a subgenre of fantasy that involves the use of magic as an element in an otherwise normally functioning world. The origins of the term and the movement it describes are defined as

> a term used in 1925 by a German Art Critic, Frans Roch, to indicate the demise of Expressionism, magical realism grew to become an important feature of the Boom literature of the 1960s in Latin American (particularly in Gabriel Garcia Marquez's One Hundred Years of Solitude of 1967) until it became, in the 1990s, in the words of Homy Bhabha 'the literary language of the emergent postcolonial world. (Hart and Ouyang, 2005, p. 1)

For our purposes regarding game narratives, actions, and symbolic enactments, it is useful to examine this in the context of Faris' framework, who notes:

As a basis for investigating the nature and cultural work of magical realism, I suggest five primary characteristics of this mode. First, the text contains an 'incredible element' of magic; second, the descriptions in magical realism detail a strong presence of the phenomenal world; third, the reader may experience some unsettling doubts in the effort to reconcile two contradictory understandings of events; fourth, the narrative merges different realms; and, finally, magical realism disturbs received ideas about time, space, and identity. (Faris, 2004, p. 7)

In this context, the core use of magical realism as a construct is to set up a scenario that "involves the intentionality implicit in the conventions of the two modes" (Zamora and Faris, 1995, p. 3). Magical realism takes the conventions of the normally functioning world and a consistent but magical system and then uses the juxtaposition between these modes as an exploration of the self. This is described by Hart and Ouyang (2005, p. 2) as a "tension between surface and innerness" and has been used in numerous cultural contexts to promote and explore the concept of the self. These include Japanese notions of individuality in the fiction of Murakami Haruki (Strecher, 1999, p.263), American notions of the individual in consideration of debt and poverty *via* the game *Kentucky Route Zero* (Martens, 2020), and numerous expositions of the self and the world through games created for the Triennale Game Collection in Milan (Ingalls, 2016). Magical realism is perhaps best known in game design circles *via* the game Life is Strange (Dontnod Entertainment, 2015), which reached a wide commercial audience, and as noted by Turpin, makes clear that the "challenges for developers attempting to turn magical realism into a gaming experience are significant" (Turpin, 2017, para. 20). These are just a few examples of magical realism as applied to recent games and popular media, which illustrate a unique characteristic of this movement, namely "its ability to express a world fissured, distorted, and made incredible by cultural displacement" (Hart and Ouyang, 2005, p.6) that has allowed magical realism to "migrate around the world" (p. 11).

But, as previously noted, nowhere was this movement more vibrant than in Latin America as magical realism also has strong ties to postcolonialism. Magical realism "functions ideologically but … less hegemonically, for its program is not centralizing but eccentric: it creates space for interactions and diversity. In magical realist texts ontological disruption serves the purpose of political and cultural disruption: magic is often given a cultural corrective, requiring readers to scrutinize accepted realistic conventions of causality, materiality, motivation" (Zamora and Faris, 1995, p. 3). It is thus no accident that Jodorowski's work, discussed previously, and *Papo & Yo* both have roots in the region.

It is this space for interaction and reflection on the notions of the individual self that poise magical realism as so apt for our purposes regarding symbolic enactment: it is often through a magical or supernatural act that ritual and myth are engaged upon or acted within. The "connections between magic and politics, between magic and self, between magic and action" (Hart and Ouyang, 2005, p. 8–11) are the design tools of this

form of engagement. In the previous discussion of Jodorowski's poetic acts, these can be read as a form of magical realism – the specific actions of the patient are afforded certain magical qualities as a phrase, action, or event. Within the act, these have magical qualities not normal in the real world, and this acts to set forward a consideration of the existential self. Later in this article, the player's actions in *Papo & Yo* can be read in similar fashion, as certain magical abilities enable metaphorical action with symbolic meaning. This then forward the notion of using these types of enactments within games, with a lens on the capabilities and structures of magical realism. Or, as Bogost writes:

> Likewise, magical realist authors like Gabriel García Marquez, Salman Rushdie, and Isabel Allende treat magic and myth as real, that is, they admit that the spectacular is real insofar as it actually comprises aspects of human culture. In cases like these, the philosopher's tendency to abstract takes a backseat to the novelist's tendency to specify. The result is something particular whose branches bristle into the canopy of the conceptual. Perhaps a similar strategy can both help illuminate the phenomenology of videogames and offer an approach to the pragmatic speculation on objects and their interrelations. (Bogost, 2008, p. 31)

Symbolic Enactment in (Digital) Games – Existing Research

Games can afford indexical symbolic action to achieve transformative potential *via* presenting objects and facilitating actions that represent inner issues thus enabling players to act on those issues in a meaningful way. Often, though not always, these actions occur through a form of magic or ability that has outsized effects within the game world and thus invites reflection. But the research on this topic as a design methodology is thin. The most prominent work on games as the symbolic enactment of deeper, elusive themes is discussion of games of Murray (1997) as symbolic dramas. According to Murray (1997), the game structure becomes the tangible object onto which we can project abstract aspects of our lives and make sense of them.

> In games, therefore, we have a chance to enact our most basic relationship with the world—our desire to prevail over adversity, to survive our inevitable defeats, to shape our environments, to master complexity, and to make our lives fit together like the pieces of a jigsaw puzzle. (…) Like the religious ceremonies of passage by which we mark birth, coming of age, marriage, and death, games are ritual actions allowing us to symbolically enact the patterns that give meaning to our lives. (p. 143)

Murray further refers to *Tetris* (Pajitnov and Pokhilko, 1984) as an example of a symbolic enactment: "Tetris allows us to symbolically experience agency over our lives. It is a kind of rain

dance for the postmodern psyche, meant to allow us to enact control over things outside our power." (Murray, 1997, p. 144).

Rusch (2009, 2016) explores Murray's symbolic drama through the concept of "experiential metaphor": the phenomenon of understanding a gameplay experience as a physical visualization of abstract ideas such as emotional processes or mental states. The concept of experiential metaphor is based on how – according to cognitive linguists Lakoff and Johnson (1980) – we understand and structure our experiences by way of experiential gestalts or image schemata. Engaging with a game on a mechanical, structural level can evoke association to similarly structured real-life experience, thus allowing players to explore intangible concepts in tangible, physical ways. This idea contains the psycho-magic of symbolic enactment in its essence. Rusch describes in detail how the grappling hook mechanic in *God of War II* (SCE Santa Monica Studio, 2007) acts as an embodied metaphor for transitions, and in particular compares it to dealing with a deteriorating relationship.

In *Making Deep Games*, Rusch (2016) notes that this mechanic spoke to her soul on a deep level, because it helped to make very concrete – visually, physically, emotionally – the different parts of the gestalt that she was being torn between (to stay and feel stuck, to jump and fail, to move on successfully). It also provided a much-needed sense of agency.

The progress on an emotional journey is often very hard to control or even assess. One day can feel fine while the next can feel emotionally catastrophic, and it is very unclear why this is so, how long it will last, and what to do about it. Being able to map these different emotional states onto tangible stages in the transition gestalt as represented in the game, and performing actions that would get her through them, helped Rusch feel calmer and more at peace, because it allowed an emotional (embodied and enacted) rehearsal of reaching the other side of her inner struggle. It may have been hard to measure, but she claims that this part of *God of War II* was transformational for her as its effects did transfer into real life.

Another work on symbolic enactment in games that deals explicitly with its transformative function stems from role playing game researchers focusing on live-action role playing games (LARP). Particularly relevant for a discussion of symbolic enactment is the work of RPG researcher and narrative designer Whitney Beatrix "Strix" Beltrán. Beltrán (2013, 2014) draws on depth psychology to explain how physically enacting various archetypal characters such as the trickster, virgin, mentor, or villain, can inform players' understanding of themselves and contribute to personal development. She establishes strong parallels between ritual and LARP, declaring LARP a ritual space in which mythical themes are engaged in through direct participation and by way of acting out non-typical roles (Beltrán, 2013). This, Beltrán (2013, p. 93) explains, meets a need in our (Western) culture where "pervasive problems with identity and meaning have emerged." She states further: "LARP is the West's solution to addressing the need to explore and connect with other roles and states of physical and emotional being – essentially, to "live" myth" (Beltrán, 2013, p.95). She introduces

the term "ego bleed" to describe how enacting archetypal character roles impacts the actual player's psyche. By acting "as if," the player becomes the character, experiences its archetypal energy firsthand, and takes some of this experience with them into real life, thus embedding it into their personality.

> Ego bleed is a two way channel in which fragments of personality are passed between the player and their character. When a player enters into archetypal engagement during larp, it is therefore possible to experience ego bleed in which an archetypal characteristic inherent in a character type or role "rubs off" on a player. (2013, p. 96).

While there is relatively little existing research on these themes, this does not mean they are not relevant aspects of games' transformative potential. A key difficulty is that their impact on players is highly dependent on a player's receptiveness and the context of play (something the LARP and RPG community is very mindful of). While both games and ritual are capable of meaningful, transformative, symbolic enactment, one of the main differences between the two forms is what we expect of them and what meaning we ascribe to the actions we perform within them, as players may disregard the meaning of actions in games given the form of the media itself (Consalvo, 2007, p. 188).

Caveat of Tapping Into the Transformative Potential of Symbolic Enactment in Digital Games

When asked by a skeptical interviewer how an indifferent mother could suddenly adopt the character of a loving mother in real life by performing a poetic act, Jodorowski (2010) points toward the crucial role of intent and expectation in the transformative process:

> First of all, do not forget that my clients all suffered being dominated by their double. If they came to me, it was precisely because they felt bad in their role and sensed a completely different nature in themselves than the "original." The process is founded, then, in a client's real desire to change. (p. 50)

Kirmayer (1999, p. 453) similarly points-out in regards to the effectiveness of ritual in psychotherapy: "[t]he expectation of change has an effect that is separate from the specific content of cognitive reframing or the capacity of the prescribed ritual to promote change." Research on the placebo effect also highlights the importance of the meaning that patients ascribe to the various aspects of the therapeutic process, including the doctor's confidence, the color, the form (e.g., pill vs. vaccine), price point, side effects of the medication, etc. (Goodwyn, 2016). This surfaces an important caveat to the transformative potential of symbolic enactment in games. Playing a game from the perspective of enacting one's most basic relationship with the world, as Murray (1997) proposes, could be a deeply moving, existential, transformative experience. But how often are players

doing that? As stated above, for symbolic enactment to unfold its transformative potential, it requires the mind's collaboration. If this collaboration is not facilitated through intentional design – through thematic/fictional/narrative choices or the game's contextual framing – it solely depends on the player's *a priori* receptiveness to the game, its characters, and/or particular experiential gestalts within it. While the grappling hook spoke to Rusch as an indexical symbol, this context does not exist to all players. To them, the grappling hook sequence remains an iconic symbol that exhausts its meaning in the representation of getting from one pillar to the next.

In general, we do not typically approach games with the same set of expectations as we might approach ritual, or as Jodorowski's clients approached their poetic acts. In his DiGRA talk, Deterding (2016) argues compellingly that mechanics are not the (whole) message. The audio-visual and social framing of a game – e.g., as a serious, critical cultural artifact that belongs in a museum, such as Brenda Brathewaite's (now Romero) *Train* (Romero, 2009), or as a game for children, such as *Playing History 2* (Serious Games Interactive, 2013) – shapes the expectations with which an audience approaches a game. This matters greatly for how the game is received and what message/experience it can effectively convey.

To harness symbolic enactment for transformation in games, designers must be mindful of how players facilitate meaning generation and how we are framing the gameplay experience as something that can potentially connect to a player's real life. The Nordic LARP community has produced a useful concept in that regard: "bleed" (which is related but not identical to the "ego bleed" as noted earlier). Bleed describes moments where players' "real life feelings, thoughts, relationships, and physical states spill over into their characters' and vice versa" (Bowman, 2015). Bleed is a crucial factor in games' transformative potential, but much like symbolic enactment, has remained underexplored in the context of digital games.

THE "HOW": CONDITIONS AND DESIGN PRINCIPLES OF TRANSFORMATIVE SYMBOLIC ENACTMENT

If we thus assume that symbolic enactment can be effective, how can we design games for this purpose? What design factors can be identified that contribute to symbolic enactment's transformative potential and can increase authenticity and inner balance? The following design principles and considerations have been derived from various theoretical and practical sources on transformative storytelling, ritual, poetic acts, and other experiential forms used in the context of counseling, psychotherapy, or personal development. They serve as the starting point for a design framework through which we can analyze existing games that contain indexical symbolic enactment in their gameplay and further help inspire new games that contribute to a meaningful life. This is intended as iterative theory building, which is then examined in the context of a case study as a means for generating foundational research: the design principles mentioned here are not complete.

Furthermore, it is difficult to discuss symbolic enactment in isolation, since the context it is embedded in – the thematic and narrative framing – is important for it to unfold its transformative potential. Therefore, the following includes contextual considerations as well.

Drawing on Three Types of Ritual to Inform Thematic and Narrative Framing of Indexical Symbolic Enactment

Referring back to the quote of Bugental (1990) in the introduction to this article, an authentic life is one in which, we are in harmony as fully as possible, including the conscious and unconscious mind. While external circumstances may not always allow for its full realization, we often know what "feels right." A process of transformation in that sense leads from inner imbalance to balance, from confusion to clarity, from hesitation or tension to inner resolve, from grief or anger to peace, and from longing to fulfillment. Symbolic enactment is the process of acting through the conflict toward and including its resolution, but it is embedded into a bigger context of meaning and dramaturgical structure that further aids in bringing the transformation about. Rituals center around transition and, as such can be potent inspiration sources to facilitate such processes in game design – "changes that have happened, are happening, or may happen" (Beck and Metrick, 2012, p. 37). Parker and Horton (1996) extrapolated three main types of rituals from a phenomenological overview of rituals in various religious traditions, including Judeo-Christian, Asian, the Western Magical tradition and Shamanism: liberation rituals, transformation rituals, and celebration or commemoration rituals.

Liberation rituals use symbolic acts of removal or disengagement from obstacles to healing. Paradoxically, this can include destructive acts. When drawing on liberation as a theme for symbolic enactment in a game context, it is important to keep this theme at the forefront so that if destructive acts are used, players stay aware of their purpose – that is, being a vehicle for healing – and those acts do not devolve into self-serving, gratuitous violence. Liberation rituals can be encapsulated in individual moments of a larger game (possibly with a different overall theme).

Transformation rituals, which commonly describe rites of passage, are naturally processual.

> Through them [i.e. transformation rituals], something new is birthed, affirmed, blessed, and empowered. In transformation rituals, the elements of initiation and blessing are coupled. These two elements go together naturally and necessarily, as do birth and nurturance. (Parker and Horton, 1996, para. 29)

In their discussion of ritual, Beck and Metrick (2012, p. 37) only focus on transformation rituals and further distinguish them into rituals of "beginnings, mergings, cycles, endings, and healings."

Celebration and commemoration rituals are associated with religious worship, anniversaries, birthdays, and local cultural

holidays. The term worship is particularly relevant here and should be understood in its original sense of appreciating the "worth-ship," or worthiness, of something. "In commemoration rituals something valuable is preserved or honored through remembrance or celebration" (Parker and Horton, 1996, para. 36). Rusch (2018) provides examples for how these types of rituals can inform game mechanics.

Embedding Symbolic Enactment Into Metaphorical Context

It has already been stated that the language of the unconscious consists of symbols and imagery. Mental images are essential for the placebo response and play an important role in narrativizing inner conflicts. Metaphorical stories promote meaning generation, and finding meaning in a psychological or physiological issue greatly contributes to the ability to overcome it. Images tend to be loaded with emotion, which impacts their transformational potential; we cannot be changed by something we do not care about (Goodwyn, 2016). Imagery in existential, transformational game design is thus not only important for the symbolic action itself, but also for the design of the context into which it is embedded. Rusch highlights the use of myth and mythical themes in game design and notes how we can explore the unconscious for mythical themes through dream work and active imagination (Rusch, 2018, 2020). Myths are metaphorical stories and they often accompany or frame ritual enactments.

Campbell (2004, p. xix) states: "[r]itual is simply myth enacted; by participating in a rite, you are participating directly in the myth." When ritual is used in psychotherapy, the myth that is being enacted stems from the client's story (and in humanistic, existential psychotherapy and Jungian approaches, the client's story is investigated in regards to its more universal/transpersonal mythical themes). This is also true for Jodorowski's poetic acts; they are not just symbolic acts, they are enactments of transformational stories in which the client is transformed into someone else, a "truer" version of themselves. Although, since the client "knows" their story, the individual context is assumed. When it comes to designing opportunities for symbolic enactment for an audience of anonymous strangers – typical of game design – it is important to thematically/narratively contextualize the symbolic action in a way that supports transformation. A metaphorical approach points toward a deeper meaning beyond the game's surface (Rusch, 2016) and, depending on how obvious the metaphorical nature of the game is, can orient players toward the symbolic nature of the action as well. Metaphors are also ideal stylistic devices to capture intangible concepts, such as emotions or inner conflicts, because they make abstract ideas concrete (Lakoff and Johnson, 1980; Johnson, 1987).

Promoting "Change" Through Contextual Mechanisms

Readiness and processing are crucial for change. Ritual and other experiential forms that target personal transformation have identified mechanisms to promote both. Pitkänen (2019) compares four types of experiential "forms of change" – psychodrama, sociodrama, playback theater, and educational LARP – and

identifies that the structure of "warm up," "drama" and "processing" are common to them all. While the "drama" part differs considerably across the four forms, warm up (which is used to reach a spontaneous, playful state that allows the exploration of new ways of acting and being) and processing are similar.

This structure corresponds to ritual performance which also includes entering a sacred space – a space "set apart" in some way from daily life – and performing the ritual and then deepening the experience through some kind of grounding action that concludes the experience (Beck and Metrick, 2012). Nordic LARP, known for tackling difficult themes and its transformative potential, employs similar mechanisms by commonly preparing players through an introductory workshop. A debriefing of the gameplay experience occurs through another workshop at the end of the ritual performance that aids in integrating what players have learnt about themselves and the topic during play and allows them to "de-role" and get back to daily life afterward (Bowman, 2014).

What does that mean for digital games, where the situation of the player is entirely different? Unless the game is played in a facilitated context, like in a therapist's office, school, hospital, etc., the player is left to their own devices with respect to easing into and out of the game's magic circle. Individually, they must emotionally process and integrate their game experience into other aspects of their lives. Since designers have little control over the contexts within which their games are played, the best tool to facilitate intention setting is likely narrative, either explicitly or through visual/auditory means.

Psychological Resonance in the Design of Symbolic Enactment

Rusch (2020) has discussed at length the concept of psychological resonance with regards to identifying mythical themes for game design. This has direct relationships for indexical symbolic enactment. She notes,

> Based on psychiatrist Erik Goodwyn's (2012, 2016, 2018) highly interdisciplinary research, psychological resonance refers to a deep, unconscious recognition and activation of archetypal patterns through symbols and imagery. Psychological resonance is at the root of the same kinds of mythic, symbolic and ritual ideas popping up time and time again all over the world, across all cultures. It is the key to understanding "what makes one ritual more likely than another to be repeated across generations?" (Goodwyn, 2016, p. 33). It's about *what* speaks to us (as humans) and *why*, on a deep, unconscious and universal level. Understanding and harnessing psychological resonance is key to designing transformative existential games, because of their emphasis on awakening our authentic self, aligning us with what rings true for us, so we can identify our own pathways to bliss, uncoerced and to our own terms. (Rusch, 2020, p. 9)

Goodwyn (2016), drawing extensively on folklore studies, lists the following criteria for psychological resonance:

I propose that the most resonant expressions are likely to have some or all of the following:

1. Minimal counter-intuitiveness (Barrett, 2007), meaning that they have only a few unusual or strange elements and so stand out, rather than have too many or too few counter-intuitive elements. Examples: talking animals, flying carpets, dragons (…)
2. Emotional evocativeness (Panskepp, 1998). Examples: stories involving basic human attachments or evoking basic emotional responses such as fear, anger, lust, and so on.
3. Sensual vividness, with a tendency toward extremes. Examples: castles of gold, mountains of crystal, brilliant lights, absolute darkness, and so on.
4. Indeterminacy of time and space. Examples: "long ago in a far-away land" – evocative of an oceanic feeling.
5. Biasing toward middle-level categories. Examples: "sword" rather than "weapon" (too abstract) or "quillioned pattern-weld blade with Brighthampton scabbard and cross" (overdetailed)
6. Low complexity of characters and motivations. Examples: the most beautiful in the land, the king, animal gods, the thief, and the beggar.
7. Rhythmic and prosodic/musical elements. Examples: "magic mirror in the wall."
8. Simple plots with reversals and/or irony. Examples: nothing is as it seems, plot twists, the slow animal beats the fast animal, and so on.
9. Apparent interconnection of events. Examples: things always occurring "just in the knick of time", and so on.

> Non-resonant expressions will be: overly counter-intuitive or overly mundane, emotionally detached or frustrating, sensually vague or abstract, specific in time and space, contain over-specific or over-general categories, be internally complex or ambiguous, will lack any rhythmic or poetic qualities, will lack a clear plot (…). (pp. 37-38)

In regards to indexical symbolic enactment specifically, emotional evocativeness, sensual vividness, minimal counter-intuitiveness, and low complexity of actions and objects involved in symbolic enactment seem particularly important, as the other criteria are more directed toward narrative expressions. If actions are too complex, convoluted, elaborate, hard to understand, and involve intricate objects, props, tools, or weapons whose functionality is unclear or complex, it is hard to relate to them intuitively. Plants, seeds, graves, family pictures, fire, water, earth, snakes, etc. are symbols frequently used in ritual and Jodorowski's poetic acts because of their intuitive, sensual, emotional qualities that are further tightly coupled to the theme that is being enacted.

INDEXICAL SYMBOLIC ENACTMENT IN ACTION: A CASE STUDY OF *PAPO & YO*

The following section analyzes *Papo & Yo* (2013) in regards to how it employs and contextualizes indexical symbolic

enactment that can increase authenticity and inner balance. We employ auto-ethnography as a method for this analysis and as such it is subjective. The basis for our discussion of the game's most symbolically potent gameplay and transformative aspects is our personal experience of it, both as players and as designers.

There are many game mechanics in this game that can be described as indexical symbolic enactments. Only a few of them, however, or only specific parts of the game, truly feel like they promote inner change by giving the player a handle on an inner conflict. What is it about these mechanics/parts of gameplay that stand apart from the rest and take on this special quality that we can also find in ritual or Jodorowski's poetic acts? How do these specific sections of the game provide an authentic sense of agency around an intangible issue that ignites an inner shift toward greater harmony?

Enacting "Liberation"

Papo & Yo is a puzzle platformer adventure game, based on Minority Media's founder and the game's lead designer Vander Caballero's childhood. He created the game as an expression of how he overcame his personal trauma of living with an alcoholic father and as a way to help others do the same. "Games can really help people" Caballero said in an interview (Donnelly, 2017), "they can help people to heal." While designing with such intent in mind is not necessary for games to have such impact on players, it is one reason why this game was selected as a case study. The game affords an experience of *liberation*. Its overall narrative structure is akin to a liberation ritual – enacting an emotional journey from inner conflict to resolution, from feeling "cursed" and responsible to help someone who does not want to be helped to "being free." This journey further culminates in a final act that is explicitly ritual-like.

Metaphorical Approach

Papo & Yo is a (mostly) metaphorical representation of what life is like with an alcoholic father. The player takes the role of a young boy, Quico, who lives in a Brazilian favela with Monster. (Monster, here, is used like a name). It begins as a cutscene with a literal depiction of Quico's home, where Quico hides in the closet from another one of his father's drunken rages. As the boy cowers in the dark, a white spiral portal drawn in magical chalk appears on one of the closet walls. As Quico – now under the player's control – steps through the portal, the game transitions to a metaphorical space that can be interpreted as Quico's inner world, which looks like his real environment but enriched with magical/fantastical elements and is characterized by imagination and creativity. In this space, Quico gains freedom of movement through manipulating the environment by way of chalk drawings, which are created by a girl whose relationship to Quico remains unclear, but might be a sister. The gears, levers, springs, and lines she draws allow for surprising, delightful and whimsical ways to reshape and restructure the world. Caballero reports about his own childhood: "I started being creative when I was a kid, and I coped with the difficult things I was going through

with creativity" (Donnelly, 2017). The puzzle platformer gameplay can thus be understood as a metaphor for using imagination as a way to navigate difficult emotional terrain.

The important function of creativity is further made tangible in the gameplay by Quico's toy robot Lula, who protects Quico by catching his falls and who "lends him wings." With Lula on his back like a jet pack, Quico can jump higher and glide short distances. Lula can also be sent off alone as an extension of Quico, operating gears, levers, and buttons that are otherwise out of reach.

However, imagination and creativity are just ways of coping. They cannot eliminate Monster and its influence on Quico's inner world. Early on in the game, the girl yells at Quico that he is "cursed." We then learn through two cut scenes set in the physical world that Quico carries guilt for a drunk driving accident he witnessed, in which his father killed someone. The girl assures Quico that the accident wasn't his fault. That killing is Monster's burden. She then informsQuico that he can cure Monster by bringing it to a Shaman. This establishes the game's goal and its conflict: steering Monster through the favelas, thus creating a path for it, while keeping it away from frogs. Hen Monster consumes frogs, it turns into a flaming beast of destruction and attacks Quico. Monster can be lured with some orange fruit that is found all over the environment. When it eats enough of it, it falls asleep. When it falls asleep on the Centipede – a slat of wood with many scrawny, magical chalk legs – the Centipede will carry Monster to where Quico needs it to go. Monster is mostly passive. It can even be (passively) helpful. Its big belly can act as a jumping board for Quico to launch him to higher up areas. At one point in the game, Quico can kick a ball toward Monster and Monster kicks it back. It remains the only moment of tender interaction between the two and as such feels highly meaningful – a reminder of what the relationship *could* be like, if things were different.

With this metaphorical set-up, *Papo & Yo*'s gameplay can be seen as indexical symbolic enactment of a conflicting, emotional journey through feelings of guilt, responsibility, fear, and the longing for a real relationship with the father, contrasted by the experience of agency and joy enabled by creativity. The inner conflict intensifies as the journey goes on and Monster, in a fiery rage, first destroys Lula and then kills the girl. Both are strong, symbolic acts of how the father's addiction impacts the well-being of Quico's and those around him, his ability to feel safe, empowered, and joyful, and this impact becomes experientially tangible to the player by taking away the mechanics that are afforded by Lula.

The game's moment-to-moment gameplay is an enactment of the conflict itself. The majority of the game does not promote authenticity and inner balance. It is an emotional and experiential build up toward the final scene, in which Quico/the player enacts liberation from Monster. Once on top of the mountain where the shaman is supposed to be, a disembodied voice – his inner wisdom? – tells Quico that he has done well, but that there is no shaman. There are only Quico's forgotten memories; the memories of all the horrible things Monster did. These memories take the form of stone statues that, when Quico pulls magical chalk levers attached to them, transform

into literal depictions of what they are meant to represent. From them, Quico is reminded of how he played with Lula in real life; of father's drinking; of how her father attacked the girl (that she exists in the literal world is a clue that she might be someone from his real life); and of how her father beat Quico.

Pulling the lever and transforming the metaphors into their literal sources can be interpreted as a process of confronting the reality of living with Monster – of seeing things as they are. While the player is enacting this part and the enactment is based on indexical symbolism, its function is mainly to communicate to the player what is happening inside Quico, rather than giving the player first hand access to his inner processing. It is a snapshot of what is happening within Quico, but the action itself – pulling the levers – carries little emotional weight. It does not feel like the player is given agency over an inner process the way ritual does, because lever-pulling does not provide agency over the elusive and intangible; it is merely functional. In other words, this mechanic is simply a way to force interactivity.

With this acknowledgment of reality freshly in mind, Quico is informed by the disembodied voice that there is no cure and that Quico needs to let go of Monster. This initiates the last part of the game that feels very much like a liberation ritual. A magical chalk line appears and leads straight to a huge rock. The rock crumbles, possibly symbolizing an inner breakthrough. Quico enters a surreal space – the magic circle of the ritual – that only features the Monster's house floating in the air and some other disjointed platforms on which powerful symbolic actions that represent letting go of Monster are about to take place. There is no more puzzle platforming. The game also becomes slightly more literal in that it depicts alcohol through bottles, and not just the frogs, revealing the metaphor.

The first platform features two huge tubes. When activating a lever, bottles pop out of one tube. Quico/the player then carries the bottles to the other tube that sends them to the platform where Monster is. The bottles appear there as frogs. Monster consumes the frogs and becomes the flaming beast, setting things around it on fire. This action of taking a bottle, putting it into a tube, and feeding it to Monster has to be repeated several times before the bridge that connects one platform with the next is completed and Quico/the player can move on to the next platform and the next step in the process of letting go.

Delivering the bottles is a powerful symbolic enactment of giving responsibility for destructive behavior back to Monster. As the player pushed bottle after bottle through the tube and saw Monster eagerly consume the frogs – destroying itself and everything around it through the flames – Rusch noted her inner voice saying things like "There! You want it? Take it! All of it! Do as you please! I am done trying to help you." While Rusch has not lived with a substance abuser, she has been in a co-dependent relationship before and tried very hard to help someone to the point of losing a part of herself. While understanding the metaphor of the bottles intellectually, the real power of enacting this part of *Papo & Yo* came from

mapping the experiential gestalt (Lakoff and Johnson, 1980) of the metaphor and its symbols onto this former relationship. The specific symbols used, in this case "bottles" as "alcohol," are what Jung would call "signs," because on this interpretation level, they refer to something known: alcoholism. But within the structure and context of the whole act, these symbols can point toward a wider range of elusive concepts. Even the reading of "bottle" as "alcohol" is too limiting in the context of the whole act and points toward the more encompassing and fuzzier concept of "choices/responsibility for self and others." As such, the bottles become indices for any burden one is carrying unjustly and to one's own detriment. They tap into a deeper level of experience that is more universal (and thus more broadly relatable) than the specific story Vander Caballero chose to tell in *Papo & Yo*. This allows the game to take on a mythical component, becoming a road map for the human experience that carries wisdom beyond the particular narrative.

The next step in the liberation process is mechanically similar to the first one; there are again two large tubes that connect the platform Quico/the player is on with that of Monster. Instead of bottles, there is a heap of rag dolls that look like the girl Monster killed in one of its rages. Quico/the player picks up the doll, throws it in one of the tubes and can then direct where it lands on Monster's platform. On Monster's platform, the doll comes to life and tries to run away but is grabbed by Monster and eaten. Every time one "sacrifices" a doll in this manner, the environment on Monster's platform changes and a bridge to a lower platform gradually manifests. Once the bridge is complete, one has to drop the next doll onto the elevated platform. The doll, now alive, will run away and be chased by Monster onto the next and final platform.

The rag doll scene feels surreal and both authors had a hard time connecting to it emotionally. Delivering the doll made us feel guilty and uncomfortable rather than empowered. The specific nature of this enacted sacrifice – to fulfill the gameplay purpose of luring Monster to the final platform – is incongruent with the overall transformative process of letting go of Monster. There are too many symbolic elements that are not intuitive. Intellectually, the player must relive one of Monster's worst acts in order to work up the resolve to finally let Monster go, but this interpretation exists only on a cognitive level. This cerebral focus, and the absence of strong emotion while playing this scene, is an indication that the symbolic enactment of this scene is not successfully speaking to the unconscious. It is an intellectual exercise, not felt on a deeper level and thus arguably lacks much transformative power.

The game's ending, however, is very powerful. Once Monster arrives on the final platform, it falls asleep on the Centipede that is already waiting there for it. To complete the journey, Quico/the player pushes the Centipede toward the edge of the platform to an endless sea of clouds down below. This simple act of pushing Monster over the edge and seeing it disappear is deeply and psychologically resonant. It moved both authors to a cleansing, meaningful sadness. The actual story of the game receded into the background, and the act of pushing Monster away became a much more encompassing, indexical symbol for all complicated good-byes and torn

relationships. For Rusch, in particular this resulted in a reflection and sense of peace; something inside her had shifted and allowed a realization to sink in, or at least anchor it more deeply, that she did not need to be other peoples' savior.

How Does *Papo & Yo* Promote "Change" Through Contextual Mechanisms?

The authors played the game at home and had only passing knowledge of the subject matter, so there was no external context set up to facilitate change. This is a very different situation than a client who voluntarily enters any kind of psychotherapy. We had no particular expectation to be transformed by this game, and the fact it occurred regardless is owed largely to the game's narrative. As players, we could be gradually introduced to Quico's struggles and align with his inner conflict, therefore symbolically enacting its resolution with him. After the rollercoaster of emotions previously described, each of the authors sought to process what had occurred. For Rusch, she felt a bit lost and alone and was lucky to be able to process and debrief the experience with her husband later that day. For Phelps, he engaged in an online discussion and debrief with others who had also played the game. How can digital games facilitate processing? The tiniest nod toward a transfer to real life is the game's literal framing; it starts in the physical or "real" world and Quico/the player returns to it once the journey is over. This can help a player make the connection to their own life to contemplate how what they just experienced in a fantastical setting applies to their daily, real life struggles.

Psychological Resonance of Symbolic Enactment in *Papo & Yo*

When Goodwyn (2012, 2016) discusses psychological resonance, he establishes it as an empirical concept. We only know whether an expression is truly psychologically resonant if it has stuck around for a very long time and survived the process of cultural transmission. Rusch (2020) has argued that we can use the criteria, listed above in this article that characterizes psychologically resonant symbols, imagery, and narratives as guidelines to create new mythical games. By designing games that harness the strategies (symbols, imagery, etc.) that have been empirically proven to be psychologically resonant through their longevity in folklore studies and mythology, we can aspire to create psychologically resonant games. It is highly impractical to conduct longitudinal playtesting in the scale that would be necessary to empirically assess whether a game truly *is* psychologically resonant in the ambitious way Goodwyn understands the concept. We note instead that aspiration to evoke psychological resonance is the extent of what we can currently achieve as an alternative to empiricism, given the fact these approaches are just emerging more formally in the design literature. Thus we employ an analytical lens to examine *Papo & Yo's* symbolic enactment, with *indications* of resonance. We then argue for the presence of such resonance given our responses during this playtest and subsequent reflection.

Moment-to-Moment Gameplay

Papo & Yo's moment-to-moment gameplay consists of two, salient indexical symbolic enactments: "puzzle platforming" as an enactment of navigating through an inner landscape by way of imagination and creativity; and "frog elimination" – getting to the frogs before Monster does and preventing consumption. Both of these mechanics make thematic sense within the game's metaphor and help to reinforce what the game is about experientially; they align the player with their avatar, Quico, and make Quico's inner conflict tangible on a moment-to-moment basis. They thus belong to the "warm up" phase of the transformational process, orienting the player toward "what's wrong" in the game world rather than to a phase of conflict resolution. For this warm up phase to be impactful, though, it must emotionally engage the player.

The factors for psychological resonance that seem particularly important in regards to symbolic enactment are emotional evocativeness, sensual vividness, minimal counter-intuitiveness, and low complexity of the actions and objects involved (Goodwyn, 2016). Puzzle platforming and frog elimination fulfill this criteria to various degrees through gameplay, artistic representation, and sound design. While physical modes of symbolic enactments such as ritual, poetic acts, and LARPs have many advantages over digital games in regards to promoting transformation, affording sensually vivid experiences is one of the great strengths of digital games. Metaphors and symbolic elements can be lavishly represented through both representation and interaction. However, careful thought is required in combining mechanics with representation; while the puzzle component is not overly difficult in *Papo & Yo*, it still requires some mental acrobatics which detract from psychological resonance by shifting the focus of the experience from the emotional to the cognitive realm.

The frog elimination sequences are less complex – all the player has to do is run up to a frog, grab it, and smash it against a wall – but the image of using green, harmless-looking frogs to represent alcohol is not intuitive and therefore not immediately resonant. The only reason for a player to dread the frogs is because of the rule system that determines their function in the game: if Monster eats them, there is hell to pay. Finding a symbol that conveys the dangerous, destructive aspect of alcohol more strongly would have enhanced the overall psychological resonance of this scene. Then again, the gameplay itself, through the hunt for the hopping creatures and the grabbing and smashing of them, does not share salient, experiential parallels with the much more complex dance around an alcoholic. This can include the tangible component of finding and emptying hidden bottles but also has the emotional component of being afraid of the alcoholic's moods and the need for caution in their presence. Frog elimination is a very "gamey" way of representing this aspect of life with an alcoholic. It focuses on the physical challenge rather than addressing the psychological complexities. By "gamey" we mean it foregrounds the entertaining challenge involved in performing the action (i.e., luring and trapping Monster without being attacked) and backgrounds its meaning. This is not inherently "wrong" or "bad" – it lies in the nature of game design to abstract complex systems to a degree where they become

playable (Juul, 2007) and to focus on giving players agency. It is hard to imagine a game in which every action carries a lot of symbolic weight and to sustain an awareness of this symbolism across several hours of gameplay. There are, however, specific scenes in *Papo & Yo* that stand out in this manner from the moment-to-moment gameplay, and it is those scenes that have the highest transformative potential.

Ritual-Like Enactments

There are four scenes in *Papo & Yo* that stand apart from and disrupt the flow of the regular gameplay. They slow the action toward the game's goal at particularly meaningful points in Quico's emotional journey and are structured in distinct steps. This gives the moments a ritual-like quality and makes them deserving of special attention as they carry the bulk of the game's transformative potential in regards to indexical symbolic enactment. Such examples include reviving Lula, and the three stations of the "letting go" sequence at the end of the game: "bottles," "rag dolls," and the actual "letting go."

Lula's Revival

In examining the three types of rituals discussed above, reviving Lula shares salient characteristics with a transformation ritual, from death to life. Lula is placed on an altar. Then, Quico/the player has to lure Monster to a trap; the trap engulfs Monster and "squeezes the anger out of it." This anger – symbolized by a single, orange flame – makes its way to Lula on the altar and infuses the broken robot with life. This process has to be repeated three times, with each flame that is squeezed from Monster being absorbed by Lula. The theme of bringing an important companion back from the dead is obviously emotionally evocative, and the player is thus empowered. The ritual allows Quico/the player to reclaim not only their companion, but everything it stood for: freedom of movement, agency, and joy.

What challenges the ritualistic quality of the scene and undermines its symbolism, though, is the process of eliciting the life-giving flame as well as the imagery of the flame itself; the mechanic has a decidedly "gamey" feel to it. The emphasis is not on performing an action that symbolically engages an inner process in a way the unconscious can intuitively understand but is rather merely an interesting solution to the design problem of making the Lula revival scene playable in a way that connects gameplay to story. While the imagery is vivid, the sequence of actions performed is too complex and requires too much intellectual interpretation to resonate on a deeper, emotional level. Further, the flame that is elicited has the wrong color. When Lula is active, it produces a little purple spark. The orange colored flame is connected with Monster in a fiery rage. Why should an orange flame with its destructive associations bring life back to Lula? The power of ritual is based on analogical connections between its symbolic elements and what they stand for. This is instrumental for governing expectations around the "magical" functioning of symbols in ritual. Using the orange colored Monster flame to restore life to Lula suggests that Lula is now connected to Monster in some essential (and troublesome) way, which is not the case.

The design is guided by the question "what can the player do that also ties back into the narrative?" rather than by "what action is a symbolic expression of an inner process that would have the strongest impact?" It is possible to emphasize the latter over the former; when Quico has to face all the bad things Monster has done to accept that Monster is beyond help, this abstract process is represented by way of stone statues that stand for memories. Something similar could have worked for the revival of Lula: Quico could have recovered life force flames from good memories of playing with Lula, while possibly having to avoid Monster. This would have allowed for similar gameplay, but with less distracting detail and more metaphorically fitting imagery. The concept of "restoring life" can be more intuitively connected to harvesting a positive essence from positive memories rather than to squeezing out anger from an abuser. This is just one possible alternative.

Letting-Go Sequence

The final part of the game is the "letting-go" sequence, which consists of feeding bottles to Monster, sacrificing the rag doll and pushing Monster into the abyss. Feeding Monster in this way and seeing Monster burst into flames, consequently destroying everything around it, is an emotionally evocative scene with sensual vividness. Actions and imagery are congruent with the inner process of handing back responsibility and coming to grips with the fact that the other person is truly unwilling to change. Feeding bottles to Monster has low enough complexity to be intuitively understandable as the symbolic act of handing responsibility over. It is as simple as "there, you have it." Thus, this step of the letting-go sequence as a whole has high potential for psychological resonance.

The rag doll scene lacks this intuitiveness of meaning: it is pragmatic from a gameplay perspective but not psychologically congruent. The function of the rag doll scene in the greater structure of the "letting go" sequence is to lure Monster to the final platform. It feels like using the rag doll was an attempt to tie in established, meaningful symbols into the gameplay to keep the game's theme and narrative in the player's mind, but without deeper consideration.

Finally, Quico/the player lets go of Monster by pushing it into the abyss. This is the shortest of the ritual-like scenes in *Papo & Yo*, but the most powerful. It focuses on letting go, which is not compromised by any design ambitions to make this more interesting with regard to gameplay. The connection between pushing Monster over the edge and saying goodbye is straightforward, intuitive, and emotionally evocative. The imagery of sleeping Monster, arms folded over its chest as if dead, completely resigned to its fate, is intuitive and cathartic. Enacting this scene sends a psychologically powerful resonating message to the unconscious, supported by the audio-visual design: "Farewell, Monster. You're no longer my problem." The struggle between hope, longing for a loving relationship with father, and feelings of guilt and responsibility has been resolved through this act. The game reaches a sense of inner peace that is transcendent with its players and their life experiences.

CONCLUSION

Drawing on interdisciplinary research, and inspired by ritual use in psychotherapy and Jodorowski's poetic acts, we argue that indexical symbolic enactments of inner conflicts in games and digital media can send powerful signals to the unconscious mind, thus contributing to greater authenticity and inner balance. Designers can directly facilitate indexical symbolic enactment for existential and transformative gameplay. This article proposed a theoretical framework including design guidelines meant to inspire designers who want to create games that contribute to a meaningful life. Those guidelines can be summarized as (1) identifying a narrative theme and structure that is inspired by the three types of rituals: liberation, transformation and commemoration/celebration; (2) embedding symbolic enactment into a metaphorical environment; (3) considering contextual mechanisms that allow players to "warm up" to the inner conflict modeled in the game and promote its "processing;" and (4) designing for psychological resonance by aiming for emotional evocativeness, sensual vividness, minimal counter-intuitiveness, and low complexity of actions and objects involved in the enactment as noted by Goodwyn (2016).

To illustrate this concept, the authors examine *Papo & Yo* through the lens of this design framework. We examined moment-to-moment gameplay, as well as four special moments in the game that stand out from the rest due to their ritualistic quality. The analysis showed that there is significant potential for indexical symbolic enactment, but that design decisions did not always favor symbolic congruency and psychological resonance for the greatest transformative impact. *Papo & Yo*, while in many ways playing with spiritual motifs, and being both inspired by personal transformation as well as intending to inspire it in others, has been conceived primarily from a "game design" perspective. This is neither wrong nor bad, per se, but means that less emphasis has been placed on the design of opportunities to strengthen the intuitiveness and psychological resonance of symbolic actions. Alternatively, an existential, transformative game design framework aims to facilitate both the design of games that are both engaging but also aware of the transformative potential through indexical symbolic enactment. This work thus hopes to inspire game designers to experiment with this approach and thereby lead to the creation of projects that contribute to a meaningful life for players by fostering authenticity and inner balance.

DATA AVAILABILITY STATEMENT

All datasets presented in this study are included in the article/supplementary material.

AUTHOR CONTRIBUTIONS

The authors have been working collaboratively toward the bigger framework of existential, transformative game design for many months. DR wrote the original draft of this pillar

of the larger theoretical design framework, while AP helped ground it in the background research and contributed throughout to framework design and collaboration. Both authors contributed to the article and approved the submitted version.

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Dark Participation in Games

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With the advent of digital games came the advent of gamer cultures and identities. A "gamer" became a new social first for the group of individuals who played video games (primarily in arcades) in the late 1970's. Over time, however, gamer cultures have grown into what is largely discussed as "toxic cultures," and come to become more associated with exclusion than inclusion if you don't fit a certain mold. Despite its prevalence, deviant behaviors in games as a subject of academic study is a confusing space, with different researchers using different criteria to describe the same things. This article provides the first comprehensive cataloging and overview of dark participation in games. This includes defining these behaviors, cataloging their variants, and discussing their social and psychological impact and their potential underpinnings. It is critical to establish a shared language about what these behaviors are in order to effectively understand and combat them.

Keywords: video games, trolling, toxic, online games, dark participation

With the advent of digital games came the advent of gamer cultures and identities. A "gamer" became a new social category for the group of individuals who played video games (primarily in arcades) in the late 1970's. As part of a socio-cultural niche, "gamer" was established to define and unite this group of people. However, with the popularization and growth of games themselves, the term "gamer" has also grown and changed. Today, this term not only represents players but differentiates "gamers" as their own subcultural movement (Golding, 2014; Grooten and Kowert, 2015). That is, all gamers are players, but not all players are gamers. Today, "gamer" is part of everyday jargon and widely integrated into personal, social, and cultural identities (Grooten and Kowert, 2015). We express our "gamerness" with our choice of clothing, the references we make, and how we view ourselves, others, and our place in the world.

Over time, however, gamer cultures have grown into what is largely discussed as "toxic cultures" and come to become more associated with exclusion than inclusion if you don't fit a certain mold. This shift was noted by Golding in 2014 with his op-ed "The End of Gamers." In it, he discussed the shifts in video game cultures away from inclusivity and toward combativeness. Four years later, these same sentiments were discussed by Condis (2018) *New York Times* op-ed:

"As events like the 2014 harassment campaign #GamerGate amply demonstrated, to some members of the gaming community, the increased visibility of people of color, women, and LGBTQ people in gaming circles is seen less as an expansion and more as a hostile takeover."

Similarly, in a Wu (2019) article, Brianna Wu states:

"Though the gaming world is huge and diverse, and full of smart and wonderful players, it is also thronged by misogynists and racists who feel free to advocate harm against anyone who's not like them."

These communities of exclusion and hostility have come to be housed under the umbrella of "toxic gamer cultures," a phenomenon that is quite well known in gaming communities. At its root, the idea of "toxic gamer cultures" refers to prevalence of deviant behaviors within games but also readily dismissing one's responsibility for them under the shared idea that it is just part of the

"anonymous and toxic gamer" collective identity (Tang and Fox, 2016). Some researchers have gone so far as to predict that the normalization of these behaviors within gamer culture could eventually shift and/or sustain cultural norms toward eventually seeing harassment in-games as harmless and acceptable (Ross and Weaver, 2012; Page et al., 2016).

UNDERPINNINGS OF TOXIC GAMER CULTURES

Why toxic gamer cultures have developed is a question many scholars have attempted to answer. Research has pointed to several environmental, community, demographic, and game play factors that contribute to the creation and sustainment of toxicity in games and gamer cultures. These are discussed in more detail below.

Environmental and Community Factors

There are several environmental and community factors to consider when discussing toxic behavior in online spaces and, specifically, within online games. Kordyaka and colleagues discuss three of these—social cognitive theory, theory of planned behavior, and the online disinhibition effect—in their 2019 article entitled "Toward a unified theory of toxic behavior in games." Put briefly, social cognitive theory argues that individuals learn toxic behaviors in games through social learning (Bandura, 1986). That is, any pre-existing toxic gamer cultures within games would perpetuate toxicity. Theory of Planned Behavior (Ajzen, 1991) argues that an individual's intentions to engage in toxic behavior is based on the specific context of the situation. That is, people may behave negatively toward others if it is accepted as a group norm (i.e., in toxic gamer cultures) and if those who perpetuate toxic behavior do not experience consequences for their actions. Lastly, the authors discuss the online disinhibition effect (Suler, 2004), which is the idea that while you are interacting on the internet, others cannot see you (you are invisible) and that they don't know you (you are anonymous). This anonymity and invisibility are generally thought of as being among the primary driving forces of toxic behavior because they create an ideal space for people to push social boundaries with a sense of few repercussions. For example, research has found that when anonymity was removed from social media sites, it reduced the amount of trolling behavior (Wright, 2013). Kordyaka and colleagues concluded that the most meaningful predictor of toxic behavior was the online disinhibition effect; however, Social Learning Theory and the Theory of Planned Behavior could play a role in sustaining toxic cultures once they have been established.

An additional factor to consider is the Social Identity Model of Deindividuation Effects model (SIDE; Postmes et al., 1998), which suggests that deindividuation or depersonalization of group members can emphasize the presumed similarities of members within a group and encourage behavior consistent with the group norms. That is, the more anonymous a person is, the more deindividuated they are (i.e., the online disinhibition effect), the more likely they are to adhere to group norms. Research has found support for these ideas, specifically in the realm of toxic

behaviors. Amiot et al. (2017) study by Amiot and colleagues found that in-group norms that favor derogatory behaviors toward an "out-group" can predict the likelihood of a member of that group exhibiting those behaviors. That is, if you consider yourself part of the "in-group" (e.g., a gamer) and engage with someone whom you consider part of the "out-group" (e.g., not a gamer) and the in-group norm is toxic behavior toward the out group (e.g., flaming, griefing, and doxing), you are more likely to engage in that kind of behavior. Research from Hilvert-Bruce and Neill (2020) further support this idea, as they found that normative beliefs about cyber aggression among gamers significantly predicted cyber aggression toward other players. This kind of accordance with group norms has also been found in other kinds of online spaces. For example, Zhao et al. (2008) found Facebook users tend to stress their group over personal identity when discussing the ways that they behave online.

Taken together, it seems that the effects of the online disinhibition effect make gaming spaces more open for toxic behavior to happen, with the SIDE (Postmes et al., 1999) effects of the social environment (i.e., the "toxic gamer cultures") potentially fueling a perpetuating cycle.

Personality, Gender Socialization, and Age

There are also a range of personality and social factors that have been found to have significant relationships with toxic behavior among online game players. Hong and Cheng (2018) found that social extraversion, a sense of inferiority to others, and depression positively predicted online trolling behavior. Toxic behavior has also been positively correlated with sadism (the tendency to derive pleasure from inflicting suffering), psychopathy (a personality disorder characterized by persistent antisocial behavior and impaired empathy), and Machiavellianism (a personality trait which sees a person so focused on their own interests and goals they will manipulate, deceive, and exploit others to achieve their goals). Of these, the researchers found sadism to have the strongest correlation with toxic behavior and concluded that "online trolling seems to be an internet manifestation of everyday sadism" (Buckels et al., 2014; p. 1). Wai Yen (2020) also found that people who harass other people score higher on measures of Machiavellianism, psychopathy, and gamer identification measures. The relationship with gamer identification would give credence to the suggestions of the SIDE model in gaming spaces.

There's also the idea that games are a "boy's toy," and the toxicity stems from the idea that games are being infiltrated by anyone who does not fit this mold. This can create heightened tension and lead to the harassment of others as a way to make them "leave their space," so to say (Lucas and Sherry, 2004; Kowert et al., 2017).

Research has also found that age is inversely related to toxicity, with younger players perceiving many forms of dark participation, such as flaming, as less serious or even normal (Mattinen and Macey, 2018).

The individual motivations of the perpetrators of these kinds of behaviors also need to be considered. Cook et al. (2018)

interviewed perpetrators of toxic behaviors (i.e., so-called "internet trolls") to uncover the antecedents for their actions in games specifically. They found that the motivation for these behaviors span three broad categories: attack, sensation seeking, and interaction seeking. Even so, the researchers note that these elements are not mutually exclusive (Cook et al., 2018). Attack focus behaviors are defined as a direct attack on another players' enjoyment of the game or gameplay. This was the most commonly reported motivation. Sensation-seeking focus refers to behaviors that lead to enjoyable consequences for the troll but are not inherently good or bad for other players (e.g., spamming). Interaction-seeking focus emphasizes trolling as an unorthodox method of communication that the trolls enlist to make players get involved in the conversation and the game. Interaction seeking plays on the idea that "no attention is bad attention." The researchers also found that the primary trigger for becoming a perpetrator of toxic behavior was social (i.e., if they were trolled themselves). Other triggers included internal (personal enjoyment) and circumstantial.

Game Play Factors

There are also factors to consider relating to game play itself. Specifically, Cook (2019) notes that imbalance between the skill levels of the players and the challenge of the game (the game is too easy or too frustrating) may be a driving force for toxic behaviors.

The competitive and multiplayer nature of games can also contribute, especially when it comes to verbal forms of dark participation. Work from Hilvert-Bruce and Neill (2020) found that gamers report aggression to be more acceptable and tolerable when it occurs online than offline. Zubek and Khoo (2002) note that when gameplay is more about competition than cooperation, the social environment is more characterized by competitiveness, trash-talking, and gloating. Shores et al. (2014) found that players who choose to play more competitively scored higher on a toxic behavior measure than those who chose to play less competitively. Additionally, Adachi and Willoughby (2011) found that competitiveness in video games was more related to aggressive behavior than violent content of games. Games with competitiveness were found to produce higher levels of aggressive behavior from the players regardless of whether or not the game contained violent content.

PREVALENCE AND IMPACT OF TOXIC GAMER CULTURES

While understanding why this behavior takes place is one side of the coin, understanding its prevalence and impact is the other.

A 2019 study by Cary and colleagues found that 80% of players said that they believed the average gamer makes prejudiced comments while playing online. A 2019 report from the ADL reported that 74% of adults who play online multiplayer games in the US experience some form of harassment while online. Cary et al. (2020) found over half of their surveyed players (53%) said they experienced harassment because of their race/ethnicity, religion, ability, gender or sexual orientation and 65% had experienced some form of severe harassment, including physical

threats, stalking, and sustained harassment. They also found that nearly 1 in 3 (29%) of players have been doxxed (which is where personal identifiable information is posted publicly online, such as your address and phone number). Taken together, this suggests that more than half of all players have experienced some form of harassment while playing online and suggests that toxic gamer cultures have permeated gaming environments and communities to a substantial degree.

Research has also found that these behaviors in online gaming spaces, however brief, can cause psychological harm to the intended victim and any third-party onlookers who might witness it (de Mesquita Neto and Becker, 2018). In 2019, the ADL found that 1 in 10 game players reported having depressive or suicidal thoughts as a result of harassment in online multiplayer games. Nearly 1 in 10 (8%) reported having to take steps to reduce the threat to their physical safety. The 2020 Byter report indicated that over half of male and female gamers have experienced abuse in games, and nearly a third (28%) reported they experienced it regularly. They also reported that 1 in 4 female gamers reported that the "widespread toxicity" in games made them feel upset, intimated, and made them not want to play again. Heightened anxiety and lower self-esteem has also been reported as a result of victimization within online games (Ewoldsen et al., 2012).

STATE OF THE RESEARCH: DARK PARTICIPATION, TOXICITY, AND TROLLING

Despite its prevalence, deviant or toxic behaviors in games as a subject of academic study is generally a confusing space. Researchers have typically assessed "toxicity" as a broad and general term with little differentiation between different kids of toxic behaviors (e.g., trash-talking, flaming, doxing, etc.). To add to the confusion, many researchers using different criteria to describe the same things (for an overview, see Ortiz, 2020). While some researchers treat any deceptive action online as toxic (Buckels et al., 2014), deception is not always required by other researchers (Fichman and Sanfilippo, 2015). Other negative behaviors with a perceived hostile intent are also sometimes grouped into trolling, while other researchers treat them as separate phenomena, such as griefing and flaming (O'Sullivan and Flanagin, 2003; Coyne et al., 2009; Thacker and Griffiths, 2012). To add to the confusion, the words "trolling" and "toxic" have often been used interchangeably, with little differentiation made to distinguish the two concepts.

There have been a few attempts to catalog different types of toxicity in games; however, they have all been limited in their scope and level detail. For example, Cook et al. (2018) note 10 different kinds of "trolling" behaviors in their catalog, although some of the behaviors included do not necessarily imply hostile intent (such as contrary play). A similar approach was taken by Komaç and Çağıltay, 2019; however, they only note nine different "trolling" behaviors. Blackburn and Kwak (2014) provide a list of "toxic" behavior that includes only seven categories, whereas Saarinen (2017) notes only five kinds of "toxic" behaviors. Kordyaka et al. (2019) are the only known authors to attempt

to differentiate "toxic" behavior in terms of their presentation or premeditation by noting some behaviors may occur repeatedly or temporarily. However, in their work they describe toxic behavior vaguely as "a behavior generating anger and frustration in players harming communication and contributing to spreading a bad mood" (p. 2487). Additionally, the only examples in the text of what might constitute toxic behavior are "insults to other players" and "spamming."

The wide variation and inconsistences in the field are likely due to the fact that formally evaluating toxic behavior in games is a relatively a new area of study. Existing studies on this topic are few and far between, and nearly all of them have been atheoretical due to a lack of empirical basis upon which to build any theories (Herring et al., 2002; Shachaf and Hara, 2010; Thacker and Griffiths, 2012).

DEVELOPING A SHARED LANGUAGE

The aim of this article is to clarify the state of the research and generate a new shared language around toxicity in games by redefining toxicity, trolling, and other key terms in this area of research. Having a shared language within the research community is a critical first step for understanding these kinds of behaviors in games, their antecedents and consequences, and unifying scholarly efforts. This is especially important in the context of digital games as they uniquely allow for verbal and behavioral dark participation due to the interactive nature of the games themselves.

Redefining Key Terms: Dark Participation, Toxicity, and Trolling

From the broadest perspective, all deviant behavior that takes place online (both in and out of games) can be placed under the broad heading of "dark participation" (Quandt, 2018; see **Figure 1**). All deviant verbal and behavioral actions that take place on the internet would that fall under this categorization. Any outcome of these behaviors that cause harm to another's health or well-being (i.e., online propaganda, fake news, harassment, etc.) are considered toxic behaviors.

It is important to note a key distinction between dark participation and toxic behavior in relation to cultural context. Dark participation is *any* deviant action that takes place in online spaces, but what constitutes toxic behavior is often culturally defined (Kwak et al., 2015). Put another way, dark participation is always deviant in the context of the environment, but what behaviors are considered toxic (i.e., behaviors that cause harm to another's health or well-being) in one situation might not be considered toxic in another. For example, in some circles contrary play (i.e., playing in ways that the game does not intend for you to play) may or may not be considered toxic. Speed running (i.e., completing a game in as little time as possible), for instance, is generally not considered to be toxic even though it is contrary to normal game playing. However, in other cases, using the game in unintended ways could be considered toxic by other players, such as using exploits in World of Warcraft (2004) (Blizzard Entertainment) to gain an unfair

FIGURE 1 | Delineation of dark participation, toxicity, and trolling in online games.
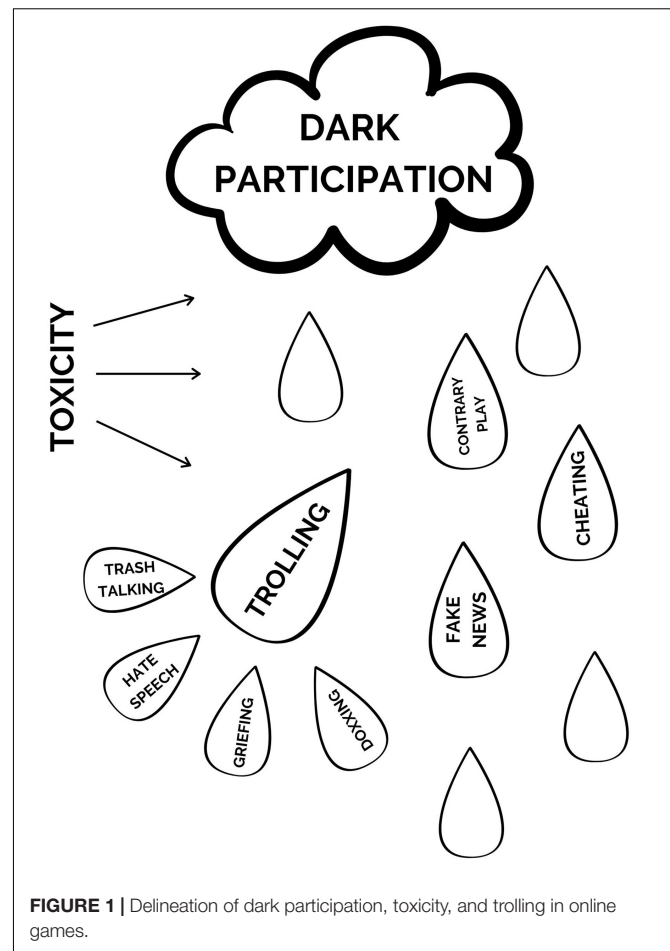
advantage. Thus, contrary play is not a behavior that necessarily causes harm or disrupts the play of others but is deviant (i.e., dark participation) and, depending on the context, could be considered toxic.

While toxicity refers to particular *outcomes* of dark participation, trolling refers to the *intent* of the perpetrator. In internet slang, a "troll" is someone who sows discord on the internet with the deliberate intent of eliciting an emotional response or otherwise disrupting on-topic discussions and actions among other players. Deliberate intent being the key phrase in this definition. As seen in **Figure 1**, toxic behaviors considered to be trolling include actions such as trash talking, griefing, and doxxing as all of these actions are done with the specific intent of causing annoyance, distress, or harm to another player.

Cataloging Dark Participation in Games

To develop a more comprehensive catalog of what is considered dark participation in games, research literature containing the keywords "toxic," "trolling," "dark participation," and "games" were searched for and retrieved via Google Scholar. Over 50 articles were identified via these search criteria. However, the vast majority of them discussed trolling and toxicity in broad terms, using such definitions as "toxic behavior happens when

players break coexistence rules, acting in antisocial ways that brings forth anger or frustration on other players, leading to a bad game experience (Neto et al., 2017, p. 26)." From this collection of work, only eight pieces of scholarly work (seven peer-reviewed articles, one dissertation, and one book chapter) were found identified that had produced a list of different types of dark participation/toxicity in games (i.e., Blackburn and Kwak, 2014; Kwak and Blackburn, 2014; Kwak et al., 2015; Fichman and Sanfilippo, 2016; Neto et al., 2017; Saarinen, 2017; Cook et al., 2018; de Mesquita Neto and Becker, 2018; Komaç and Çağıltay, 2019).

After compiling an initial list of terms from these eight articles, the gaming community was enlisted to make suggestions to the list via social media (i.e., Twitter and Facebook). Drawing from the aforementioned research and community suggestions, a list of toxic behaviors in games was developed and can be seen in **Table 1**. All of the terms were drawn from the literature with the exception of "swatting," which was noted by several members of the gaming community as a missing component to the list.

This list also provides the first categorization of dark participation in games across their spectrum of characteristics, verbal to behavioral and transient to strategic (see **Figure 2**).

A verbal action is one that is expressed verbally (via voice chat or text) from one player to another, whereas a behavioral action is one that is either performed with one's in-game character or triggers an "out-of-game" action. "Transient" refers to an action that is often committed "in the moment," whereas "strategic" implies that the individual took time to gather information and formulate a plan before performing the action.

It is important to recognize the difference in behaviors as this can greatly influence the perception of their severity and their impact on the victim of the behavior. For example, doxxing (behavioral, strategic) is more likely to have a severe and long-term negative impact on the victim than trash-talking (verbal, transient). Supporting this, research has noted that trash-talking is less likely a form of "trolling" (i.e., an action with negative intent) and more likely simply a normal by-product of competition, like seen in traditional sports (Türkay et al., 2020). In contrast, doxxing can and has led to long-term psychological challenges, such as post-traumatic stress disorder (Allegra, 2017).

Subcategories of Dark Participation

It is important to note that the categories of dark participation outlined in **Table 1** can (and often do) have subcategories nested within them. For example, as noted by Kwak et al. (2015), various forms of "inhibiting team," such as refusing to communicate, leaving the game/going AFK, or being an unskilled player. Similarly, Saarinen (2017) subdivides "griefing" into four categories: harassment, power imposition, scamming, and greed play. Cataloging all the variants that may fall within the different categories identified in **Table 1** is not within the scope of the current work. The aim of the classification system outlined in

TABLE 1 | Toxic actions in games and gamer culture from verbal/transient to behavioral/strategic.

	Description	Transient/Strategic
Verbal actions		
Trash talking	Putting down or making fun of other players	Transient
Misinformation	Repeating game-unrelated chat	Transient
Spamming (verbal)	Repeatedly engaging in an action, such as sending the same verbal message or using the same in-game move, often to the consternation of others.	Transient
Griefing	Irritating and/or harassing other players by using the game in unintended ways	Transient
Sexual harassment	Insults or comments based on gender, including threats, the criticism of women and their interests, and stalking	Transient
Hate speech	Insults based on religion, ethnicity, nationality, or other personal information	Transient
Threats of violence	Threats of physical abuse, vandalism, arson, sabotage, possession, or use of weapons or other dangerous act	Transient
Flaming	Presenting emotionally fueled or contrary statements with an instrumental purpose	Strategic
Behavioral actions		
Spamming (behavioral)	Repeatedly engaging in an action, such as using the same in-game move, often to the consternation of others	Transient
Inappropriate role-playing	Pretending you are a different person to obtain a specific reaction or not abiding by role playing norms of the game and/or community	Strategic
Contrary play	Playing the game outside of what it is intended by most players	Strategic
Inhibiting team	Inhibiting your own team from being successful in winning	Strategic
Aiding the enemy	Behaving in a way that strategically aids the opposing team	Strategic
In-game cheating	Using methods to create advantage beyond normal gameplay in order to make the game easier for oneself	Strategic
Hate raiding	Purposefully infiltrating the gaming space of another with the intention of spreading hate/harassment	Strategic
Doxxing	Publicly sharing and/or publishing another player's identifying information	Strategic
Swatting	Prank calling emergency services in an attempt to dispatch armed police officers to a particular address	Strategic
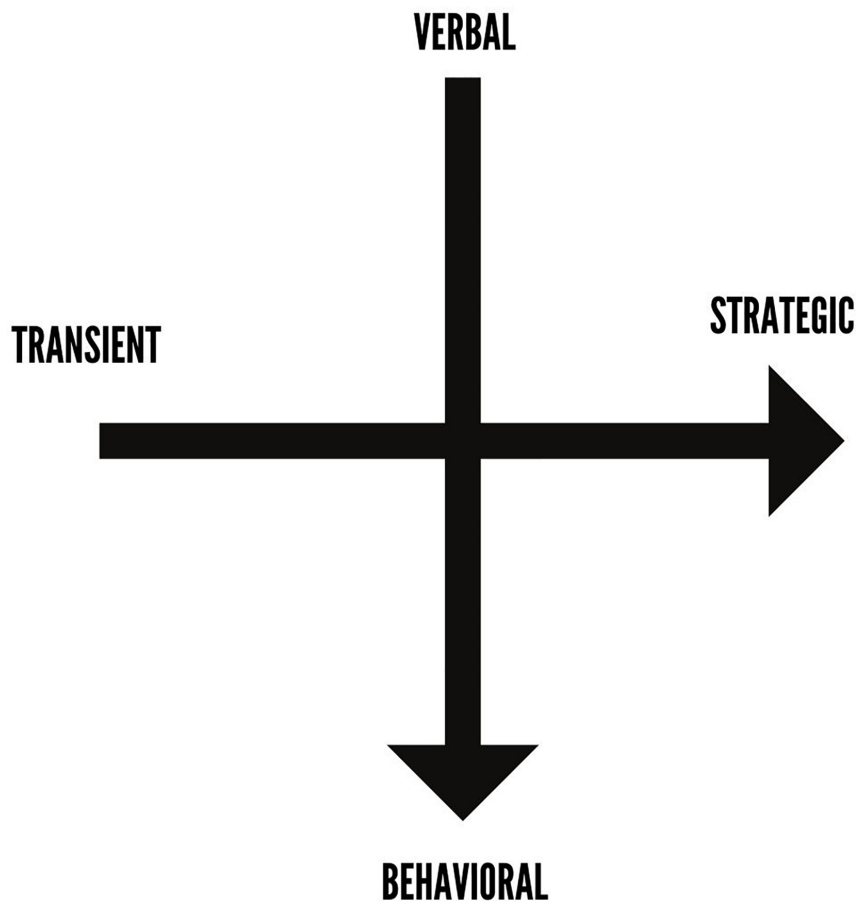
FIGURE 2 | Axes of dark participation in games.

this article was to catalog the higher-order categories of dark participation in games. Future work should consider identifying the different subcategories of behavior in games to provide a more comprehensive understanding of the spectrum of behaviors.

MOVING FORWARD

Understanding what toxicity is, why it happens, and its prevalence within gaming communities is the first step to understanding how to combat it. For example, we know that toxic behavior is largely driven and sustained by anonymity and disinhibition, and a lack of accountability means we can make change by increasing accountability through more effective in-game reporting systems. The Anti-Defamation league [ADL] (2019) reports that 62% of players think companies should do more to make online games safer and more inclusive. Game companies could also enlist more specific guidelines to curate community building. Tran (2019) article by Victoria Tran discusses how specificity in community design can help foster less toxic, more inclusive communities.

More research collaborations are also needed between the industry, academia, and organizations. While many companies do in-house research, that information is largely proprietary. While proprietary information may help one company, sharing that information and engaging in collaboration can help entire communities. We need more transparency and concerted efforts to understand toxic behavior and how to effectively address it. For example, textual analysis such as the ones done by Kwak and Blackburn (2014), Neto et al. (2017), and de Mesquita Neto and Becker (2018), could better help to predict when the more severe forms of dark participation may begin to occur, particularly in highly competitive in-game scenarios. Cooperation from the video game industry by providing in-game chat logs and or other kinds of server data would help push the development of detection systems for particularly deviant players.

Last but not least, we need to mobilize gamers themselves. Research has found that confronting toxic behaviors in games is one of the most effective ways to extinguish the behavior (Whitty and Carr, 2006; Young and Jordan, 2013; Ridout and Campbell, 2014; Tang et al., 2020). However, recent reports indicate that only 18% (Cary et al., 2020) to 20% of gamers say they stand up to harassment when they see it (D'Anastasio, 2020), even though 76% of players (Cary et al., 2020) felt prejudice should be confronted in online games. Change from the bottom up is also the only way to begin cultural change, which

Hilvert-Bruce and Neill (2020) note "modification of beliefs which support the legitimacy and acceptability of cyber-aggression in games" (p. 303) are key to prevention and intervention efforts relating to dark participation in games.

CONCLUDING THOUGHTS

Toxic behavior in games is a real problem as over 53% said they experienced harassment because of their race/ethnicity, religion, ability, gender, or sexual orientation and 65% had experienced some form of severe harassment, including physical threats, stalking, and sustained harassment. This article provided the first attempt to comprehensively catalog what constitutes dark participation in games in order to establish a shared language.

This shared language is the first step critical step needed to better understand these behaviors and how to combat them.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

RK researched and wrote the article.

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Check for updates

Live Streams on Twitch Help Viewers Cope With Difficult Periods in Life

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Live streaming platforms such as Twitch that facilitate participatory online communities have become an integral part of game culture. Users of these platforms are predominantly teenagers and young adults, who increasingly spend time socializing online rather than offline. This shift to online behavior can be a double-edged sword when coping with difficult periods in life such as relationship issues, the death of a loved one, or job loss. On the one hand, platforms such as Twitch offer pleasure, distraction, and relatedness with others to help with coping, and the increased sense of anonymity and control could stimulate self-disclosure. However, the prevalence of trolling and memes may also discourage people from opening up, and relationships that are built online—especially those with microcelebrity streamers—could be perceived as more meaningful than they actually are. To create a deeper understanding of Twitch as a new media platform embedded in game culture, and how users perceive its potential as a coping mechanism, we have conducted a first exploration by means of a survey. The questions focused on general Twitch behavior, the difficult period in life, and the role of Twitch during this period. It was distributed online among people who considered themselves active Twitch users, and who had gone through a difficult period. Eighty-four participants completed the entire survey. The majority of participants indicated that Twitch helped them cope, and that it became a larger part of their lives during the difficult period compared to regular viewing. Recurring themes were the entertainment, distraction, and sense of community Twitch offers. Viewing behavior during difficult periods appears to remain largely the same in terms of the streamers that are watched, although time spent viewing increases, and there is a change toward more time spent actively watching rather than having the stream on in the background. With this work, we aim to create a deeper understanding of Twitch as a platform, and its importance for gamers that are going through difficult periods in life.

Keywords: live streaming, difficult periods in life, coping, game culture, mental well-being, human-media interaction

1. INTRODUCTION

Game culture has grown beyond actively playing games, as an increasing amount of game play is being broadcast online. Live streaming services such as Twitch provide ways for a large audience to spectate others as they play, while simultaneously being able to interact with the broadcaster and with other viewers, all from the comfort of their own homes. The rise in popularity of live streaming started in the early 2010's with the broadcasting of esports tournaments, and has since grown into an industry in which individual *streamers* (broadcasters) have made it their full-time job to provide

entertainment for an audience of up to tens of thousands of viewers on a daily basis. Platforms such as Twitch are "complex and rich ecosystems" (Deng et al., 2015, p. 1), that are increasingly being studied through various lenses such as media and game studies, psychology, and communication. The multidisciplinary nature of research into live streaming is perhaps best captured by Taylor's description of the phenomenon as "an interesting collision of the televisual, computer games, the internet, and computer-mediated communication" (Taylor, 2018, p. 2).

Twitch has become a popular pastime, with the average user spending 95 min per day watching live streams on the platform. The majority of people active on Twitch are male (81.5%), and 55% of users are between 18 and 34 years old, with the average age being 21 years old[1]. This constitutes an age group in which the transition from adolescence into adulthood takes place (Arnett, 2014, as cited in Mahmoud et al. 2012). This transition generally includes major life changes such as moving out of the parental home and becoming increasingly independent, starting college or working life, (romantic) relationships developing and evolving, and trying to find one's identity and purpose in life. Not being able to successfully complete these transitional steps, as well as the general academic, social, and financial stress stemming from life as a student, can lead to anxiety and depression (Mahmoud et al., 2012). We can therefore assume that a substantial part of the people active on Twitch are going through this transitional phase, and could be experiencing mental health issues as a result. In addition, there are a number of invasive life events that could happen at any age, such as divorce, the death of a loved one, coming out, or job loss, which could also have a detrimental effect on people's mental well-being.

There are several ways, both constructive (adaptive) and destructive (maladaptive), to cope with these difficult periods caused by life events or by transitioning into adulthood. A maladaptive coping strategy such as avoidance may make things worse and in fact lead to exacerbation of the mental health issues (Mahmoud et al., 2012). With especially the youth spending an increasing amount of time online (Lenhart et al., 2010), on platforms such as Twitch, we feel that it is important to investigate if these media are being used as coping mechanisms during difficult periods in life and, if this is the case, whether this is an adaptive or maladaptive form of coping. Although an increasing amount of research is being done into Twitch and similar live streaming platforms, to our knowledge the potential role of Twitch as a coping mechanism during difficult times has not yet been explored.

By means of a survey study, we set out to investigate whether Twitch is perceived as a useful coping mechanism by its users, and how this is supported by the different elements of this ecosystem. For example, we attempt to find out to what extent the televisual and computer game aspects of live streaming provide a sense of distraction, and how the computer-mediated social aspects could lead to tight-knit, safe communities in which meaningful conversations take place. We want to emphasize that we do not intend to promote Twitch as a viable alternative to professional help. Instead, we consider it a potential complement

to treatment, a way to lower the threshold to seek professional help, and a platform that can be used—and is already being used—to reduce the stigma surrounding mental health.

2. BACKGROUND

2.1. Live Streaming and Twitch

Live streaming platforms are participatory online communities in which users can provide content by broadcasting a video feed, which can then be consumed by other users acting as viewers. At the same time, a chat facility running parallel to the video broadcast enables viewers to interact with the broadcasters, also known as streamers, and with each other in real-time (Hamilton et al., 2014; Taylor, 2018). Twitch is currently the largest live streaming platform, with over 2 million viewers and over 90,000 broadcasts active on average at any time[2]. It originally started as the "Gaming" category of the general live streaming platform Justin.tv, which was founded in 2007. In 2011, this section containing broadcasts of people playing games had grown into its own dedicated platform, Twitch. Amazon bought Twitch in 2014 for $970 million. Live streaming is different from other user generated content (UGC) platforms, such as YouTube, mainly due to the active participation of viewers and streamers (Gandolfi, 2016), and the similarities it shares with live sports platforms (Deng et al., 2015). Next to individual streamers that often broadcast according to fixed schedules and are generally receiving consistent viewership, there are certain esports and charity events that temporarily attract large numbers of viewers. While these events tend to take on a more traditional top-down broadcasting style, the individual streamers often allow the viewers to become part of the show, for example by responding to their input from the chat, or by inviting them to join games that are being played on stream (Gandolfi, 2016).

Twitch contains several design features that shift the focus from the game being played onto the streamers and viewers present on the platform (Anderson, 2017), some of which are depicted in the viewer's perspective of a broadcast shown in **Figure 1**. For example, people create their own identity though their user names and channel pages, and the streamer is usually visible and audible on the stream alongside the game being played (Sjöblom et al., 2019). Multiple sources have found that most viewers choose which channels they watch based on the streamer, instead of the games that are being played (Hamilton et al., 2014; Deng et al., 2015; Gandolfi, 2016; Anderson, 2017). This move toward focusing more on the person rather than the game was taken even further in 2016 when Twitch introduced the *In Real Life (IRL)* category of streams, and relaxed the requirements on streams having to center around game play. This category was later succeeded by a number of more specific variations, including *Just chatting*, *Sports and fitness*, among others. The chat is another key feature that allows the live streaming audience to become visible and actively participate, turning them into a community with shared experiences instead of passive, individual viewers (Hamilton et al., 2014). The main reasons for people to engage with live streams are tension

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[1]https://muchneeded.com/twitch-statistics/

[2]https://twitchtracker.com/statistics/
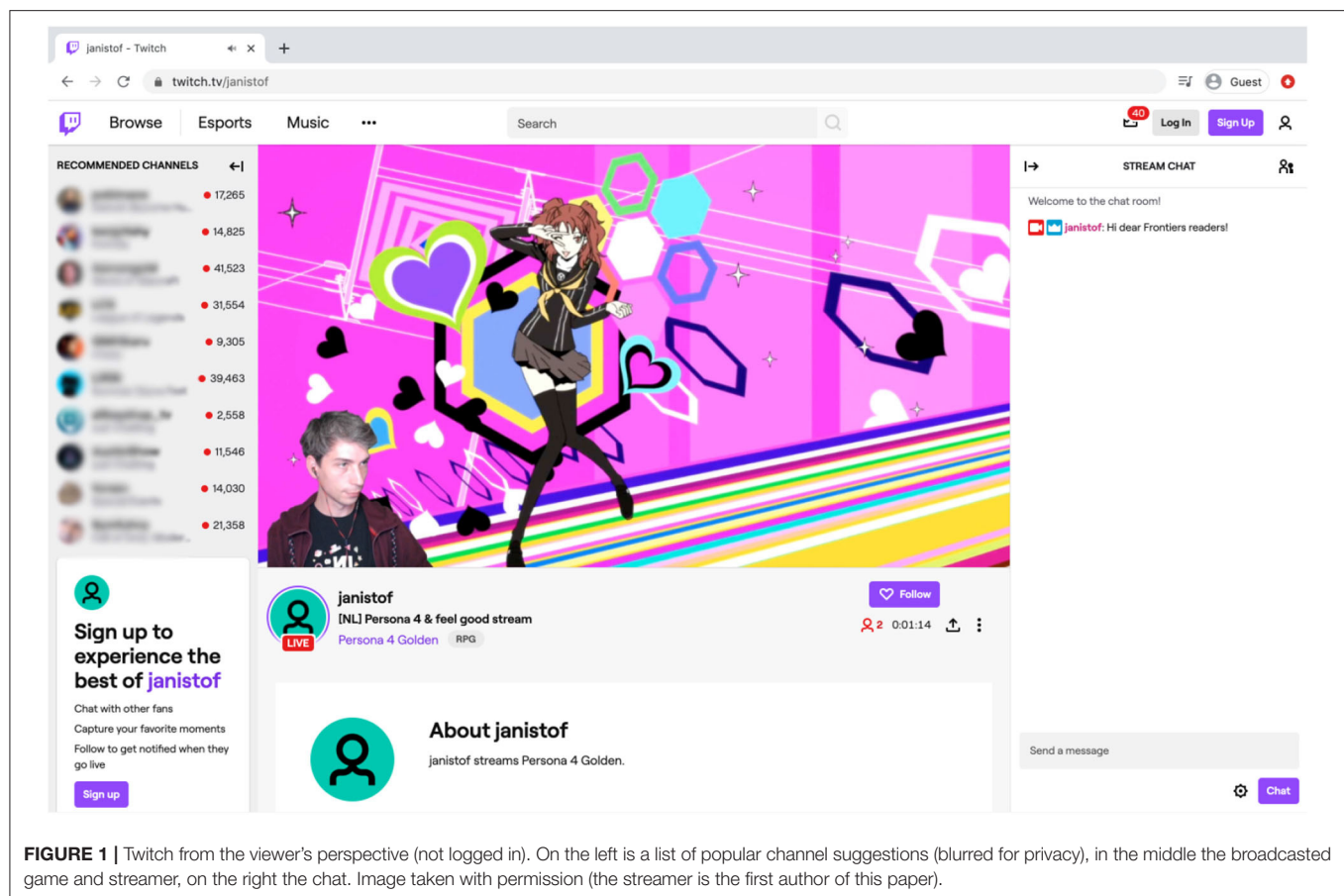
FIGURE 1 | Twitch from the viewer's perspective (not logged in). On the left is a list of popular channel suggestions (blurred for privacy), in the middle the broadcasted game and streamer, on the right the chat. Image taken with permission (the streamer is the first author of this paper).

release, social interaction and community, entertainment, and information seeking (Gandolfi, 2016; Sjöblom and Hamari, 2017; Hilvert-Bruce et al., 2018; Taylor, 2018).

Gandolfi (2016) distinguishes, based on theories of immersion, between three different orientations of a streamer toward their viewers, which determines the amount of interaction that takes place between them: (1) as professional, which focuses on the streamer's expertise at challenging and competitive games, with little to no interaction with viewers; (2) as hedonist, where the viewers experience a game's aesthetics through the streamer, usually without competitive pressure, sometimes in the context of emergent game play such as speed running[3] or open-ended (sandbox) experiences and role play. In these streams there tends to be little interaction with viewers, and it is mostly about the game being played; (3) as companion, which is more about the streamer as a person rather than an extension of the game avatar. These streams have a large degree of interaction between the streamer and the viewers, and the topics of conversation go beyond the game that is being played. It is possible for the same streamer to switch orientations, even mid-stream, for example when a professional competitive player takes time as a companion to interact with the audience at the start of the

stream before loading the game, or when they decide to pick up a casual, non-competitive game and take on a hedonic role.

Streamers make money from playing advertisements, sponsorship deals, contracts with live streaming platforms and game publishers, and donations from viewers (Johnson and Woodcock, 2017). Viewers can subscribe to a streamer at $4.99 for one month, part of which goes to the streamer and part to Twitch. The viewer receives several benefits in return, such as an icon next to their username and additional emotes (emoji) to be used in chat. They can also make one-time donations. Both types of donations can usually be accompanied by a message to the streamer, which is often automatically displayed on stream and acknowledged by the streamer (Sjöblom et al., 2019). A number of streamers have managed to make enough money to make live streaming their main occupation. Wohn et al. (2018) have found that, in addition to making donations, viewers also provide emotional and instrumental support to the streamers. An important predictor of viewer loyalty, in terms of repeated viewing behavior and how much support is given to streamers, is whether or not viewers develop a parasocial relationship with the streamer (Hamilton et al., 2014; Hu et al., 2017; Lim et al., 2020). A parasocial relationship is a one-sided intimate connection with a media performer such as a streamer, based on repeated encounters (Dibble et al., 2016). This relationship is one-sided as the streamer does not experience this connection with, nor

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[3]Trying to complete a game as fast as possible, sometimes with specific constraints and sometimes with the use of bugs or exploits.

gives the same amount of support to the viewer. The parasocial relationship, in turn, is stimulated by wishful identification, which means that viewers picture the streamer as a role model and want to imitate them (Hoffner and Buchanan, 2005), as well as by emotional engagement with the streamer and with other viewers watching the same broadcast (Hamilton et al., 2014; Lim et al., 2020).

The distribution of viewers among channels is highly skewed, with the top 1% of channels attracting 70% of all viewers (Deng et al., 2015). This means that there is a small group of popular streamers that attract tens of thousands of concurrent viewers, while most streamers have only several hundreds of viewers or less, or even no viewers at all. Hamilton et al. (2014) considers streams with over 1,000 concurrent viewers "massive," and notes that in these streams, it can be difficult for the streamer and the viewers to keep up with the fast pace at which messages appear in the chat, which the researchers compare to the dynamics of a stadium crowd (cf. the similarity between live streaming and live sports viewing dynamics suggested by Deng et al. 2015). As a result, more meaningful interactions tend to take place in streams with smaller audiences (Nakandala et al., 2017; Hilvert-Bruce et al., 2018). However, this does not mean massive streams are only watched for the games being played, because the streamer is still valued as an entertainer, regardless of the lack of direct communication (Hamilton et al., 2014). It is also possible for the streamer to reduce the pace of the chat, by allowing only subscribers (viewers that have donated the $4.99 fee for a month) to post messages. This enables meaningful conversation to take place in larger streams, although at the cost of accessibility (Hamilton et al., 2014).

Twitch is used predominantly by young people, with an average age of 21 years old and 55% of the users between the ages of 18 and 34 years old[4]. A vast majority (81.5%) of users is male, which is also reflected in the large number of channels featuring male streamers, compared to female streamers (Nakandala et al., 2017). Nakandala et al. (2017) have found differences in the types of conversation that take place depending on the gender of the streamer. The chat of popular male streamers (with large numbers of viewers) contains more game-related words, while the chat of popular female streamers tends to have more objectifying words (i.e., focusing on the streamer's appearance, or considering them an object rather than a person). These differences are not present in smaller streams, although more social signaling words were found in smaller channels featuring a female streamer. This can be seen as an indication that these streams are considered more as a social gathering than a sports event (Nakandala et al., 2017).

2.2. Difficult Periods in Life and Coping

In our study, we asked participants to reflect on a difficult period in their lives. Although most people can intuitively describe what is meant by a difficult period and name examples such as divorce, abuse, loss of a loved one, or transitioning into college life, formal definitions of what constitutes a difficult period may vary. Herron et al. (2016) call these "sensitive life experiences" and

describe them as life events and transitions that put individuals in a vulnerable state. Massimi et al. (2012) talk about "life disruptions," and call the vulnerable state they leave people in "destabilizing." In addition, these disruptive events are said to be unpredictable and uncontrollable. The effects on people are often invisible to outsiders, stigmatized, and last for a prolonged period of time (Massimi et al., 2012). Folkman and Lazarus (1984) describe the resulting feeling of "stress" as a combination of personal characteristics and an event that happens in the person's environment. This means that there are individual differences in the impact of the same potentially stressful event, based on personal characteristics (i.e., resilience, past experiences). In their research on the role of playing games during difficult times, Iacovides and Mekler (2019) adopt a definition from Pals (2006), which describes a difficult time as anything that is perceived by the person as stressful, confusing, troubling, or discouraging. This captures several of the elements mentioned previously, such as the vulnerable and destabilized state, and the unpredictable and uncontrollable aspects of the event or transition (resulting in confusion and discouragement).

Coping is defined by Folkman and Lazarus (1984) as "constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person." This definition focuses on coping as a process, rather than a personality trait. Different coping processes can be categorized as either problem-focused or emotion-focused, where problem-focused processes are commonly used if the underlying stressors can be changed or controlled, and emotion-focused processes when the stressor cannot be addressed. Problem-focused strategies can be focused on the environment (e.g., removing barriers, finding resources) or on the self (e.g., learning new skills). The majority of emotion-focused strategies is aimed at reducing the emotional distress caused by the stressor, including avoidance, minimization, and distancing. Combinations of both types of strategies can prove to be beneficial, for example by first caring for one's emotional well-being before addressing the underlying cause with a problem-focused approach. However, they can also negatively affect each other, e.g., when one gets stuck in an unproductive cycle of a problem-focused coping strategy (such as seeking additional information) that only leads to increased feelings of emotional distress (Folkman and Lazarus, 1984). A further distinction can be made between constructive (adaptive) and destructive (maladaptive) coping strategies (Mahmoud et al., 2012). However, which strategy is considered adaptive or maladaptive is highly context-dependent. For example, although avoidance (escapism) is generally considered a maladaptive coping strategy, it can be helpful to first distance oneself from the stressor or to avoid a direct confrontation, before addressing it with a problem-focused coping strategy (Folkman and Lazarus, 1984).

Life transitions, such as moving out of the parental home and starting college life, can lead to difficult periods and are common in early adulthood (18–24 years old), an age group that also makes up a substantial part of the Twitch users. This time of adolescence and early adulthood is also when we try to find out who we are and develop an identity, and when we

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[4]https://muchneeded.com/twitch-statistics/

attempt to engage in intimate, long-term relationships (Erikson and Erikson, 1998). Additionally, people going through puberty and young adulthood (approximately 10–25 years old) are said to use more maladaptive coping strategies than other age groups (Mahmoud et al., 2012). Furthermore, research has suggested that there are differences in coping strategies between men and women, where women are generally more likely to turn to emotion-focused strategies and seek social support, while men tend to opt for problem-focused strategies but are also more likely to resort to alcohol or drugs as an (emotional) avoidance strategy (Ptacek et al., 1994). In addition, particularly younger men have relatively low mental health literacy and are less likely to seek professional help compared to women (Rice et al., 2018).

2.3. Game Culture and Coping With Difficult Periods in Life

The present study is inspired by the work of Iacovides and Mekler (2019), in which they investigated by means of a survey how actively playing games could be beneficial during difficult times. They found that games were indeed commonly used as a coping mechanism. Games are able to offer players ways to distract themselves, to confront their feelings, to connect with others, and to achieve personal growth. These coping strategies appear to be both emotion-focused (e.g., distraction, connecting with others) as well as problem-focused (e.g., confronting feelings, personal growth). This is congruent with the observed social and emotional benefits of playing games (e.g., Olson, 2010; Granic et al., 2014; Kowert et al., 2014). However, participants in the study also highlighted several negative effects of spending too much time playing games, such as a decrease in productivity, physical activity, or real-life socializing. Games were referred to by some participants as a maladaptive coping strategy, mostly in the sense that they could be used to avoid confronting the underlying stressors for a prolonged period of time. There is an ongoing debate about the use of games as an avoidance (escapism) strategy. Games offer a way for people to gather their bearings, to recover, and to regulate their moods before confronting the issues at hand (Kosa and Uysal, 2020). However, because games are designed to be highly engaging there is a pitfall of escaping for too long, beyond the point where one should be confronting their difficulties (Griffiths, 2015; Kosa and Uysal, 2020).

When comparing game play to watching others play, we envision similarities as well as differences between the experiences, benefits, as well as challenges offered. Although a sense of agency is lost because the player becomes an observer, the presence of the streamer and the possibility of interacting with other viewers add new sources of entertainment and community. This is what Gandolfi (2016) refers to as the "reverse remediation" of live streaming, turning game play into video while extending the original game into a public and social setting. Most notably, the chat adds the option of also discussing serious and personal topics that are not related to the game being played. The anonymity of Twitch, combined with the lighthearted nature of game play, could lead to levels of self-disclosure similar to or exceeding those commonly found in online social communication (Valkenburg and Peter, 2009).

Although the specific role of live streaming platforms such as Twitch in coping with difficult periods has not previously been researched, several related research avenues do indicate that there are people active on the platform that are going through a difficult time, and that Twitch has had a beneficial effect on them. For instance, in Wohn et al. (2018) viewers are quoted saying they received valuable help from streamers as well as from other viewers. This was a reason for them to provide (monetary) support to the streamer. Hilvert-Bruce et al. (2018) found that a lack of external support in real life served as a motivator for engaging more with live streams. They highlight the potential of using online communities as a way to fight loneliness, and as a safe alternative for people who struggle to engage in real-life social interactions. Participants in the study by Iacovides and Mekler (2019) also indicated that they were involved with other aspects of game culture, such as live streaming, and that the act of becoming a streamer provided social support.

We imagine that, compared to the general population, a relatively large number of streamers will have experienced, or is currently experiencing difficulties themselves. Most streamers are adolescents or young adults that are going through the same life transitions as the majority of their viewers. In addition, life as a streamer can be stressful and competitive in its own right (Johnson and Woodcock, 2017), so it may well be that building a career out of live streaming at a relatively young age is already a stressful life transition. Finally, live streaming can be a viable profession for people with certain mental or physical conditions, such as social anxiety, that prevent them from participating in jobs that require them to leave the house (Johnson, 2018). The parasocial relationships that form between these streamers and their viewers could put them in the position of a role model, allowing them to improve mental health awareness and literacy by opening up about their own struggles. In fact, several streamers have taken up the role as mental health advocates[5], and Twitch has responded to this by creating a *Mental health* category of streams. The fact that Twitch is aware of streamers and viewers going through difficult times is also apparent from their dedicated page with mental health support and information[6], which was developed in collaboration with Take This, a mental health organization that is active in the gaming community[7].

Considering the reported motivations for viewers to engage with Twitch—tension release or distraction, entertainment (emotion regulation), and social interactions—we see a potential role of Twitch as a coping mechanism. We expect that this role is further supported by the design of the platform, which places an emphasis on the people present on Twitch, and facilitates the development of communities. In addition, the parasocial relationship with the streamer and the emotional engagement

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[5]A number of streamers that openly discuss mental health are listed as Take This Ambassadors: https://www.takethis.org/programs/ambassador-program/
[6]https://help.twitch.tv/s/article/twitch-cares-mental-health-support-information
[7]https://www.takethis.org/

with other viewers may provide social support, and stimulate self-disclosure by viewers that are going through difficult times. Knowing that smaller communities, and specifically those centered around female streamers, tend to have more social and meaningful communication, we aim to investigate whether viewers show a preference toward these types of broadcasts during their difficult times, and whether their perceived relationships with the streamer and other viewers change. Finally, we explore whether female viewers adopt different coping strategies on Twitch compared to male viewers.

3. METHODOLOGY

We conducted an exploratory study into the use of Twitch, and how viewers' behavior on the platform might change during difficult periods in life, by means of a survey. Due to the sensitive nature of the questions, the participants were well-informed that they could stop filling in the survey at any time if they felt uncomfortable doing so. The data were collected in November–December 2019.

3.1. Measures

A survey was created and implemented in Qualtrics. It included a total of 30 questions from existing literature on Twitch viewing behavior (Gandolfi, 2016; Gros et al., 2017), and on the effects of playing games during difficult periods in life (Iacovides and Mekler, 2019), as well as questions that were designed specifically for the current study. The survey consisted of four parts: (1) demographic information; (2) general video game playing and Twitch viewing behavior; (3) description of the experienced difficult period in life; (4) Twitch viewing behavior during the difficult period in life. The questions were a combination of open-ended questions, multiple choice questions, and Likert scale ratings. The full list of questions can be found in the **Supplementary Materials**.

The demographics questions included age, gender, level of education, and country of birth. These questions were included to verify, by comparing with existing data on the Twitch user base, whether the participants in the current study represent the general viewer population on Twitch, or whether a particular subset can be identified that is more likely to use Twitch as a coping mechanism. Furthermore, the inclusion of these questions allowed us to explore whether there were any differences regarding viewing behavior on Twitch, or in terms of coping strategies, based on factors such as gender identity.

Participants were then asked to describe their general gaming behavior, as well as their activities on Twitch. These questions were included to find out whether they see themselves as gamers, and how important watching live streams is to them. We based these questions on literature that looked into live streaming viewership, including elements that motivate people to engage on platforms such as Twitch (Gandolfi, 2016; Gros et al., 2017). We included additional questions to investigate whether participants were more likely to watch streams with many or few viewers, and female or male streamers. Finally, participants were asked to describe how they use Twitch, for example whether they only observe streams or also interact with the streamer or other

viewers. There is no mention of a difficult period in life at this point, in order to establish a baseline of general viewing behavior. It is possible that some participants never experienced Twitch outside of their difficult period, although we would still expect the severity of their difficulties to fluctuate which could lead to changes in behavior as the severity increases.

At the start of the section regarding the difficult period in life, participants were reminded once more that they were free to stop their participation at any time. A definition of what was considered a difficult period was then presented, which was identical to the description used by Iacovides and Mekler (2019) in their research on playing games during difficult periods in life, but where references to *playing games* were replaced with *watching Twitch*. The description, which was originally based on Pals (2006), was as follows:

> All of us have times of—perhaps ongoing—personal difficulty. Please think of stressful, confusing, troubled, or discouraging time in your life, during which you watched Twitch. Please describe this difficult time in your life. What did you experience as stressful, confusing, troubling, or discouraging?

Participants were then asked to categorize this difficult period (e.g., depression, physical health), and were given the option to provide a more elaborate description. Although details regarding the difficult periods in life that our participants experienced were not necessary in order to investigate whether Twitch can serve as a coping mechanism, these questions were still included in the survey for three reasons. Firstly, it allowed us to verify that the experience described by the participant aligned with the provided definition of a difficult time. If this turned out not to be the case, we would be able to exclude participants or revise our definition. Secondly, these descriptions help to create a deeper understanding of what participants have been through, allow us to empathize with them, and they add context to participants' descriptions of the role of Twitch during this difficult period. Finally, this section acted as a segue to the last section of the survey, concerning the role of Twitch during this difficult period.

The final part of the survey started with a question about the amount of time spent watching Twitch during the difficult period in life, and whether participants perceived watching Twitch to be helpful during this period. Depending on the answers to these questions, participants were directed to a different set of follow-up questions. Participants who did not watch Twitch at all, or who did not find it helpful, were asked whether they hypothetically could see Twitch as being helpful and, if so, how. The other participants, who did indicate that they watched Twitch during the difficult period and stated that it was at least somewhat helpful (scores 3–5 on a 5-point Likert scale) received follow-up questions regarding their Twitch behavior during this time, for example related to stream size and their interactions on the platform. This allowed us to compare the behavior during the difficult period with the baseline provided by the earlier set of questions. We also asked them to recall and describe a specific event in which Twitch was helpful to them, to provide context for the (mostly quantitative) description of the behavior on Twitch.

The survey was iteratively reviewed and revised, with support from colleagues in our department. It was then pilot tested with three participants, who were familiar with Twitch but did not necessarily experience a difficult period, so they were asked to imagine that they did. The survey was found to be clear during the pilot test, the only minor change that was made was to add a genre of games to the list of options (*battle royale*).

3.2. Participants

Participants were recruited through voluntary response sampling, by advertising the survey on various subreddits (r/Samplesize, r/Twitch, r/Mentalhealth, r/Greekgodx, r/Reckful, and r/Forsen), and Facebook groups related to Twitch. The survey was also retweeted by JJ Balderok, a Dutch game journalist with approximately 9,000 followers, and it was discussed in chat on several Twitch channels, which resulted in a streamer on the Belgian *Kayzr* channel (approximately 5,600 followers) discussing the research during their broadcast. Two selection criteria were communicated when advertising the survey, which were that participants needed to have been active as viewers on Twitch, and they had to have gone through, or were still going through, a difficult period in life. This may have resulted in a sample that is not representative of the Twitch viewership in general, however we deliberately chose these criteria because our main focus was on exploring if and how Twitch could be used as a coping mechanism, not on creating a quantitative overview of the number of people on Twitch that had experienced a difficult time.

A total of 128 participants started the survey. Out of these, six were deleted because they only provided answers to the questions about demographics, and did not complete the second part on their interactions with Twitch. Another nine were deleted because they showed satisficing behavior (i.e., straightlining), or because the replies to the open-ended questions included nonsense, were clearly trolling, or referred to memes. This is an inherent part of doing research online, especially in popular culture, and we were even warned that this might happen by some of the serious participants. Out of the 113 remaining participants, 84 completed the entire survey. For clarity and consistency, we included only these 84 participants when discussing the results.

All participants gave informed consent, and the research was approved by the Research Ethics and Data Management Committee (REDC) of the Tilburg School of Humanities and Digital Sciences, at Tilburg University. Participants were issued a random identifier at the start of the survey, which was used to pseudonymize the data. The data collection and storage procedures are compliant with the General Data Protection Regulation (GDPR). There was no compensation for participation in the survey.

3.3. Procedure

The survey could be opened and completed remotely, on a computer or on a mobile device. The first page introduced the study, and reminded participants of the inclusion criteria (they had to be users of Twitch, and have experienced a difficult period). After giving informed consent, the participants went through the four sections of the survey in the order as described

in section 3.1. Care was taken to ensure them that they could stop their participation at any time. It took participants 3–99 min to complete the survey, with an average of 16 min ($SD = 16$ min). One participant was excluded when measuring the completion time because they left the browser tab open overnight. After completing the survey, participants were thanked for their time, and were asked to leave their e-mail address if they would like to be contacted for potential follow-up questions. Because the questionnaire responses already provided rich and comprehensive data, we decided not to contact any participants. Following the example of Iacovides and Mekler (2019), the subreddit and Facebook pages where the survey was posted were monitored in case participants voiced any concerns, and the researchers also had regular debriefing meetings while analyzing the data.

3.4. Analysis

Due to the exploratory nature of the current study, no statistical testing was performed on the quantitative responses to the multiple choice and Likert scale questions. Instead, we use descriptive statistics and graphs to identify and illustrate patterns that occur in these data.

The responses to the open-ended questions were coded by two researchers, using a bottom-up approach. After coding the data independently, the resulting codes for each question were compared and merged into a final set, and the responses to the open-ended question were coded with this set. There were cases in which multiple codes applied, for example in the descriptions of the difficult times that participants went through, where there could be multiple elements to the difficult period (e.g., physical health problems and depression). In this case, we took an inclusive approach and assigned both codes, without making any assumptions about how different codes might relate to each other.

4. RESULTS

4.1. Demographic Information

Out of the 84 participants that completed the survey, nine identified as female, 73 as male, 1 as other, and 1 did not want to disclose this information. The average age was 23 years ($SD = 6$ years). Participants were from 30 different countries (1 unknown), with most participants born in the Netherlands ($N = 23$), the United States of America ($N = 10$), the United Kingdom ($N = 6$), Canada ($N = 5$), and Germany ($N = 5$).

4.2. General Video Game and Twitch Behavior

To get an overview of whether Twitch viewers consider themselves as being part of game culture, we asked them to indicate on a five-point Likert scale whether they define themselves as a gamer, whether others define them as gamers, and whether their friends are gamers. As shown in **Figure 2**, most participants consider themselves part of game culture.

We were also interested to see how big the role of Twitch is in people's lives. This was measured by asking how many hours per week, and on how many days of the week, people tend to watch Twitch. The results (see **Figure 3**) indicate that Twitch is

FIGURE 2 | Answers to questions investigating whether participants consider themselves part of game culture.

FIGURE 3 | Weekly viewing patterns on Twitch, in hours per week **(left)** and days per week **(right)**.
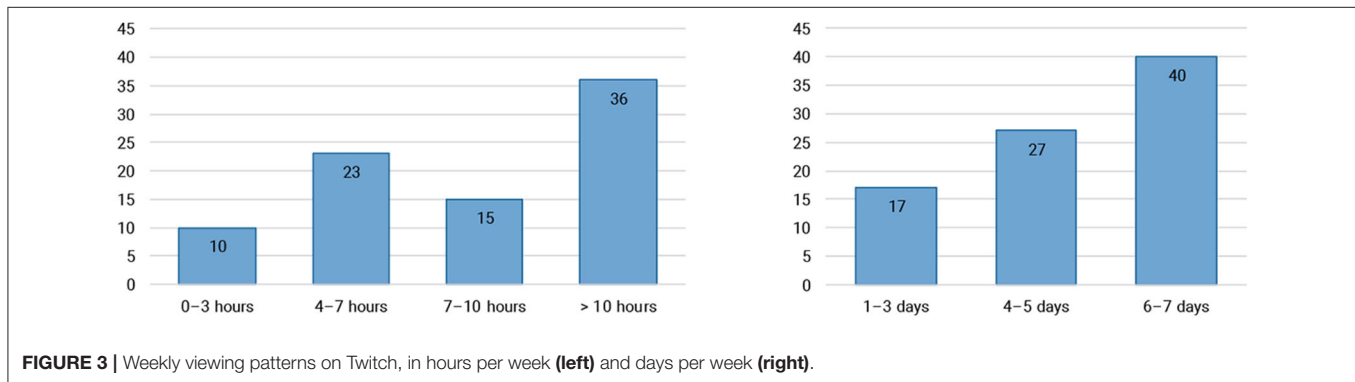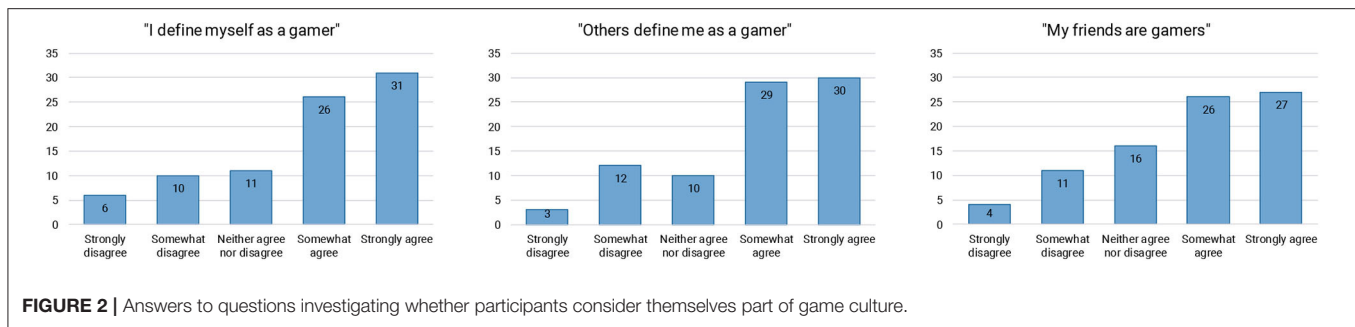
a common pastime, with the majority of respondents watching more than ten hours a week, spread across 6 or 7 days.

4.2.1. Motivations and Preferences for Watching

There is a broad range of different genres being broadcast on Twitch, so we asked participants which types of games they preferred watching (**Figure 4**). Two categories of streaming channels that are not directly related to gaming, *Creative* and *In Real Life*, were also included. Participants that assigned *Other* referred to collectible card games, low quality games, and live events such as LAN parties. Furthermore, three participants indicated that they choose which channels to watch based on the streamer, and not the game being played. We also asked whether the games that participants tend to watch on Twitch are the same as the games that they play themselves, with which 33 people (39%) either disagreed or strongly disagreed.

It appears that to several viewers, the streamer and their community are more important in keeping them engaged than the game that is being played. This is further supported by participants' answers to the question about their main reasons for using Twitch, shown in **Figure 5**. The main motivations for watching live streams appear to be entertainment, and the ability to follow streamers and become part of their community.

To test our assumption that people would prefer to turn to smaller, more intimate communities that allow for more personal interaction, we asked participants about their preferences regarding stream size. Based on literature (Hamilton et al., 2014), we distinguished between smaller streams (1,000 or less concurrent viewers), and larger streams (above 1,000 concurrent viewers). This baseline could then be compared with

their preferences during the difficult period in life. Seventeen participants (20%) indicated that they watched smaller streams, while 28 participants (33%) preferred larger streams, and the remaining 39 (46%) watched a combination of small and large streams.

Furthermore, we asked how often the participants watched male or female streamers. The possible answers were never, sometimes, about half the time, most of the time, always, or I don't know. Male streamers were watched at least about half the time by all respondents (1 indicated they did not know), where 77 participants (92%) indicated to spend most of the time or all their time watching male streamers. In contrast, 66 participants (79%) indicated to never or only sometimes watch a female streamer (1 indicated they did not know). However, these results should be interpreted with caution, because there is also a substantially larger number of male streamers on the platform. In other words, these results do not necessarily indicate a preference toward male streamers, they could simply be a result of female streamers being underrepresented on Twitch. If we look at the 9 female participants and 73 male participants in the study separately, we do see that 5 of the female participants (63%) watch female streamers at least half the time, while this only applies to 12 male participants (16%).

4.2.2. Interactions on Twitch

In the final part of this section, we inquired about the use of various features on the platform, such as the ability to chat with other viewers, and to interact with the streamer. All participants indicated that there was some degree of interaction between the streamer and the viewers, with 62 participants (74%) reporting

FIGURE 4 | Participants' preferred game genres to watch (they were able to select multiple answers).

FIGURE 5 | Main motivations for watching Twitch.
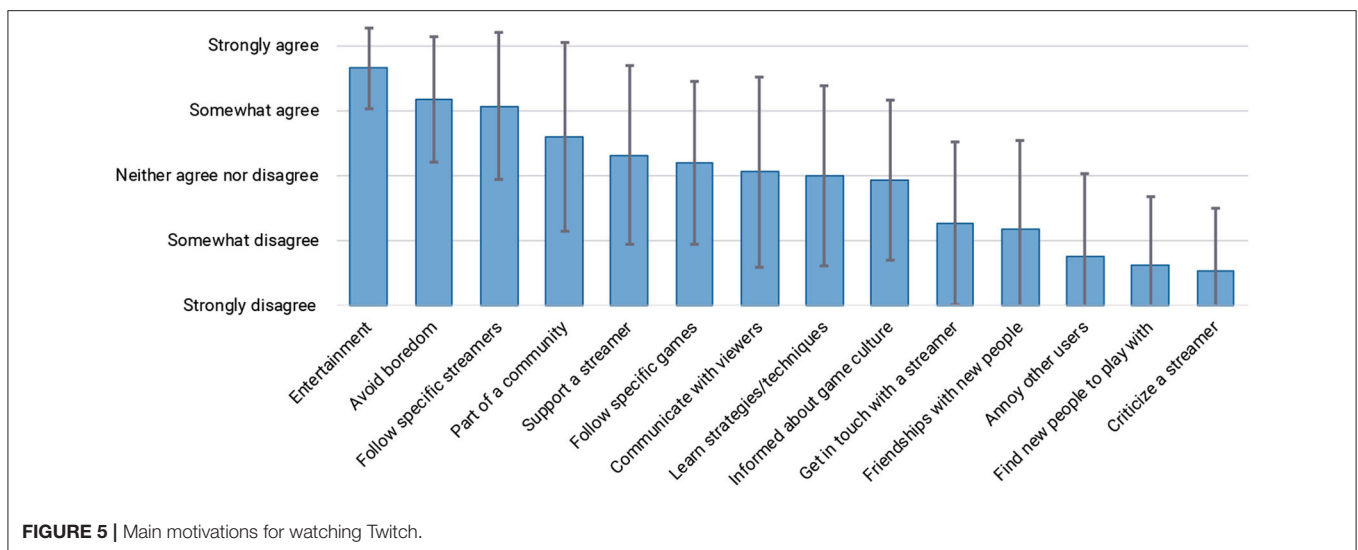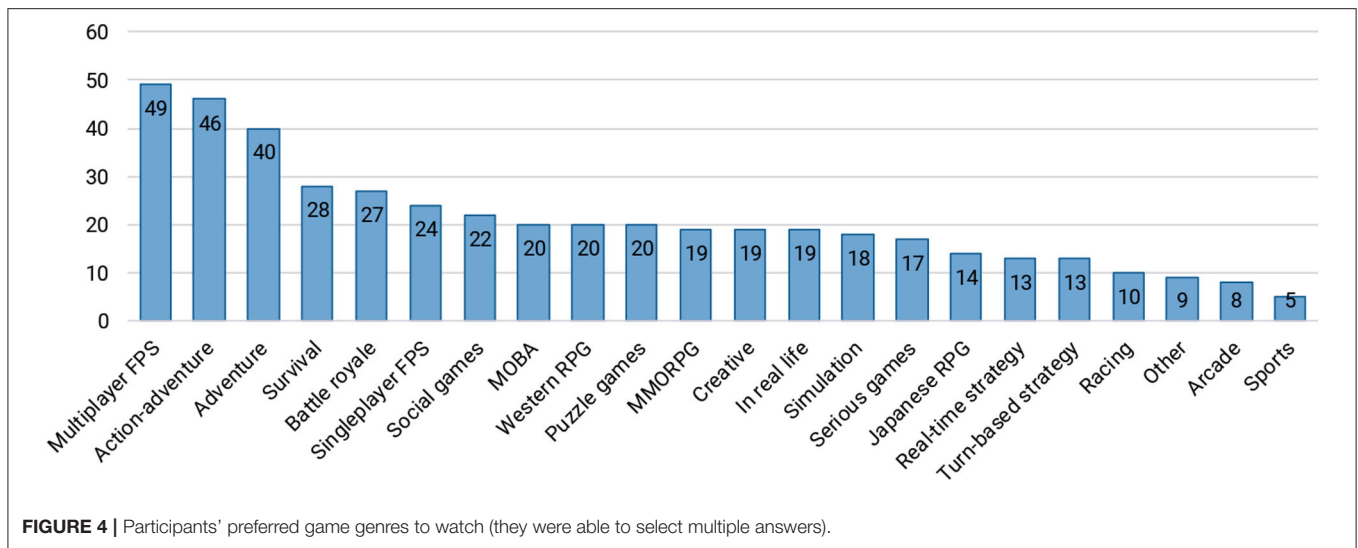
a lot of, or even constant interaction. However, the strength of their personal connection to the streamer was more diverse, with 19 participants (23%) reporting a very weak to weak connection, 38 participants (45%) considering their personal connection average, and 27 participants (32%) indicating a strong to very strong connection to the streamer. Regarding the interactions with other viewers, we asked participants how often they were reading the chat, and how often they wrote messages of their own. While the majority (64 participants, or 76%) indicated to read the chat either most of the time or always, only 35 participants (42%) actively participated themselves most of the time or always. Another 36 participants (43%) indicated that they never or only sometimes contribute to the chat. The reported personal connection to other viewers is similarly spread out as the connection to the streamer, where 26 participants (31%) reported a very weak to weak connection, 30 participants (36%) having an average connection, and 28

participants (33%) forming a strong or very strong bond with other viewers.

Finally, an open-ended question was included to find out what participants would usually do on Twitch, for example whether they were only watching, commenting on the stream, or talking about personal things. This also provided insight into the contexts in which people watch Twitch, as 34 participants indicated that they would at times have the stream on in the background, while they were in fact doing other things (eating, chores, playing games themselves). When participating in chat, 38 participants indicated that stream-related topics were discussed, while 17 participants also interacted about other things, such as details regarding their personal lives. Multiple participants mentioned spamming memes, such as typical Twitch emotes or catchphrases, as their contribution to the chat. One participant highlighted how it can be challenging to get a word in, if the chat is very active.
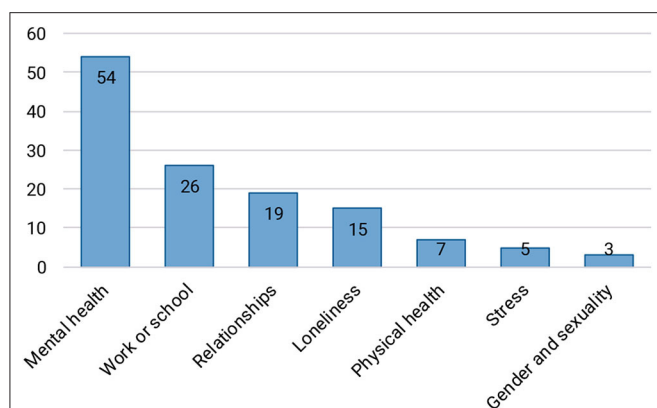
FIGURE 6 | Types of difficult periods encountered by participants. It is possible for one participant to have reported multiple categories. Relationships can refer to romantic partners, family, or friends.

4.3. Difficult Period

The survey continued by asking participants about the difficult period in life they had experienced. A definition of a difficult period was provided, after which participants were asked to recall and then categorize the difficult times they experienced. Several examples of these categories were provided, such as depression, relationship issues, and physical health issues. Subsequently, there was space to provide a more elaborate description of the difficult period, however this was not required. The answers to both open-ended questions were coded in order to identify recurring themes, and the number of participants that mentioned each theme is shown in **Figure 6**. Note that it was common for one participant to have experienced a combination of these codes. A large number of participants experienced a form of depression or (social) anxiety, often combined with—or triggered by—other difficulties.

How several factors can be interconnected, and how this difficult period can persist for a prolonged period of time, is illustrated by the following participant:

> I sometimes get depressed because of my medical problems that I've had to deal with since I was born. Which makes me have low self esteem. Which then makes it hard for me to socialize. Family problems, moving to different states & countries constantly and having to make new friends all the time etc. [...] (P82, 18, male)

The majority of the participants in the study were young adults, an age group that is characterized by several potentially impactful life changes, such as moving out of the parental home, romantic relationships becoming more serious, and transitioning to higher education or to working life. This could lead to stress or mental health problems:

> due to a new point in my schooling and moving out on my own but still being financially dependent on family, I've felt trapped within my new space. (P109, 20, female)

Thirty-nine participants (46%) indicated that they were currently still in this difficult period in life, while 29 (35%) no longer were. An additional 14 participants (17%) were unsure, and 2 (2%) did not wish to disclose this information. In the remainder of section 4, we do not distinguish between participants that were currently still in the difficult period in life, and those that were no longer in this period. However, it is important to keep in mind the variation in the nature of the difficult period, as well as the stage participants were currently in.

4.4. Twitch During the Difficult Period

Six participants did not watch Twitch during the difficult period in their lives, and were therefore not asked about any changes in their behavior on Twitch during the period. Instead, they were asked whether they thought Twitch could potentially be helpful in difficult times. Another nine participants did watch Twitch, but did not find it to be helpful. One participant illustrates this with an example:

> Finishing a master's degree comes with pressure. Twitch is the place to relax. By visiting Twitch I waste more time which should be invested in my thesis. Resulting into more stress, more twitch and so on... and so on... (P1, 24, male)

The same participant did indicate that, although Twitch was not helpful to them in this particular case, it could be helpful in dealing with difficult periods in general, because you can find people that are similar to yourself on the platform. We assume that, in the particular case of having to finish the master's degree, the most efficient way to get out of the difficult period was to commit to getting the work done, and Twitch would be an unconstructive distraction. Another participant expressed concerns about using Twitch to cope with difficult periods, as it may even exacerbate the problems that people are experiencing:

> Twitch is a dangerous source of "social" activity. Its ease of access can lead to cutting off with the real world. As a result of this risk, Twitch is not a good source of help during a difficult period in life. (P17, 26, male)

Most people, however, were positive about watching Twitch during their difficult period, as 29 out of the 69 participants that used Twitch during this time found it to be very helpful (42%), 20 participants (29%) found it to be helpful, and 20 participants (29%) found it to be somewhat helpful to them. We asked participants to explain what Twitch meant for them during their difficult period, and—optionally—to recall a specific situation when Twitch was particularly helpful to them. One participant, who was struggling with their own sexuality, remembered a specific event involving a monetary donation to the streamer by another viewer. In most streams, these donations can be joined by a text message, which is then often displayed automatically on the stream, without any moderation or intervention by the streamer. This particular donation contained a homophobic message, which was then instantly shut down by the streamer. In other words, the streamer publicly disapproved of this behavior, which left a powerful positive impression on this participant.
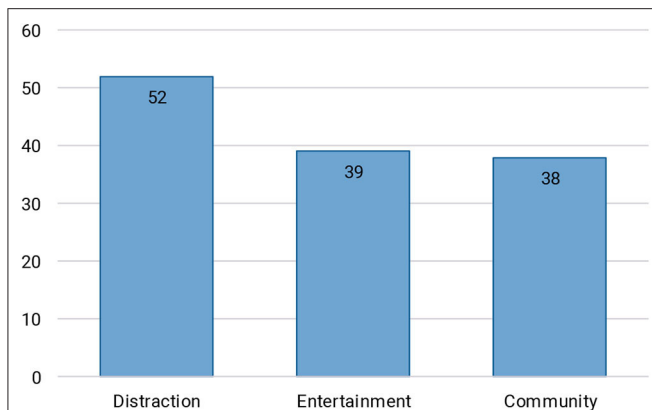
FIGURE 7 | The number of participants that mentioned distraction, entertainment, and being part of a community as the positive effects of watching Twitch during their difficult period. It is possible for one participant to mention more than one theme.

The answers to these two questions were analyzed and three main themes emerged, explaining the positive contributions of Twitch: distraction, entertainment, and being part of a community. **Figure 7** shows the number of times these themes were mentioned by participants. It was possible for one participant to talk about multiple themes. There were several gender-based differences regarding entertainment (mentioned by 61% of male participants and 38% of female participants) and community (mentioned by 54% of male participants and 63% of female participants), although with only eight female participants more research is needed to confirm these findings. Distraction was mentioned by approximately the same number of male and female participants (76 and 75%, respectively).

4.4.1. Distraction
For many participants, watching Twitch was a way to temporarily keep their mind off the difficulties they were facing. Watching a live broadcast was considered to be a stronger distraction than watching a prerecorded show:

> During many evenings I felt very anxious and could not calm down, I was afraid of nightmares in the night. Watching streams and just knowing the other person is really there talking at the moment helped much better to calm me down than just watching videos on YouTube (P107, 28, female)

The ability to communicate by means of spamming "copy/pastas," memes, or emoticons, is also seen as a way to distract oneself from negative thoughts:

> I made a copypasta on Avast's stream and chat liked it and copied it. It was a very happy moment where I felt proud of something, even if it was a stupid meme. It meant something to me. (P46, 19, male)

This spamming can be a method for viewers to share in an emotional experience with the streamer, for example when certain key events happen in the game (Hamilton et al., 2014). Even if it may not be a solution to their problems, being present in a community on Twitch, hearing someone speak and sharing the experiences made participants feel less lonely. For some, Twitch was something to look forward to in a time when they had little else to look forward to. Participants also mentioned that Twitch offered stability, as it was "[...] something constant in [their] life in a period where [they] felt everything is changing" (P107, 28, female).

4.4.2. Entertainment
A number of participants reported not only finding distraction in live streams, but also thoroughly enjoying, and being cheered up by watching them. Streamers as entertainers bring a positive attitude that inspires the viewers and provides them with a more optimistic outlook on life:

> I was stressed, didn't know what to do with my life, I just wanted to be alone all the time. Then I found tyler1 and greekgodx playing games together (overwatch, minecraft etc.) and their interaction always made me chuckle and brightened my day. I am forever thankful for that. (P54, 24, male)

Greekgodx in particular was lauded by several participants for his positive attitude, and his ability to make people laugh. In addition to the streamers' positive attitude, viewers get a sense of joy out of the community as a whole:

> The streamers that have a strong community and their own "inside jokes" and that just genuinely have a fun and entertaining streams. To name a few; forsen, xqcOW. (P90, 22, male)

4.4.3. Community
There are different ways in which viewers can get involved in the streamer's community. There are streamers that have sessions where they play games with viewers, or invite guests to participate in a talk show-like setting. Furthermore, streamers can also view and respond to the chat, and they tend to acknowledge donations or people subscribing to their channel on stream. Several participants indicated that Twitch can serve as a safer, less stressful environment for social interactions:

> It definitely gave me a feeling of positivity and having a community. It feels like you are hanging out with the streamer but not having the social pressure that you usually have when you hang out with friends etc. (P90, 22, male)

In most responses to these open-ended questions, there was a clear distinction between the real and the virtual. At the same time, some participants indicated that by engaging in social interactions online, in relative anonymity, they experienced personal growth that transferred into real life:

> Talking to people helped a lot with my social anxiety. As I mentioned, even the simplest interactions could stress me out. As I started interacting with the streamers I liked to watch and chatting to the other viewers, I found myself growing more comfortable with talking to strangers and being myself online as

well as in real life. It's a wonderful distraction too, and something to look forward too which can motivate me throughout the day. Belonging to a community is definitely a big part of it as well. (P103, 19, female)

One participant specifically mentions the use of the *offline chat*, a design feature that we had previously not considered in this research. When streamers are not broadcasting, their page and the chat remain active. This allows visitors to interact with each other, and be an active part of the streamer's community, even if the streamer is not around. It also enables popular streamers to provide not only entertainment and distraction through their live broadcasting, and through fast-paced interactions in the chat (e.g., spamming), but also to build a tight-knit community with more in-depth, serious conversation using the offline chat and other platforms such as Discord or social media. Several participants found a community in which they felt comfortable discussing personal matters, and were able to receive emotional support in return. At times, it is even the streamer who opens up about their own difficulties first:

> I'm not going to name the streamer because they were talking about their problems during this stream, but the way they expressed completely matched how I was feeling. I was surprised that there was someone else feeling what I was feeling, but then people in chat started to step forward and claimed they also felt the same way. Some got passed the "feeling" they had and shared what worked for them and even offered to be a line of emotional support if needed later. (P48, 22, male)

Another participant mentioned a format that was introduced by popular streamer Pokimane, called *Dr. Poki*. In these segments, Pokimane invites viewers to "call in" (through voice chat), to discuss their real life issues with her on stream. At the same time, memes and jokes are being posted in the chat in rapid succession, which adds a light-hearted touch to the otherwise relatively serious talk happening on stream. In addition, people felt accepted by the communities on Twitch:

> [...] it's really nice to know that somewhere, even though it's somewhere that doesn't exist physically (a chatroom) I can still feel accepted even if I don't feel accepted into society at large (P113, 22, did not wish to disclose).

4.4.4. Changes in Viewing Behavior

In order to investigate whether Twitch became a bigger part of participants' lives, we asked them whether they thought they spent more, less, or an equal amount of time watching Twitch during the difficult period in their lives, compared to their viewing behavior outside of this difficult period. Fifty participants (72%) indicated that they spent at least a little more time watching Twitch (1 did not recall). Furthermore, based on the assumption that it is easier to find emotional support in smaller communities, we repeated the previous question about participants' preferred stream sizes, now during the difficult period. However, there was no significant shift in preferred stream sizes compared to general viewing behavior (22% small streams, 38% large streams, 40% both sizes). There was also no change in the amount of

time participants spent watching female streamers compared to male streamers. In general, it appears that participants kept watching the same streams during the difficult period that they were already watching outside of this period.

Participants also did not report a stronger personal connection to other viewers ($M_{dif} = 0.13, SD = 0.77$ on a five-point Likert scale), nor to the streamer ($M_{dif} = 0.13, SD = 0.97$) as they were going through their difficult period. For the eight female participants in our study, this increase in the strength of the personal connection with other viewers ($M_{dif} = 0.38, SD = 0.74$), and with the streamer ($M_{dif} = 0.38, SD = 0.52$) was larger than for the male participants. The perceived amount of interaction between the streamer and the viewers did not increase ($M_{dif} = 0.07, SD = 0.71$). However, although participants did not send more messages to chat than before ($M_{dif} = -0.03, SD = 0.82$), they did indicate reading chat more during the difficult period ($M_{dif} = 0.20, SD = 0.70$). This may be caused by a shift toward more active viewing, rather than having a live stream on in the background.

5. DISCUSSION

We set out to explore whether live streaming platforms such as Twitch could offer support for viewers going through difficult times, such as relationship issues, the death of a loved one, or job loss. A survey containing multiple choice questions, rating scales, and open-ended questions was created and distributed through a number of channels related to gaming and Twitch live streaming. Eighty-four participants contributed by completing the entire survey and provided us with rich and extensive descriptions of their experiences. It was impossible for us to tell all of their stories, but we hope to have provided a clear impression.

Before discussing the nature of the difficult period, and how Twitch had potentially provided support during this period, we asked several questions about the participants' general experiences with live streaming. We found that most participants consider themselves to be part of game culture, and that they spend a substantial part of their time watching Twitch. The main motivation for watching Twitch is to be entertained, and to follow specific streamers and to be part of their community. We found that the streamer and their community are more important than the game that is being played (cf. Deng et al., 2015; Gandolfi, 2016; Anderson, 2017). This was further supported by the fact that many participants indicated that they watch different game genres than the ones they actually play themselves. Furthermore, most of the streamers that the participants watched tend to interact frequently with their viewers, for example by addressing their comments in the chat. These findings regarding Twitch viewing behavior are generally consistent with the survey by Gandolfi (2016). We did find that participants in our study spent more time watching live streams, compared to the findings in Gandolfi (2016). This could be due to differences in recruitment strategies—we recruited mostly in Twitch-related networks, while Gandolfi (2016) recruited in game-related networks—or due to the rise in popularity of Twitch over the past years.

Most participants either prefer to watch larger streams (of at least 1,000 concurrent viewers), or a combination of larger and smaller streams. The majority of streamers that were mentioned in the answers to open-ended comments as having played an important role for participants during their difficult times— e.g., Lirik, Forsen, xQcOW, Pokimane, and Greekgodx—are popular streamers with over 1,000 viewers. Male streamers are more commonly watched than female streamers, although this could be due to the larger number of male streamers present on Twitch. It did seem to be the case that female participants in our study watched more female streamers than the male participants did, however with only nine female participants we cannot draw strong conclusions. The skewed gender distribution in our sample is a result of the voluntary response sampling approach combined with the over-representation of viewers that identify as male on Twitch (Nakandala et al., 2017). In future work we are interested in specifically studying differences in viewing behavior, effects, and preferences based on gender. There were large individual differences in how strong the perceived connection with the streamer and with other viewers was. An interesting finding was that a number of people used Twitch as something to have on in the background while they engaged in other activities such as playing games themselves, or completing various chores.

After learning more about the participants' Twitch viewing behavior, we made an inventory of the types of difficult periods they had encountered, and found that the majority of cases were related to problems with mental health. The difficulties were often complex and long-term, which we assume is why most participants (46%) were still going through this difficult period when they completed the survey. A vast majority of participants (82%) found Twitch to be at least somewhat helpful during their difficult times. Perhaps as a result of this, they also reported spending more time on Twitch while experiencing these difficulties. Other than increasing their time investment, participants' viewing behavior did not change much. Although we expected that it would be possible to get more emotional support in smaller streams, it appears that people prefer to stay with the streamers that they were already watching before they were going through a difficult time. We also discovered several ways for larger communities to tap into some of the advantages of smaller communities, such as using offline chat and other communication platforms outside of Twitch, or featuring viewers on the stream (e.g., by playing games with them). At the same time, smaller communities still appear to provide more in-depth conversation and possibilities to interact with the streamer, and some participants indicated that they shift their viewing behavior based on their needs:

> Either watching LIDL[8] games with Forsen for entertainment or spending times in smaller communities and talking with other viewers and the streamer (P96, 23, male)

One additional, subtle change in viewing behavior we observed was that participants reported reading the chat more while they

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[8]Low budget games, a term coined by streamer Forsen.

were experiencing their difficult time, compared to their general Twitch behavior. We believe this might be an indication that they started spending more time actively watching, rather than having the stream on in the background.

Out of all of the participants' reports on how Twitch was helpful to them during their difficult times, we distilled three main themes: distraction, entertainment, and community. Much like when actively playing games (Iacovides and Mekler, 2019), watching live streams can keep your mind off the difficulties. This can be done by immersing oneself in the streamer's gameplay, or by engaging with the streamer and the chat, even if simply by spamming memes. Participants also reported events of being entertained, and seeing their mood improve by watching live streams. This stems mostly from the commentary and behavior of the streamer and other viewers. Finally, by becoming part of a streamer's community the viewers were able to reduce their feelings of loneliness, get a sense of belonging, engage socially with others, and in some cases even talk openly about their struggles. A main advantage of online communities such as those on Twitch, compared to socializing offline, is that viewers get to choose to what extent they want to hold on to their anonymity, and how much they self-disclose. There is less pressure, and fewer expectations:

> The idea of being apart of a community of people anonymously and not having to talk about myself and everyone being okay with how little/much they shared about themselves. I guess I looked forward to log on twitch and see everyone again. (P48, 22, male)

These three themes—distraction, entertainment, and community—align well with coping strategies that people use in general when dealing with difficult times (Folkman and Lazarus, 1984). The majority of coping strategies used on Twitch appear to be emotion-focused, mostly adaptive, with some problem-focused strategies such as practicing social skills as well. As one participant did note, there are situations such as having to finish schoolwork in which Twitch cannot serve as an adaptive coping mechanism, and instead poses a risk of distracting people from the task at hand. Literature has also shown that there are individual differences regarding the preferred coping strategy, for example based on gender (Ptacek et al., 1994). Although we see some hints toward differences in the use of Twitch as a coping mechanism based on gender (e.g., female participants watching more female streamers, and reporting more social benefits and a stronger connection to other viewers and streamers during the difficult time, compared to male participants), future research with a more balanced sample is needed to verify these phenomena. It appears that with the ability to distract, entertain, and provide social connections, Twitch streaming has something to offer for most people, and it is possible to seek out particular streamers based on one's preferences. For example, those looking for a larger degree of interaction with the streamer could seek channels where the streamer acts as a companion, while those wanting to be distracted by expert game play could opt for streamers that take on the role of a professional (cf. Gandolfi, 2016).

Although we did not specifically investigate the nature of the relationship with the streamer, it does appear that wishful identification and parasocial relationships occur between viewers and streamers, as reported in Lim et al. (2020). For example, one participant mentioned living vicariously through the streamer, and it has become clear from our studies as well that viewers tend to be loyal to particular streamers and their communities, which was also found by Wohn et al. (2018). Several researchers indicate that learning how to play, or get better at certain games is a motivation for watching a stream (Hamilton et al., 2014; Lim et al., 2020), although this motivation did not score highly in the present study. Lim et al. (2020) indicate that this is a form of observational learning, a process in which one learns by observing a (role) model (in this case, streamers) exhibit a behavior (a game play strategy) and the response they receive in return (e.g., a reward in the form of victory or score points) (Bandura, 2001). We postulate that observational learning might also happen with streamers' social behavior, and their approach to managing their own mental well-being. Several streamers have been through a difficult period themselves, and the job of being a streamer can be stressful (Johnson and Woodcock, 2017; Johnson, 2018). Therefore, we believe that streamers, especially those that self-disclose about their own struggles, can serve as a role model for viewers and facilitate observational learning of skills other than gaming. In the future, we would like to look deeper into the nature of this relationship between a streamer and their viewers. As one of the participants in the study also indicated, there is a risk that the relationships with the streamer and with other viewers on Twitch become a replacement for genuine, real world relationships with others. However, several people indicated that, due to their depression or anxiety, it was simply impossible for them to build and maintain these real world relationships. For these people, Twitch was a way to have at least some form of a social connection, and in some cases it even served as a safe environment for practicing social skills, which helped build the confidence and comfort to start engaging in real world interactions again. In addition, the participants in our study seemed well aware of the difference between the virtual and the real world, and the one-sided nature of the relationship between themselves and the streamer.

To summarize, we discovered that people did find support on Twitch during difficult periods in their lives. This support tends to come in the form of distraction, entertainment, and being part of a community. These elements are inherent to Twitch as a platform, and to the content that is provided by streamers. As a result, we do not see a large shift in viewing behavior as viewers go through a difficult period, other than an increase in viewing time and a tendency toward more active rather than passive viewing. There are subtle design elements of Twitch (e.g., offline chat), and ways in which streamers behave (e.g., interacting with viewers, providing, and upholding community values) that further enhance the supportive role of Twitch. It is important to reiterate the exploratory nature of the current study. The use of a retrospective self-report comes with certain advantages (e.g., anonymity and richness in information of responses), but also has its limitations, including various biases and inaccuracies such as socially desirable responses and

a tendency to agree with what is stated or asked (Paulhus and Vazire, 2007). It is also possible that participants' self-reported experiences and time spent watching were subject to negativity bias (Rozin and Royzman, 2001), or that their capacity for accurate reporting was affected by their current mental state, since approximately half of the participants were still going through a difficult period when filling out the survey. At the same time, watching Twitch could lead viewers to reach a flow state (Csikszentmihalyi, 2000), which could make them understate the amount of time spent. The study can—and should—therefore be complemented with other approaches, such as longitudinal studies, to provide a more accurate description of the relationship between viewers' behavior on Twitch and their emotional state. In addition, it would be interesting to study more deeply the interactions that happen on live streaming platforms, e.g., by means of observations. The strength of the current approach lies in the multitude of potential future research avenues inspired by the qualitative accounts of our participants' experiences, and in the fact that it provided us with insight into the participants' personal lives, including thoughts and feelings that would likely not have been disclosed in observations of live streaming sessions.

6. CONCLUSION

Our aim with this study was to create a more elaborate understanding of the behavior of existing Twitch viewers, and how this may change during difficult times. It is clear from our research that streamers, supported by platforms such as Twitch, do serve an important purpose for people that are active on the platform and are going through a difficult time, even without consciously attempting to do so. They do this by providing a distraction through entertainment, maintaining a positive attitude, and building a tight-knit community around themselves. The majority of Twitch viewers is at an age where they can encounter a number of important life events, which can cause stress and difficulty coping. It is also a demographic that is unlikely to seek out professional help when needed. We have to keep in mind that the interactions that happen on Twitch are not a replacement for any kind of professional support. At the same time, we do believe that the streamers and viewers active on Twitch are able to contribute to mental health awareness and literacy, and hope that they are able to remove some of the obstacles that prevent people from seeking out additional help when needed.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because, due to privacy considerations and the sensitive nature of this topic, participants were not asked to give consent for publishing the raw data. Requests to access the datasets should be directed to Jan de Wit, j.m.s.dewit@tilburguniversity.edu.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Research Ethics and Data Management Committee (REDC) of the Tilburg School of Humanities and Digital Sciences, at Tilburg University. Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

JW, AK, and JT designed the study. AK and JT performed data collection and analysis, and each wrote a master's thesis on this research. JW reviewed both theses and compiled them into a first version of the manuscript, which was then reviewed by AK and JT. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.586975/full#supplementary-material

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Customizing Your Demons: Anxiety Reduction via Anthropomorphizing and Destroying an "Anxiety Avatar"

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Character customization is a prominent feature in digital games, affording users the ability to tailor one's virtual self-representation (avatar) to match aspects of their actual or ideal self, influencing psychological well-being. The mental health implications of character customization can be partially explained by self-discrepancy theory, which argues that achieving congruence with one's avatar reduces cognitive dissonance. However, the role of undesirable self-concepts such as mental health ailments have largely been overlooked in this context despite forming part of one's identity. In theory, customization of an avatar representing undesirable self-concepts presents a self-regulatory paradox: individuals desire to reduce discrepancies with a self-representation, yet they also desire to enlarge discrepancies with a disliked-self. To reconcile this, two experiments explored the psychological implications of imbuing avatars with undesirable self-concepts. In Study 1 ($N = 90$), participants customized an avatar to represent anxiety within themselves (i.e., an anxiety avatar). Customization significantly reduced state anxiety compared to a control group, supporting the proposed discrepancy-reduction mechanism. Study 2 ($N = 122$) employed a 2 (customization: yes, no) × 2 (destruction: yes, no) between-subjects design, with participants either destroying or observing an anxiety avatar. Destruction of customized anxiety avatars resulted in the largest reduction in anxiety among all conditions, supporting the proposed discrepancy-enlargement mechanism. Theoretical and practical implications for the use of avatar-based e-mental health interventions are discussed.

Keywords: customization, avatar, anxiety, self-discrepancy theory, anthropomorphism, mental health

INTRODUCTION

In 2016, United Kingdom-based illustrator Toby Allen's "Real Monsters" series depicted mental health ailments (e.g., anxiety) as anthropomorphic, or humanlike, creatures. The artwork received widespread publicity on various online communities for raising awareness of mental health issues. However, despite being lauded by these communities, some commenters expressed desires to visually modify the creatures to better align with their unique conceptualization of each disorder (Reddit, 2017). This reaction can be explained via two important phenomena in mental health scholarship. First, individuals actively seek self-congruence by reducing discrepancies between how they see themselves and how their self-concepts are ultimately portrayed (Gonnerman et al., 2000).

Second, despite psychological research focusing largely on congruence with desirable aspects of the self, mental health ailments ultimately form part of one's self-concept as well (World Health Organization [WHO], 2001). Taken together, Allen's series exposes a seemingly counterintuitive psychological phenomenon: Human desire for self-congruence may extend to even the most undesirable aspects of the self.

Self-congruence is increasingly being sought after, and achieved, within digital games and online virtual environments (VEs), where users' identities are visually represented by avatars, or 3D virtual self-representations (Bailenson, 2018). As a digital incarnation of the user's self-concept(s), an avatar (or virtual self) is composed of visual attributes that reflect parts of the user's identity; often an idealized incarnation of the self (Jin, 2012). Because the virtual self is integral to one's identity, self-avatar congruence has been shown to lead to psychological outcomes akin to those elicited by self-congruence in the real world. For example, avatars resembling a user's ideal self has been shown to influence self-appraisals (Kim and Sundar, 2012). As a result, users actively manage their virtual selves to be in line with their unique identity standards and minimize undesired deviations between the self and the avatar.

To achieve self-avatar congruence, avatars are often tailored by the user to project salient visual cues (e.g., avatar height, race) related to some aspect of the self (Bailenson, 2018), a process known as customization (Kalyanaraman and Sundar, 2006). Customization contributes to self-avatar congruence by allowing customized objects (e.g., avatars) to reflect desired aspects of the user's identity (Franke et al., 2010; Kim and Sundar, 2012). This heightened congruence, enabled via customization, has been shown to positively influence attitudes (Van Der Heide et al., 2013) and overall well-being (Fox et al., 2009).

The affordance of customization is a major draw of modern digital games, primarily because it provides users with access to ideal aspects of the self (Przybylski et al., 2012). Consequently, users seldom customize avatars, or any self-referencing content, to represent undesirable aspects of the self (Marshall, 2008; Dunn and Guadagno, 2012). Indeed, attractiveness of an avatar contributes toward the user's connection with the character, which in turn contributes to participation in virtual communities (see Kim et al., 2012). This human proclivity for conveying the idealized self in virtual worlds, coupled with the ubiquity of customization interfaces within VEs, has relegated virtual identity research to focus on actual and desirable self-concepts (e.g., Jin, 2012; Kim and Sundar, 2012). However, given the importance of undesirable self-concepts in identity formation, emerging ethnographic research suggests there are benefits to achieving congruence with an avatar representing undesirable aspects of one's identity.

Users of popular VEs such as Second Life (SL) are increasingly creating avatars that convey less desirable, but no less integral, self-concepts (Stewart et al., 2010). For example, Bloustien and Wood (2013, 2016) recent work identified a growing segment of SL users creating avatars that exhibit their physical disabilities (i.e., avatars representing the disabled self-concept). Where creating an avatar representing the disabled self can be beneficial to the user by fostering self-worth (see Dunn and Burcaw, 2013

for a review of disability identity), the implications of creating an avatar rooted in undesirable, mental health-related self-concepts (e.g., anxiety) remain ambiguous. Furthermore, should benefits arise from achieving congruence with an avatar imbued with undesirable self-concepts, mechanisms driving such effects are largely unknown. Thus, this paper seeks to explore the effects of imbuing avatars with a wholly undesirable, mental health-related self-concept: anxiety. Anxiety is particularly germane to this investigation due its classification as the most prevalent health-related self-concept, and a common ailment among users of VEs (Lo et al., 2005; Mehroof and Griffiths, 2010; Anxiety and Depression Association of America [ADAA], 2017).

Assuming individuals could tailor an avatar to represent an undesirable self-concept, such as the anxious self, this would present a unique conundrum in terms of affective outcomes due to competing mechanisms at play. On the one hand, the avatar may serve as an emotion-laden cue representing a negative affective state (e.g., anxiety) in its most accurate form, facilitating negative responses (i.e., anxiety thoughts) (Lilienfeld et al., 1993). Conversely, creating a more self-congruent avatar both reduces discrepancies and affords the user an increased sense of control (Marathe and Sundar, 2011), subsequently contributing to positive responses (e.g., favorable attitudes) (Carver and Scheier, 1983). These competing mechanisms pose an important theoretical query: what are the emotional and psychological effects of customizing a virtual avatar representing an individual's anxious self-concept?

Another equally important question is whether the effects of self-avatar congruence are contingent on user-avatar interactions, or whether the affordance of mere customization suffices. Put differently, can specific interactions with a customized avatar representing an undesirable self-concept augment the effects of self-avatar congruence? Research suggests that, despite a natural inclination to reduce discrepancies with a reference value, people may also wish to engage in behaviors to distance themselves from a "feared or disliked possible self" (see Carver et al., 2000, p. 743). One such behavior may be the destruction of the avatar itself. Experiments have shown that positive evaluations of a created object dissipate upon its destruction (Norton et al., 2012). In this way, just as customization can foster congruence, destruction of a customized anxiety avatar may increase the discrepancy between one's actual self and a negative reference value (e.g., feared or disliked possible self). Such a reappraisal, one which detaches the self from a target stimulus, has been shown to engender positive emotional responses (Kalisch et al., 2005).

The aforementioned questions ultimately emphasize the potentialities associated with customizing a virtual avatar representing one's anxious self-concept, namely the emotional and psychological effects. To begin to address the aforementioned questions, we conducted two experiments examining avatar customization in a novel context, focusing on the affective responses to customized avatars representing the anxious self (henceforth referred to as an "anxiety avatar"). Study 1 tests whether customization of an anxiety avatar reduces negative affect (i.e., anxiety reduction) by reducing the difference between the user's anxious self-concept and its virtual representation (i.e., discrepancy reduction). Conversely, Study 2 explores

how destruction of a customized anxiety avatar may reduce negative affect by increasing the difference between the user's anxious self-concept and its virtual representation (i.e., discrepancy enlargement).

Drawing on human–computer interaction (HCI) research and self-conceptual frameworks, this paper seeks to make several contributions. First, we address the gap in the literature by exploring self-avatar congruence in the context of undesirable self-concepts. Second, in doing so, we also assess boundary conditions of customization effects, which have largely been studied as positive consequences resulting from matching content to desirable aspects of the self. Lastly, we seek to establish the viability of avatar-based self-regulatory strategies for anxiety management, many of which can be seamlessly integrated into existing character customization interfaces across a wide swath of digital games. In the following section we examine pertinent literature, provide a review of the studies' methodology and results, and conclude with a discussion on theoretical and practical implications.

LITERATURE REVIEW

The Virtual Self

The virtual self is conceptualized as the projection of self-concepts onto virtual avatars (Yee and Bailenson, 2007), which are graphical embodied representations of the user within VEs. Self-concepts function as a sum of a person's beliefs and knowledge about their unique personal qualities and attributes (Mann et al., 2004), a schema storing concrete and abstract views about the "self" (Markus, 1977). Thus, the virtual self serves as "an object with certain properties" (Clegg, 2013, pp. 201–202), properties which can include both desirable and undesirable aspects of one's identity (e.g., anxiety) (World Health Organization [WHO], 2001, p. 14). In this regard, avatars "provide access points in the creation of identity" (Taylor, 2002, p. 40), and perpetuate a consistent user identity (Peachey, 2010). Avatars also function as a rhetorical device (Kolko, 1999), with physical and psychological self-concepts outwardly communicated through salient cues embedded within the avatar (Schultze, 2010). In this way, avatars allow the user to explore different identities and project self-concepts onto avatars, transforming VEs into "social laboratories for identity study" (Peachey, 2010, p. 37).

Self-Discrepancy Theory

The self, virtual or otherwise, is delineated across three basic domains: the actual, ought, and ideal self. The actual self is comprised of the representation of attributes that you and others believe you possess. The ought self is the representation of attributes that one believes they should possess. Lastly, the ideal self represents attributes that one would like to possess – an idealized self (see Higgins, 1987). Given the natural inclination for users to match avatars to their ideal or desirable self-concepts (Dunn and Guadagno, 2012), ideal self-concepts comprise the lion's share of virtual identity research (e.g., Mancini and Sibilla, 2017; also see Nowak and Fox, 2018). The prominence of

idealized self-representations is evident in VEs such as *World of Warcraft* (WoW), a popular massive multiplayer online role-playing game (MMORPG). In such VEs, users seldom create avatars that reflect "undesirable" aspects of the self, such as being short or obese, primarily because they do not align with the user's idealized self (Ducheneaut et al., 2009).

Higgins (1989) self-discrepancy theory (SDT) presumes individuals actively manage (virtual) self-perceptions to be in line with their unique identity standards, a process known as self-regulation (Burke and Stets, 1999). That is, users respond to salient discrepancies between the self and a reference value (e.g., a virtual avatar) by engaging in behaviors that reduce discrepancies with the reference value (Carver and Scheier, 1990, 2004). This is important because discrepancies between and among self-concepts have been shown to relate causally to psychological well-being in experimental (Higgins et al., 1985) and longitudinal studies (Strauman, 1996), and can lead to psychological distress (Schafer et al., 1996).

Customization and Self-Regulation

Given that humans seek congruity with their self-representations, virtual or otherwise, users may engage in discrepancy reduction within VEs by tailoring the appearance of their avatar to align with a particular self-concept. By means of a computer interface, individuals may modify the appearance of an avatar, imbuing it with desirable traits (e.g., using a tall avatar when the user is short), and aligning the virtual self with their ideal self (Bessière et al., 2007). This process of tailoring the avatar's appearance to a desired form is known as customization (Dunn and Guadagno, 2012; Kalyanaraman and Wojdynski, 2015). As a user-initiated process, customization relies on user decisions which result in changes to, and control over, the content (Kalyanaraman and Sundar, 2006). Customization ultimately ensures that any object, virtual or otherwise, is infused with some aspect of the self (Marathe and Sundar, 2011). In doing so, research has consistently shown that customized content, be it game characters or web content, is evaluated more favorably and is ascribed greater value and importance when users are involved in its creation (see Kalyanaraman and Wojdynski, 2015).

While the effects of customization are robust, a methodological oversight continues to prevent a more nuanced understanding of how, and to what extent, matching content to the self can benefit an individual. Consider the typical experimental scenario used in any empirical investigation of customization: one group customizing a self-referencing object (e.g., an avatar) is compared with a control group who is assigned the self-referencing object. Regardless of the research question or dependent variables, the customized object is almost always tailored to reflect the ideal or actual self (e.g., Dolgov et al., 2014; Kim et al., 2015; Birk et al., 2016). This may be an experimental artifact, though its appearance is not limited to controlled lab settings, as surveys distributed across multiple VEs also reveal that a grand majority of customized avatars are rooted in an idealistic self-view (e.g., Turkay and Adinolf, 2010). That is, customization is largely studied as a process used to match content to actual or idealized aspects of the individual, overlooking other self-concepts are equally important in the

construction of the self. Indeed, users have a tendency to project important aspects of one's identity onto their avatars (e.g., Vasalou and Joinson, 2009). Yet, concentration on idealized self-concepts, particularly among communication scholars, presents a potential theoretical and empirical blind spot. While seemingly counterintuitive, matching content to undesirable aspects of the self merits investigation and may indeed already be occurring within modern VEs. Qualitative research suggests that individuals use customization interfaces to circumvent the normative tendency to build the ideal virtual self, opting instead to imbue avatars with less socially desirable self-concepts. For instance, Bloustien and Wood (2013) found that users of SL often imbue their avatars with physical disabilities as exhibited by use of virtual wheelchairs or prosthetic limbs. Ultimately, this use of avatar customization raises a unique series of questions: if humans benefit from imbuing avatars with qualities related to their physical disorders, can the same be said for mental health-related disorders? If so, is discrepancy reduction a potential mechanism driving this phenomenon?

The Anxious Self

Despite extant identity research focusing on the three basic domains of the self, self-theorists acknowledge that the self extends beyond the actual, ought, and ideal (Gonnerman et al., 2000). For example, mental and physical health disorders can form part of an individual's identity despite such disorders typically being viewed by the afflicted as negative or undesirable (see Larson et al., 1984). More specifically, Tregaskis (2002) articulated the "disabled self" as an encapsulation of mobility trauma within the individual, while Price et al. (1994) proposed the "depressed self" as the integration of depression into one's identity. The present study focuses on the inclusion of anxiety into one's self-concept (Schmukle and Egloff, 2006) and the affective implications associated with projecting this "anxious self" onto an avatar.

Anxiety is an internalized mental disorder characterized by a sense of vulnerability and tendency to respond fearfully to stressors (McNally, 1989), as well as psychological distress due to expectation of negative outcomes (Epstein, 2013). Psychologists divide anxiety into trait and state anxiety (Spielberger et al., 1970). The former describes one's propensity to experience anxiety, whereas the latter is situational and short-term (Rule and Traver, 1983). This investigation focuses exclusively on state anxiety, as opposed to depression or other mental health ailments, for two reasons. First, state anxiety is both common and easily evoked, having been experimentally induced in a variety of psychological studies (e.g., Richards et al., 1992; D'Argembeau and Van der Linden, 2004). Second, state anxiety is transient and reactive to external factors (see Moser, 2007). Because of this, an investigation into anxiety provides high internal validity, as changes in state anxiety can be more clearly connected to experimental manipulations.

The pervasiveness of human anxiety, and its evident role in identity formation, also prompt inquiry into how depictions of one's anxious self may influence psychological well-being. As previously mentioned, the anxious self, and other "less cherished aspects of the self" (Thoits, 2013, p. 361), form part

of one's identity (World Health Organization [WHO], 2001). SDT argues that humans seek to minimize differences between a self-concept and its reference value (an exemplar) via self-regulation. Indeed, audiences have vocalized similar desires to modify depictions of anxiety in film (Olstead, 2002) to align with their unique conceptualizations (see Hoffner and Cohen, 2012). Should the principles of SDT hold for undesirable self-concepts, a discrepancy between how one views his/her anxious self and how it is portrayed would elicit a similar urge for self-regulation.

Anthropomorphizing Anxiety

Conveyance of psychological or emotional self-concepts onto avatars, while absent of overt cues associated with physical disabilities (e.g., wheelchairs, prosthetic limbs), can also be facilitated via customization. Specifically, the ability to assign human qualities (e.g., personality) to objects, virtual or otherwise, is defined as anthropomorphism (DiSalvo and Gemperle, 2003). Scholars in various domains have acknowledged that individuals have an anthropomorphic tendency to imbue human attributes onto non-human entities (Reeves and Nass, 1996). This anthropomorphic tendency extends to descriptions of natural phenomena (Legare et al., 2013), with humans often personifying undesirable self-concepts. For example, diseases may be referred to as "powerful monsters," (Mukherjee, 2010, p. 45) or "emotionless aliens" (Hitchens, 2014, p. 11) by the afflicted. Similarly, cancer patients have been known to anthropomorphize their disease in a similar fashion (see Jain and Lynch, 2011). It can thus be argued that the anxious self can be anthropomorphized via avatar customization.

Contrary to the self-congruity hypothesis, which maintains that individuals seek congruence with idealized self-representations (Grubb and Grathwohl, 1967), we propose that the benefits of discrepancy reduction may extend to undesirable self-concepts (anxiety) and their exemplars (avatars) as well. Specifically, avatar customization would bring a reference value (i.e., the avatar) closer to its expected value (i.e., the disabled self-concept), a congruence which would presumably elicit positive affect (Carver and Scheier, 1986). Thus, considering the customization process, and its self-regulatory function facilitated by matching avatar appearance to aspects of the self, we propose that customizing an anxiety avatar will contribute to psychological well-being.

> **H1**: Customization of an anxiety avatar will significantly reduce anxiety.

Avatar Identification and Self-Congruence

In avatar-based VEs, self-congruence with an avatar representing one's anxious self-concept can be thought of in terms of the degree to which the user perceives the avatar as similar to themselves. This phenomenon is known as avatar identification (Van Looy et al., 2012), and is characterized by a heightened emotional connection with the avatar (Cohen, 2001). Player-avatar identification (PAI) argues that avatar identification occurs when a user values an aspect of the avatar and perceives this aspect as important to their identity (Li et al.,

2013). Hoffner and Buchanan (2005) distinguish between two distinct types of avatar identification: similarity and wishful identification. Where wishful identification is characterized by the user's desire to be more like the avatar (Konijn and Hoorn, 2005), similarity identification is thought of as a "rapprochement between player and character" (Van Looy et al., 2012, p. 202). In this way, customizing an avatar to be more similar to one's self-concept can thus signal self-discrepancy reduction (see Bessière et al., 2007; Kim et al., 2012).

In sum, by selecting (or modifying) physical traits of an avatar (e.g., skin color), users can imbue avatars with self-relevant concepts related to anxiety as personified by their inputs. As a result, this investigation proposes that avatars customized to represent an undesirable self-concept (i.e., the anxious self) will result in increased similarity identification with the avatar, thereby making it congruent with their anxious self-concept.

> **H2**: Users who customize an anxiety avatar will exhibit significantly greater similarity identification compared to the control condition.

Appraisal of an Anxiety Avatar

Achieving a heightened degree of avatar identification via discrepancy reduction is considered an inherently enjoyable experience contributing to positive feelings within VEs (Hefner et al., 2007). Positive feelings engendered via avatar customization are also thought to influence the user's overall evaluation of the avatar, as avatars exhibiting greater similarities to the user contribute to positive appraisals of the avatar (i.e., attitudes) (see Nowak and Fox, 2018). Bagozzi (1992) posits that such appraisals directly influence emotional reactions. Specifically, positive or negative attitudes trigger similarly valanced affective states such that positive attitudes are associated with positive affective states, and vice versa. Furthermore, Lazarus (1991) argues that one of the three outcomes that can result as a function of appraisals are affective states (e.g., anxiety). Thus, should customization of an anxiety avatar reduce discrepancy with a relevant self-concept, this heightened similarity should in turn generate a favorable appraisal of the avatar, eliciting positive affect. In sum, the positive psychological effects of customization on the appraisal of the avatar is contingent on it being congruent with the user's self-conceptualization of anxiety.

> **H3**: The effects of customization on anxiety will be mediated by similarity identification and attitudes toward the avatar.

Discrepancy-Enlargement

While self-regulatory feedback loops, facilitated via customization, are focused on discrepancy-reduction or "approach processes," there are also discrepancy-enlarging loops. Discrepancy-enlarging loops, while not as commonly discussed in self-regulating feedback systems, are characterized by a purposeful deviation from a reference value. These avoidant processes are particularly relevant to this investigation given that an anxiety avatar is rooted in a "feared or disliked possible self"

(see Carver et al., 2000, p. 743). Increasing the distance between a user's feared or disliked self-concept and its reference value, namely an avatar imbued with such concepts, has also been shown to contribute to psychological well-being. Kalisch et al. (2005) found that this detachment is an optimal cognitive strategy for emotional regulation. In this way, engaging in a reappraisal of the relationship between the self and a self-representation (i.e., a customized anxiety avatar), may allow users to volitionally reduce anxiety via detachment (p. 877). The potential of avatar-based discrepancy enlargement is further bolstered by media psychology's assumption that users largely avoid sources of distress in the first place (Vorderer and Knobloch, 2000, p. 65). Given the aforementioned discussion, we pose the following complementary research question: Can increasing discrepancy with a customized anxiety avatar reduce anxiety?

In modern VEs, a popular game mechanic that significantly, and regularly, influences the user-avatar relationship is the destruction of the avatar. Video game scholars acknowledge that the death, or destruction, of one's avatar is an important event, one which influences psychological well-being (Wenz, 2014). For example, research has shown that individuals in *WoW* respond to the unplanned destruction of an avatar by mourning its loss in planned ceremonies (Haverinen, 2016). More specific to this investigation is the effect of avatar destruction on identification with the avatar. Nöth et al. (2008) argue that "identification of the player with the avatar breaks down in the moment of the avatar's death" (p. 158). In this way, destruction of an avatar reduces identification, and thus represents a discrepancy-enlargement mechanism capable of influencing a user's affective state.

> **H4**: Destruction of customized anxiety avatars will reduce anxiety from pre- to post-test.

As previously mentioned, customization should engender similarity identification via the transference of relevant self-concepts onto the avatar. However, the avatar's destruction should demarcate the self-concept with which the avatar is imbued (i.e., anxiety). That is, a distancing effect should result where the user's desire to be like the now-distanced undesirable self-concept is significantly eroded, reducing negative affect. In this way, reduced wishful identification serves as a signal of the user's desire to distance him/herself from the reference value. The aforementioned effects are presumably relegated to destruction of customized avatars due to any increased valuation of an object being contingent on it being successfully created by the user. Put differently, only when individuals create objects themselves can the accrued favorable valuation dissipate upon its destruction (Norton et al., 2012). In this way, destruction of a customized anxiety avatar should then result in its negative appraisal, though negative affect associated with its destruction should be offset by the positive affect elicited via discrepancy enlargement, resulting in net positive affect (i.e., anxiety reduction).

> **H5**: Destruction of a customized anxiety avatar will lead to significantly less wishful identification compared to destruction of a non-customized avatar.

H6a: Destruction of a customized anxiety avatar will elicit positive affect (decreased anxiety) through wishful identification.

H6b: Destruction of a customized anxiety avatar will elicit negative affect (increased anxiety) through attitudes.

User Control

Beyond discrepancy reduction, customization can also afford users a sense of agency (or control), which bears importance due to anxiety-related distress being characterized by a "profound sense of lack of control" (Large et al., 2016, p. 199). According to the agency model of customization (Sundar, 2008), a customization interface makes the user a source, as opposed to simply a receiver, of content. This self-as-source schema allows the user to serve as the origin of the content, imbuing specific self-concepts (e.g., skin color) onto the avatar (Marathe and Sundar, 2011) while prompting feelings of control and the ability for the user to exert influence over digital content (e.g., avatars) (see Kalyanaraman and Wojdynski, 2015, p. 431). For example, in video games such as *Neverwinter Nights 2*, users can modify avatar appearance using sliders to adjust physical traits (Dunn and Guadagno, 2012). By increasing the number of dimensions that an avatar can be altered, interfaces increase perceived interactivity and a sense of user control (Kalyanaraman and Wojdynski, 2015). In this way, user control should influence affective outcomes and was thus included as a covariate in all subsequent analyses. A visualization of the proposed hypotheses is shown in **Figure 1**.

STUDY 1

Methods

In order to test the aforementioned hypotheses specific to avatar customization (discrepancy reduction), a 2-condition between-subjects experiment ($N = 90$) was administered through Qualtrics, with participants recruited via Amazon MTurk. The experiments in this paper were reviewed and approved by the institutional review board (IRB) and met all ethical guidelines and requirements. Participants were informed that an independent video game company was conducting a survey to examine opinions toward virtual characters. Avatar customization served as the independent variable, operationalized as the presence or absence of system features available to the user to generate a virtual creature (avatar) representing the anxious self. Dependent variables of interest included anxiety, identification with the avatar, and attitudes toward the avatar. Mean scores and standard deviations of relevant variables are shown in **Table 2**.

Manipulation Check: Perceived Customization

A single 7-point Likert scale item measured participants' level of agreement with the following statement: "The creature was personalized according to my feelings." The item was adapted from Kalyanaraman and Sundar (2006).

Dependent Variables
Anxiety

The State-trait Anxiety Inventory (STAI) measures, via self-report, the severity of current anxiety symptoms, as well as trait aspects of anxiety. The STAI served as a repeated measure, employed both prior to and immediately after the experimental conditions. The 6-item 7-point Likert scale was adapted from Marteau and Bekker (1992) ($\alpha = 0.80$). Items measured the level of agreement with a variety of statements, such as "I feel tense," and "I am worried."

Identification

Self-avatar identification was delineated across two dimensions of the psychological construct: wishful and similarity identification. Wishful identification with the creature was measured via a 5-item 7-point likert scale ($\alpha = 0.73$) adapted from Van Looy et al.'s (2012) scale. Items measured the level of agreement with a variety of statements related to participants' perception of the creature, such as "I wish I could be more like the creature," and "I imagine myself in the creature's place." Similarity identification was adapted from Van Looy et al. (2012) who conceptualized similarity identification as self-avatar congruence. A 5-item 7-point Likert scale ($\alpha = 0.82$) assessed participants' agreement with various statements, including "I felt connected to the creature," and "The creature represented me as a unique individual."

Attitudes

Attitudes toward the creature were measured via a 12-item 7-point Likert scale measuring user's level of agreement with various statements including, "the creature was appealing," and "the creature was interesting" ($\alpha = 0.96$) (Kalyanaraman and Sundar, 2006).

User Control

The "active control" dimension of interactivity was measured via a 2-item 7-point Likert scale adapted from Liu's (2003) factor analysis on the perceived interactivity scale ($\alpha = 0.79$). Participants rated their level of agreement with the following statements, "I felt I had control over my experience," and "My actions decided the kind of experiences I got."

Participants and Procedures

Among all participants, 57 identified as males and 33 identified as females, with ages ranging from 19 to 58, and an average age of 32.32 ($SD = 7.68$). After initial completion of demographic questions, participants were instructed to reflect for 1 min on a time when they experienced a high level of anxiety. This anxiety manipulation was deemed appropriate given that past representations of events elicit similar feelings during the re-experience (see D'Argembeau and Van der Linden, 2004). Furthermore, the cognitive appraisal of anxiety-related events has been shown to cause anxiety (Lilienfeld et al., 1993). After the reflection, self-reported anxiety was measured (pretest scores). Participants were then randomly assigned to either the customization or control condition.
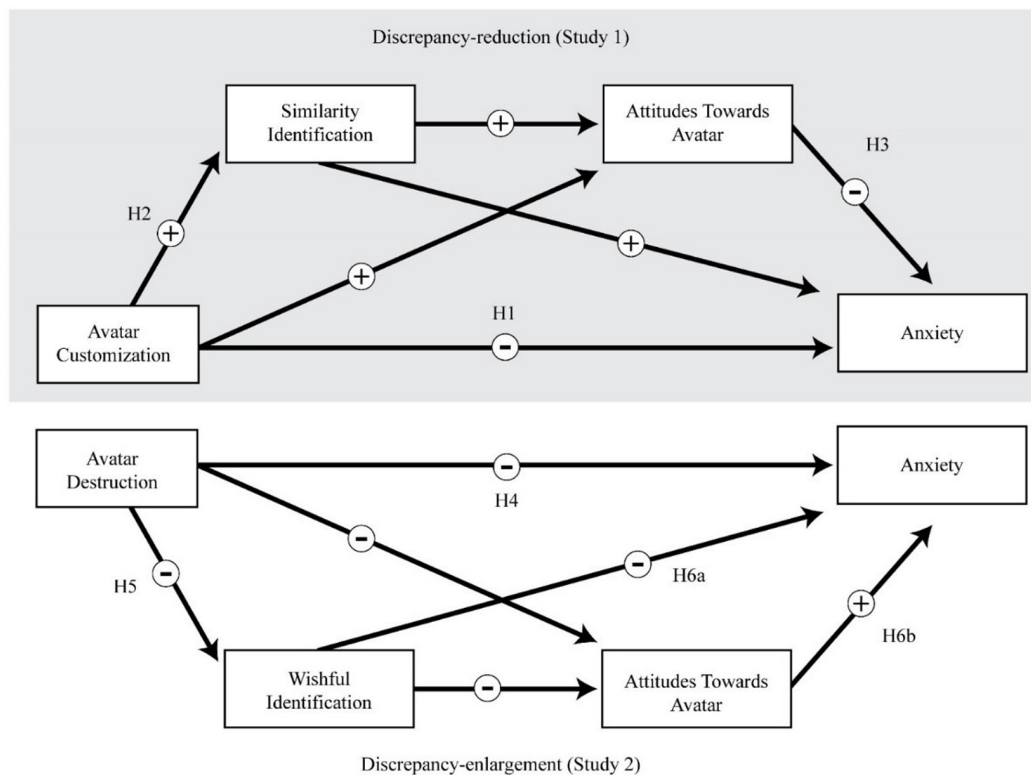
FIGURE 1 | Proposed serial mediated models of anxiety reduction via discrepancy-reduction (Study 1) and discrepancy-enlargement (Study 2). ± Signs indicate predicted effect valence.

In the customization condition, participants were prompted to select from a range of parameters they felt best represented anxiety within themselves (see **Figure 2**). Specifically, participants were presented with nine statements about the creature, including "If my anxiety were a creature it would live in a desert/swamp/cave," and "If my anxiety were a creature it would be an omnivore/herbivore/carnivore." The statements were selectable within Qualtrics via a series of customized radio buttons, each corresponding to the aforementioned statements. After selecting the items which best represented anxiety within themselves, a screen instructed participants to wait for the system to generate a 3D creature representative of their anxiety (see **Figure 3**). A single, randomized creature was generated prior to the experiment using the custom creature creator within the video game *SPORE* and exported as a 3D model using Adobe Photoshop. This ensured that all participants were shown the same creature regardless of their chosen customization parameters. In the control condition, these questions were bypassed, and participants were presented with the same creature along with a prompt stating that the creature was generated by the system to represent anxiety within them. Upon exposure to the creature, both groups were then asked to examine the creature for 30 s, after which their self-reported anxiety levels were measured again (posttest scores). Lastly, participants completed a thought-listing exercise and finished the remainder of the survey.

RESULTS

Manipulation Check: Perceived Customization

A one-way ANOVA revealed that the customization manipulation was successful, such that there were significant differences in perceived customization between the customization group ($M = 4.71$, $SD = 1.44$) and the control group ($M = 2.8$, $SD = 1.6$), $F(1,87) = 35.26$, $p < 0.0001$. Correlations among all of the variables are shown in **Table 1**. Mean scores and standard deviations of relevant variables are shown in **Table 2**.

Dependent Variables
Anxiety

A repeated-measures analysis of variance (rANOVA) was run with customization as an independent factor, and STAI at pretest and posttest as the dependent within-subjects factor. Results showed no differences in anxiety at pretest between groups [$F(1,88) = 0.302$, $p > 0.05$, $\eta_p^2 = 0.003$]. However, there was a significant interaction between customization and anxiety change from pretest to posttest [$F(1,88) = 13.15$, $p < 0.001$, $\eta_p^2 = 0.13$]. That is, there was a significant increase in anxiety from pretest ($M = 18.51$, $SD = 7.37$) to posttest ($M = 20.06$, $SD = 7.29$) among those in the

FIGURE 2 | Avatar customization interface in studies 1 and 2.

control condition ($M_{difference} = -1.55$, $p = 0.01$; 95% CI [-2.8, -0.31], $\eta_p^2 = 0.06$), supporting the efficacy of the anxiety manipulation. Conversely, anxiety from pretest ($M = 19.35$, $SD = 7.19$) to posttest ($M = 17.68$, $SD = 7.32$) significantly decreased for those in the customization condition ($M_{difference} = 1.66$, $p < 0.01$; (95% CI [0.418, 2.92]), $\eta_p^2 = 0.07$). Thus, H1 was supported.

Wishful Identification

A one-way ANOVA revealed that customization significantly influenced wishful identification with the avatar such that customized avatars were more wishfully identified with ($M = 2.85$, $SD = 1.79$) compared to those in the control group ($M = 2.12$, $SD = 1.36$), $t(88) = -2.19$, $p < 0.05$, $\eta_p^2 = 0.05$.

Similarity Identification

A one-way ANOVA revealed that customization led to significantly greater levels of similarity identification with the avatar ($M = 3.73$, $SD = 1.55$) compared to the control group ($M = 2.5$, $SD = 1.42$), $t(88) = -3.91$, $p < 0.001$, $\eta_p^2 = 0.14$. Thus, customization led to greater levels of self-avatar congruence, supporting H2.
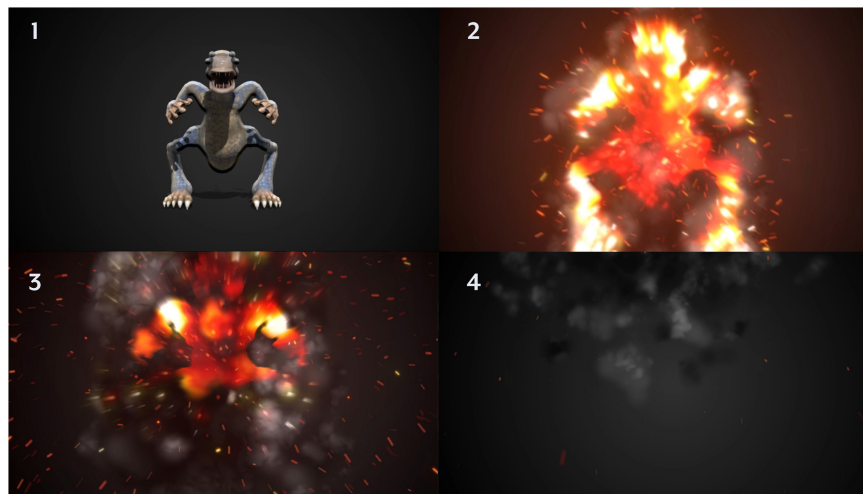
FIGURE 3 | Visualization of the avatar destruction animation sequence used in study 2.

TABLE 1 | Pearson correlation matrix for all dependent variables in Study 1.

	Perceived Customization	Similarity Identification	Wishful Identification	Attitudes	User Control	STAI (T1)	STAI (T2)
Perceived Customization	–	0.71**	0.5**	0.41**	0.24*	0.12	0.04
Similarity Identification		–	0.81**	0.58**	0.21*	0.13	0.06
Wishful Identification			–	0.61**	0.15	0.07	−0.01
Attitudes				–	0.38**	−0.11	0.41**
User Control					–	−0.18	−0.33**
STAI (T1)						–	0.81**
STAI (T2)							–

*$p < 0.05$, **$p < 0.01$.

TABLE 2 | Study 1 mean scores and standard deviations across experimental conditions.

	No Customization	Customization
Perceived Customization	2.8 (1.6)	4.71 (1.44)
State Anxiety T1	18.51 (7.37)	19.35 (7.19)
State Anxiety T2	20.06 (7.29)	17.68 (7.32)
Wishful Identification	2.12 (1.36)	2.85 (1.79)
Similarity Identification	2.5 (1.42)	3.73 (1.55)
Attitudes	3.26 (1.67)	3.74 (1.71)
User Control	4.76 (1.59)	4.95 (1.37)

Standard deviation values are shown in parenthesis.

Attitudes

A one-way ANOVA revealed no significant differences in attitudes toward the avatars between participants in the customization ($M = 3.74$, $SD = 1.71$) and control group ($M = 3.26$, $SD = 1.67$) $t(88) = −1.35$, $p > 0.05$, $\eta_p^2 = 0.02$.

User Control

A one-way ANOVA revealed that avatar customization did not lead to significantly greater levels of user control ($M = 4.95$,

$SD = 1.37$) compared to the control condition ($M = 4.76$, $SD = 1.59$) $t(88) = −0.6$, $p > 0.05$, $\eta_p^2 = 0.004$. Correlations among all of the variables are shown in **Table 1**.

Serial Mediation

To test the hypothesis that customization of an anxiety avatar can reduce anxiety through similarity identification and attitudes (H3), a bootstrapped (5,000 resamples) serial mediation analysis (Hayes, 2015, p. 10) was conducted. The PROCESS macro (Model 6; Hayes, 2012) was used to determine whether customization predicted similarity identification, and whether similarity identification influenced attitudes toward the creature, which subsequently influenced participants' anxiety at posttest.

The mediation model (**Figure 4**) established customization as a significant predictor of similarity identification with the avatar ($b = 1.15$, $p < 0.01$; 95% CI [0.51, 1.8]). Similarity identification subsequently predicted attitudes toward the avatar ($b = 0.62$, $p < 0.01$; 95% CI [0.41, 0.83]). Lastly, attitudes were significantly inversely related to state anxiety at posttest ($b = −0.94$, $p < 0.05$; 95% CI [−1.8, −0.09]). The model demonstrated significant indirect effects of customization on anxiety through similarity identification and attitudes, resulting
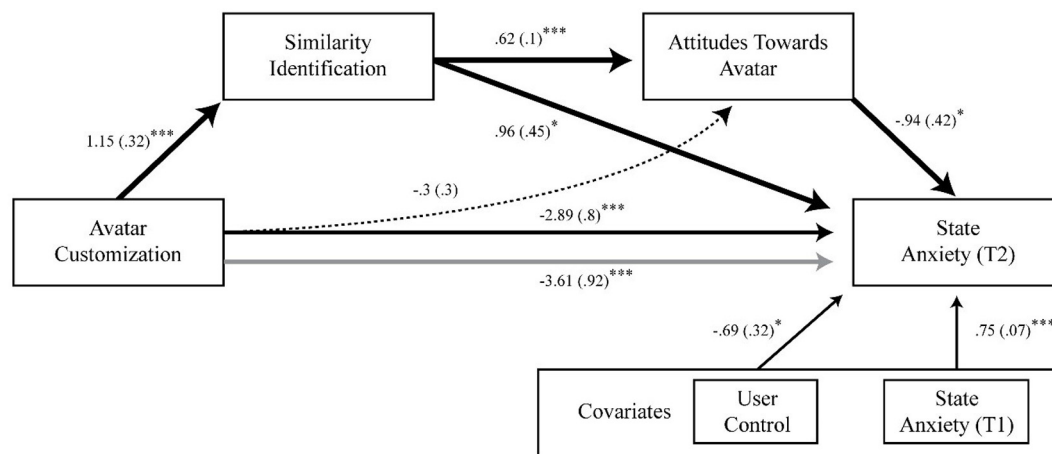
FIGURE 4 | Study 1 coefficients for serial mediation analysis of avatar customization on anxiety through proposed mediators. Bold paths are statistically significant, while dashed paths are non-significant. Standard error terms are shown in parentheses. Grey line denotes the effect of avatar customization on anxiety when mediators are included in the model. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

in decreased anxiety ($b = -0.68$, bootstrapped $SE = 0.32$; 95% CI [-1.62, -0.21]). However, the inclusion of mediators increased the predictive utility of customization on anxiety at posttest, leading to anxiety reduction ($b = -3.61$, $p < 0.01$; 95% CI [-5.45, -1.77]), larger than the total direct effect ($b = -2.89$, $p < 0.01$; 95% CI [-4.48, -1.3]). A discussion on the nature of this effect is addressed in the general discussion section.

DISCUSSION: STUDY 1

Study 1 tested the assumption that customization of an anxiety avatar would reduce anxiety through increased similarity identification (discrepancy reduction) and attitudes. The results support the proposed relationship between customization and similarity identification. Mere affordance of customization increased perceived congruence between the user's self-concept (i.e., the anxious self) and the customized avatar representing that self-concept. Moreover, this discrepancy reduction led to favorable evaluation of the avatar despite representing an undesirable aspect of the user (**Figure 4**), ultimately reducing anxiety at posttest.

The theoretical rationale behind this finding is rooted in the need for consistency between and among our self-schemas, a proposition that Study 1 extends to undesirable self-concepts. However, there are two important caveats that must be considered when examining congruity with the anxious self, and perhaps other undesirable self-concepts. First, studies examining congruence between and among self-concepts acknowledge that such concepts are largely positive (Aaker, 1999). This is not the case with the anxious self, a schema comprised of wholly undesirable traits. Second, a primary motivation behind achieving "self-congruity" is to aid in self-presentation. While participants ultimately created a representation of the anxious self, the avatar was not used in

a social context. Thus, while self-consistency may explain the emotional benefits of customizing an anxiety avatar, further research is needed to understand what makes congruence with undesirable self-concepts, as opposed to desirable ones, theoretically different. Overall, these findings suggest that customization of the anxious self can elicit positive affect via discrepancy reduction.

STUDY 2

Method

Where Study 1 argued that customization of the anxious self would elicit positive affect via discrepancy reduction, Study 2 posits that discrepancy enlargement, by way of destroying the avatar, may also reduce anxiety (**Figure 1**). To explore this alternative mechanism, a 2 (customization: yes, no) × 2 (destruction: yes, no) between-subjects ($N = 122$) experimental design was employed using Amazon MTurk. Participants were instructed to destroy an avatar representing anxiety within themselves after its creation (see **Figure 5**). The same variables from Study 1 were examined. There was a total of 65 male and 57 female participants ranging from 21 and 70 years old ($M = 33.8$, $SD = 9.5$).

Study 2 employed the same experimental design as Study 1, with one exception: after participants were shown the anxiety avatar (customized or non-customized), participants in the destruction condition were instructed to initiate an animation which depicted the avatar being destroyed in a disintegration animation. The 15-s animation was created using Adobe Premiere Pro and Adobe After Effects and was embedded within the survey. Participants in the non-destruction condition also watched an animation, though it instead showed the creature in an idle pose. After exposure, self-assessed anxiety was measured (posttest), followed by a thought-listing exercise, and the remaining dependent measures.
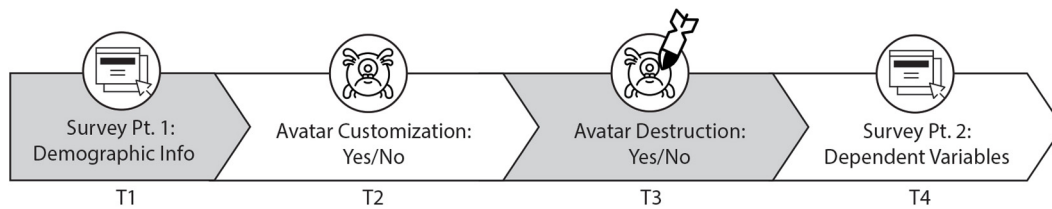
FIGURE 5 | Visualization of the experimental procedures for study 2.

RESULTS

Manipulation Check: Perceived Customization

Mean scores and standard deviations of relevant variables are shown in **Table 3**. All Cronbach alpha scores were within the accepted range. The manipulation check of customization proved successful such that participants in the customization condition perceived a greater level of customization ($M = 4.37$, $SD = 1.81$) compared to those who did not ($M = 3.63$, $SD = 1.93$) [$F(1,118) = 4.61$, $p < 0.05$, $\eta_p^2 = 0.038$].

Dependent Variables

Anxiety

As predicted, a two-way repeated measures analysis of variance (rANOVA) running avatar customization and avatar destruction as independent factors revealed a significant decrease in anxiety from pretest to posttest among those who destroyed a customized anxiety avatar [$F(1,118) = 12.94$, $p < 0.0001$, $\eta_p^2 = 0.10$]. Thus, H4 was supported. Similarly, while not predicted, destruction significantly reduced anxiety from pretest to posttest among participants who did not customize the avatar [$F(1,118) = 5.03$, $p < 0.05$, $\eta_p^2 = 0.04$].

Wishful Identification

With regards to H5, there was a significant main effect of avatar destruction on wishful identification [$F(1,118) = 5.82$, $p = 0.01$, $\eta_p^2 = 0.04$]. Furthermore, pairwise comparisons revealed destruction of a customized avatar elicited significantly less wishful identification ($M = 1.83$, $SD = 1.2$) compared to the

non-destruction group ($M = 3.22$, $SD = 1.89$) [$F(1,118) = 9.05$, $p < 0.01$, $\eta_p^2 = 0.07$]. Thus, H5 was supported.

Serial Mediation

To test whether destruction of a customized avatar reduced anxiety through wishful identification, a bootstrapped (5,000 resamples) serial mediation analysis was conducted using the PROCESS macro (Model 6; Hayes, 2012). This model was chosen to examine the direct and indirect effects of the proposed variables, and spotlighted participants in the customization conditions ($N = 62$). Avatar destruction served as the independent variable, with wishful identification and attitudes included as mediators, and posttest anxiety as the dependent variable.

The results of the bootstrapped serial mediation analysis revealed that wishful identification and attitudes mediated the relationship between avatar destruction and anxiety. The indirect effects of avatar destruction through solely wishful identification (Ind1) resulted in positive affect (decreased anxiety) ($b = -3.39$, boostrapped $SE = 1.3$; 95% CI [-6.64, -1.35]), in support of H6a. Conversely, the indirect effects through wishful identification and attitudes (Ind2) resulted in negative affect (increased anxiety) ($b = 1.4$, bootsrapped $SE = 0.75$; 95% CI [0.31, 3.55]), in support of H6b. Inclusion of wishful identification and attitudes into the model rendered the direct effect of destruction on anxiety non-significant ($b = -1.17$, $p > 0.05$, 95% CI [-4.59, 2.24]), indicative of mediation. Furthermore, this indirect effect of destruction on anxiety through wishful identification was significantly different than zero, as shown by the significant Sobel test statistic ($z = -2.22$, $p < 0.05$), supporting the proposed discrepancy-enlargement mechanism.

TABLE 3 | Study 2 mean scores and standard deviations across experimental conditions.

	No Destruction/ No Customization	Destruction/ No Customization	No Destruction/ Customization	Destruction/ Customization
Perceived Customization	3.58 (2.09)	3.68 (1.77)	4.33 (1.98)	4.41 (1.66)
Similarity Identification	3.52 (1.97)	3.36 (1.72)	3.93 (1.69)	3.5 (1.61)
Wishful Identification	3.09 (2.09)	2.89 (1.97)	3.22 (1.89)	1.83 (1.2)
Attitudes	3.64 (1.62)	4.03 (1.6)	3.93 (1.37)	3.32 (1.48)
User Control	4 (1.69)	4.22 (1.49)	4.51 (1.61)	4.78 (1.35)
Anxiety Change	−0.23 (0.91)	0.13 (0.62)	−0.26 (1.22)	0.35 (1.03)

Standard deviation values are shown in parenthesis. Anxiety change is the standardized Z-score difference in state anxiety from pretest to posttest. Negative values imply negative affective response (i.e., increase in anxiety), whereas a positive value indicates positive affect (i.e., decrease in anxiety).

DISCUSSION: STUDY 2

Study 2 extended beyond mere customization, exploring how destruction of an anxiety avatar can reduce anxiety via discrepancy enlargement. The results show that the destruction of an anxiety avatar reduces user-avatar identification, subsequently reducing state anxiety. Destruction also significantly influenced appraisal of the avatar through reduction of wishful identification, indicative of discrepancy enlargement. In sum, customization aided in discrepancy reduction, while subsequent destruction initiated a discrepancy-enlargement loop, distancing the user from the undesirable self-representation, eliciting positive affect via this detachment (see **Figure 6**).

GENERAL DISCUSSION

At the crux of both studies is the notion that content which is tailored to reflect some aspect of the self can influence psychological well-being. Results across both experiments found that exposure to avatars customized to represent the user's conceptualization of their anxiety translated into a significant reduction in state anxiety. By increasing similarity identification (Study 1: discrepancy reduction) or decreasing wishful identification with the avatar (Study 2: discrepancy enlargement), customized anxiety avatars proved to significantly influence psychological well-being via self-regulation. In sum, satisfying the drive for self-regulation by tailoring an avatar to match a particular aspect of the self contributes to psychological well-being even when the self-concept in question is wholly undesirable.

Anxiety Begets Anxiety

As it stands, the findings contest a long-held belief in anxiety research: anxiety begets anxiety (see Corr, 2011). The adage proposes a cycle wherein exposure to anxiety-related stimuli triggers anxiety thoughts, which exacerbate anxious feelings. However, if this were the case, viewing an avatar representing the user's anxiety would only serve to intensify anxiety, though this was not the case when the avatars were customized in Study 1. Indeed, after the anxiety induction exercise, participants in the control conditions experienced an increase in anxiety when presented with the non-customized anxiety avatar. Yet, participants who customized the anxiety avatar experienced a reduction in anxiety despite the avatar being considered a more accurate representation of their negative emotional state; a visual which would, in theory, propagate anxious feelings.

The proposed mechanism driving this effect is the ability for customization to reduce discrepancies between the user and a self-relevant object (avatar). However, an alternative explanation may also be explained by the fact that customization is inherently an enjoyable experience (Schnurr and Scholl-Grissemann, 2015). That is, the mere process of creation may have afforded sufficient positive affect to counteract any anxiety thoughts. In theory, Study 2 should have replicated these results, yet our results found the reverse to be true: those who customized, but did not destroy, their anxiety avatar experienced an increase in anxiety. A potential explanation may be rooted in subtle differences in the presentation of the customized avatars across both studies. Whereas Study 1 presented the avatars as static, 3D models, Study 2 presented the avatars in an animated 15-s video clip with sound effects (see **Figure 3**). Considering that dynamic (animated) visuals yield stronger influences over human emotions and psychological

FIGURE 6 | Path coefficients for serial mediation analysis of avatar destruction on anxiety through wishful identification and attitudes. Bold paths are statistically significant, while dashed paths are non-significant. Standard errors are shown in parentheses. Grey line denotes the effect of avatar destruction on anxiety when mediators are omitted from the model. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

involvement (e.g., Wu et al., 2014), it may be that exposure to a dynamic anxiety avatar influenced emotional responses in ways that offset the benefits accrued through discrepancy reduction. Future investigations should explore these possibilities (i.e., mere customization, dynamic animation) to determine whether self-regulation is indeed the primary mechanism driving anxiety reduction.

Expanding the Scope of Customization

The results also expand the scope of customization research, which has almost exclusively focused on matching content, whether avatars or clothes, to desirable aspects of our identity (e.g., Kaiser et al., 2017; Mancini et al., 2019). Within this contemporary customization paradigm, individuals are presumed to customize avatars to match their idealized selves, or tailor clothes to exhibit desirable personality traits (e.g., adventurous). Indeed, a survey of MMORPG gamers and their avatars uncovered four primary avatar types, or discrepancy profiles, of which three involved avatars created to convey idealized and desirable features different than the user's offline self (Mancini and Sibilla, 2017).

While it may not be intuitive to allow users to customize content to reflect unappealing facets of their identity, such as the anxious self, it is evident that there are implications associated with doing so. Indeed, from a phenomenological perspective, demonstrating the positive effects of matching content to undesirable self-concepts bolsters SDT's central argument, showing that self-regulation also applies to aspects of our identity that are not housed within the three main selves. Under what other circumstances this form customization can render psychological benefits remains to be explored, however.

Given the ubiquity of customization among online retailers, matching content to undesirable aspects of the self may indeed be applicable, and appropriate, in industries such as fashion. Consider the Saks Fifth Avenue's "The Future Is Stigma Free" clothing line, which promotes shirts designed to reduce discrimination surrounding mental health illness. Though the shirts feature the titular phrase, they do not specifically mention or depict stigmatized aspects of the self, such as depression or anxiety. In this case, allowing users to customize the shirts to depict their mental illness, whether through color or imagery modification, can lead to several benefits. This form of customization would theoretically contribute to favorable evaluations of the product (Franke et al., 2010). Additionally, given the results, customization of such an "anxiety shirt" would also contribute to an improved emotional state, despite representing the illness in question.

Destruction as Self-Distancing

Having established the theoretical and phenomenological value of customizing an avatar representing the anxious self, Study 2 expands our understanding of how customization's impact on psychological well-being can be enhanced through subsequent interactions with the avatar. Results from our follow-up study

found interactions that increase, rather than decrease, user-avatar discrepancies can also reduce anxiety. Destruction, an act shown to reverse any favorable effects garnered by creating an object (Norton et al., 2012), was used as this distancing interaction. Destroying a customized anxiety avatar significantly reduced anxiety, presumably by psychologically distancing the user from the source of distress. This provides further empirical support for self-regulation strategies, and novel insight into the psychological effects of destruction. Additionally, it raises questions about how user control can be conceptualized in VEs. Because destruction did not lead to a significantly higher sense of user control, it remains to be seen whether other forms of control, such as controlling the size or movement of the avatar, could facilitate anxiety reduction without discrepancy-enlargement. Future research should explore the various manifestations of user control as it pertains to the user-avatar dynamic, and its influence on psychological well-being.

Through a developmental prism, the findings reinforce the notion that customization of a self-relevant avatar can clarify or modify one's self-concept(s), in turn shaping one's identity (Schlenker, 1985, p. 66). Combined with the understanding that our identities are inextricably linked to our psychological well-being, it is reasonable to propose avatar customization as a promising anxiety management strategy within digital games and e-mental health. Hypothetically, regular interactions with a customized anxiety avatar may be beneficial if they reinforce discrepancy-enlargement loops, facilitating continual anxiety reduction. However, several aspects of this form of self-regulation remain unclear. As previously alluded to, while this study explored destruction as a distancing mechanic, there are other forms of interactions which may have a different self-regulating effect. For example, distance may be operationalized as the degree of a power disparity between the user and the anxiety avatar. Considering that psychological research has established an association between a sense of power and height (Duguid and Goncalo, 2012), manipulating the avatar be smaller than the user may facilitate a similar distancing mechanism, or a shift in the power dynamic. This action would also presumably increase the user's sense of control, which would contribute to anxiety reduction. Regardless of the nature of the interaction, it is unclear what affective outcomes arise as a result of extended exposure to, or interaction with, an anxiety avatar.

LIMITATIONS AND FUTURE RESEARCH

Worth noting are issues related to the efficacy of the experimental manipulation given individual differences related to anxiety and depression. According to Dobson (1986), self-schema theory argues that people with depression, for example, generalize and interpret their undesirable self-concept differently from non-depressives (p. 191). MacLeod and Mathews (1988) also acknowledged parsing between state and trait anxiety as being problematic. Their study found that, among those with high trait anxiety, exposure to threat cues focused attention to the stimulus, whereas increased state anxiety led to avoidance among those with low trait anxiety. Furthermore, studies have also shown

that trait anxiety is associated with selective processing, which is elicited by state anxiety (Williams et al., 1988). Lastly, the studies could be strengthened by exploring the role of trait anxiety in shaping affective outcomes associated with customizing (and destroying) an anxiety avatar.

Another important note relates to the indirect effects found in Study 1. While significant, similarity identification and attitudes did not fully mediate the direct effect of customization on anxiety at posttest. These findings signal an absence of full mediation and expose a significant suppressor effect. Put differently, inclusion of similarity identification and attitudes enhanced the predictive capability of the independent variable (customization). While this finding diminishes the predictive power of the proposed discrepancy-reduction mechanism at-play, it does raise important questions regarding individual differences (e.g., locus of control), and what other mediating psychological variables pertinent to anxiety research (e.g., self-efficacy) may need to be accounted for.

One explanation may relate to participants' locus of control, or beliefs about the degree to which one's control of outcomes result from internal or external factors (Rotter, 1966). Individual differences in locus of control can influence affective and behavioral outcomes (see Deci and Ryan, 2000). Considering the avatar was not customized in real-time (i.e., users did not actively change the morphology of the 3D model through their mouse inputs), individual differences in locus of control may have influenced outcomes. Participants with internal loci of control may have felt they exerted insufficient influence over the avatar's appearance, reacting negatively upon its presentation, whereas those with external loci of control might have attributed discrepancies to the customization interface itself. While locus of control is conceptualized as a trait variable, technological affordances can shift perceived locus of control (Ahn et al., 2014) in the short term, eliciting downstream effects. As noted earlier, Marathe and Sundar (2011) acknowledge that customizable interfaces "place the locus of control within the user" (p. 732). Thus, different measures of "user control" (e.g., Waddell et al., 2015) may benefit future studies.

Lastly, there are two important caveats regarding the avatar customization interface employed in this study which limit the ecological validity of the results. First, the customization manipulation employed in the studies were rudimentary and not comparable to character creation interfaces common in modern video games. Whereas modern games allow a greater bandwidth of editable physical features on an avatar, the current investigation used text-based radio buttons to provide the user with control over limited physical parameters on their avatar. For example, users could express their desired tail length but not the specific color or skin texture. Despite the limited malleability of the avatar, the manipulation of customization abides by the fundamental principle of customization: a particular output can be altered so as to match desired attributes dictated by the user's inputs. Second, users did not control the avatar in a gaming context at any point. This is particularly important considering that avatars are typically under the "player's control" (Kromand, 2007). Despite the anxiety avatars existing in isolation outside of the direct influence of the user upon their creation, the study did successfully create the illusion of customization, and thereby fostered the necessary conditions to connect users to their graphical representation (i.e., increased identification) despite not using the avatar in a game scenario. Indeed, our results suggest that avatar creation alone may yield meaningful outcomes for users.

CONCLUSION

The proposition that increasing similarity identification can function as discrepancy reduction (Study 1), and reduction in wishful identification can function as discrepancy enlargement (Study 2), was largely supported across two experiments. Through a simple customization interface, participants were able to imbue avatars with salient characteristics indicative of their unique conceptualization of anxiety within themselves. As a result, users achieved congruence with the anthropomorphized depiction of the anxious self. That is, how they perceived anxiety within themselves, and how it was represented, became more aligned. In our sample, this elicited positive affect (reduced anxiety) via improved appraisal of the avatar. Similarly, decreasing identification with the avatar, through destruction, reduced anxiety as well. While customization is "self-as-source," it is our hope that our findings direct attention toward other aspects of the self, and the psychological implications of doing so. From an applied perspective, there are multiple avenues through which to apply this knowledge. Consider modern digital games; seldom are players afforded the opportunity to customize in-game enemy characters. Given the potential benefits of creating and destroying anxiety avatars, game designers may consider implementing such mechanisms to allow players to destroy self-relevant characters in ways that contribute to their well-being.

Interactions with, and as, an anxiety avatar may be also be augmented by the unique affordances of emerging media platforms, such as augmented reality (AR) and virtual reality (VR). Both AR and VR allow the user to modify their appearance (self-representation) by overlaying virtual content over their body or by granting them control over a virtual avatar in a VE accessed via a head-mounted display, respectively (see Bailenson, 2018). In the latter case, users are afforded the capacity for "avatar embodiment," which describes the way in which VR systems swap (part of) a user's body with a virtual proxy (e.g., Spanlang et al., 2014). This illusion of inhabiting another virtual body is also referred to as "body transfer" (Bailey et al., 2016) or a "body ownership illusion" (Slater, 2009) and has been shown to have wide-ranging effects. For example, characteristics of an avatar embodied by a user have been shown to influence motivation (Hudson and Hurter, 2016), cognitive task performance (Chang et al., 2019), and, more pertinent to this investigation, anxiety and fear (Ferrer-Garcia et al., 2017). Acknowledging the influence of avatar embodiment through XR platforms, future work should investigate the implications of creating and embodying anxiety avatars, either through AR filters akin to what is found on apps like Snapchat, or through avatar embodiment in VR. For example, the recent game *Hellblade: Senua's Sacrifice* leverages VR to allow users to embody a character suffering

from mental illness. The implications of such embodied experiences are largely unknown, though such trends underscore the relationship between avatar design and mental health in video games.

In sum, there are clear theoretical and practical implications associated with customizing virtual avatars representing one's anxiety, and the effects are only beginning to be understood. Yet, it is evident that avatar-based e-health solutions warrant further attention, and placement alongside recent HCI developments for health and wellbeing as noted by Blandford (2019).

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by The University of Florida Institutional Review Boards (IRBs). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

DP contributed to the experimental design, data collection, stimulus development, analysis, and manuscript writing. SK contributed to the experimental design, analysis, and manuscript writing. Both the authors contributed to the article and approved the submitted version.

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Recommendations for Implementing Gamification for Mental Health and Wellbeing

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Gamification is increasingly being proposed as a strategy to increase engagement for mental health and wellbeing technologies. However, its implementation has been criticized as atheoretical, particularly in relation to behavior change theory and game studies theories. Definitions of the term "gamification" vary, sometimes widely, between and within academic fields and the effectiveness of gamification is yet to be empirically established. Despite this, enthusiasm for developing gamified mental health technologies, such as interventions, continues to grow. There is a need to examine how best to implement gamification in mental health and wellbeing technologies in a way that takes quick production cycles into account while still emphasizing empirical investigation and building a rigorous evidence base. With reference to game studies and the medical (eHealth/mHealth) literature, this article interrogates gamification for mental health and wellbeing by examining core properties of the game form. It then explores how gamification can best be conceptualized and implemented for mental health and wellbeing goals from conceptualization through to iterative co-development and evaluation that accommodates software development schedules. Finally, it summarizes its conceptual analysis into recommendations for researchers and designers looking to do so. These recommendations are: (1) assess suitability, (2) implement to support, (3) assess acceptability, (4) evaluate impact, and (5) document comprehensively. These recommendations aim to encourage clear language, unified terminology, the application and evaluation of theory, comprehensive and constant documentation, and transparent evaluation of outcomes.

Keywords: engagement, wellbeing, mental health, mHealth, eHealth, gamification, applied games, health information technologies

INTRODUCTION

Digital Health Technologies and the Engagement Problem

Digital health technologies, such as mobile phone apps and Web-based interventions, are increasingly considered a cost- and resource-efficient method of delivering health interventions to the general population. They can be accessed from any location in the world with an Internet connection, and as such have the potential to overcome geographical, awareness, attitudinal, and potentially even financial barriers to access (Price et al., 2014). The flexibility of these technologies also means they can be deployed at any part of the treatment timeline

(pre-, during, and post-treatment) and can serve a variety of roles such as education (including psychoeducation and skills training), symptom tracking, distraction from pain or unpleasant emotions, and communicating remotely with a therapist (Price et al., 2014). In tandem with face-to-face consultations and treatments, digital health technologies have the potential to fundamentally restructure the healthcare system.

However, while clinical evaluations of eHealth technologies have found beneficial effects on mental health and wellbeing (Spijkerman et al., 2016), potentially resulting in better outcomes than their face-to-face counterparts (Lappalainen et al., 2014), they have also observed considerable attrition rates. Notably, a review of Web-based interventions aimed at common mental disorders found highly variable rates of adherence to study protocol ranging from 3.37 to 100% (Brown et al., 2016b). Attrition rates increase, and adherence rates decrease, further once the technology is rolled out for public usage (Fleming et al., 2016). For example, a study comparing module completion in an online cognitive behavioral therapy intervention found that 66% of trial participants had completed two or more modules of the program, compared to only 15.6% of community participants (Christensen et al., 2004).

A proactive strategy of encouraging users to make contact, and then continually engage, with interventions has been linked to decreased attrition (Kelders et al., 2012). One strategy that has been proposed and employed in eHealth and mHealth to encourage such engagement and re-engagement is gamification (Deterding et al., 2011; Huotari and Hamari, 2012; Cugelman, 2013). This article interrogates the concept of gamification for mental health and wellbeing and provides research and design recommendations synthesized from the literature as well as a doctoral project that involved the co-design, development, and evaluation of a gamified mental health and wellbeing app.

Defining Gamification for Mental Health and Wellbeing

While the term "gamification" has been used to describe multiple game-related concepts in the past, recent academic consensus has settled on using it to describe the process that Deterding et al. (2011) define as "the use of game design elements in non-game contexts." Real-world examples of gamification include the Nike+ system, which aims to promote regular running through socially competitive mechanics, and Code Academy, which rewards users who complete its educational courses with points and badges (Sicart, 2014).

Despite the growing consensus on what "gamification" describes, inconsistencies still exist in the literature (as observed by Seaborn and Fels, 2015). This may be partially due to gamification's explosive popularity, and the wide variety of disciplines from which its users and researchers come, all of whom approach it with their own perspective and framing. The term "gamification" is often used to describe other closely related forms of applied games, such as serious games (Seaborn and Fels, 2015). However, by examining the Deterding et al. (2011) definition, we can more precisely delineate the differences between gamification and other forms of applied games.

Specifically, Deterding et al. (2011) position "play" and "games" in opposition to each other. This is consistent with sociologist Roger Caillois' conception of play as a spectrum between "*paidia*" (free, unstructured play) and "*ludus*" (rules-based, goal-directed play—that is, games). On a continuum of game vs. play and whole vs. parts, Deterding et al. (2011) situate gamification (also referred to as "gameful design") as partly game. This is in contrast to games, including serious games, which are wholly game. Gamification is also positioned as conceptually opposite to toys (wholly play) and related, but distinct, to playful design (partially play).

Deterding et al.'s (2011) definition is frequently cited in calls for applying gamification for health and wellbeing (e.g., Cugelman, 2013; King et al., 2013). However, alternate definitions for gamification exist. Huotari and Hamari (2012) propose one that is particularly suited for application to health and wellbeing, including mental health: "a process of enhancing a service with affordances for gameful experiences in order to support [a] user's overall value creation" (p. 20). By placing the emphasis back on the *service* (Huotari and Hamari use this term in a general goods and services context), this definition complements the goals of health services research. Furthermore, unlike Deterding et al.'s definition, which implies that gamification is a property (i.e., a technology is gamified), Huotari and Hamari's definition implies that gamification cannot occur without a gameful experience: that is, without the perception of such from the user. This will be discussed in more detail later in this article. Nevertheless, both definitions provide useful ways with which to conceptualize gamification. While Deterding et al.'s definition emphasizes the *elements* of game design and is therefore useful as a (taxonomic) lens through which to approach *researching* gamification, Huotari and Hamari's definition is useful as a lens through which to *implement* it.

Briefly Reviewing the Effectiveness of Gamification for Mental Health and Wellbeing

Gamification is experiencing increasing application in digital health, often in the form of badges, leaderboards, points, and challenges (Miller et al., 2014). In the field of physical health, it is commonly applied to physical fitness and diet (Lister et al., 2014) as well as chronic illnesses (Lazem et al., 2015; AlMarshedi et al., 2017; Sardi et al., 2017). Notably, Lister et al.'s (2014) review on physical fitness and diet mobile phone apps found that gamification was present in just over half of the sampled apps, and that just under a quarter of their sample contained more than three gamification elements (as defined by the authors).

However, compared to physical health, there seems to be less uptake of gamification for mental health and wellbeing (Johnson et al., 2016). While it has been applied to mood and resilience (Roepke et al., 2015; Litvin et al., 2020), anxiety disorders (Dennis and O'Toole, 2014; Miloff et al., 2015; Lindner et al., 2020), tobacco and substance misuse (Earle et al., 2018; Struik et al., 2018; Zhang et al., 2019), sleep (Werner-Seidler et al., 2017), wellbeing (Vella et al., 2018), and serious mental illness (Varnfield et al., 2019), gamified mental health interventions tend to include

less gamification features, with a systematic review finding the majority of included interventions used only one (Brown et al., 2016b). Another review on stress management apps in the Google Play Store also found low levels of gamification (Hoffmann et al., 2017). Specifically, only 32% of the sampled apps employed gamification, and the apps that did use gamification tended to contain only one gamification element (as defined by the authors). This field enjoys a relatively quick pace of change, with a more recent systematic review by Cheng et al. (2019) finding that the median number of gamification elements used in the included gamified mental health apps was 5. However, it must be noted that these three reviews defined gamification elements differently.

This article focuses primarily on gamification for mental health and wellbeing. However, the relative lag in uptake of gamification for mental health means that mental health gamification literature is less comprehensive. For this reason, I will discuss gamification for general health and wellbeing for the remainder of this section while noting mental health-specific research where available.

There is increasing interest in using gamification for health purposes, particularly to target low engagement with health technologies and improve adherence to health behaviors. However, gamification is often applied without fully considering engagement, motivation, or behavior change theories (Seaborn and Fels, 2015). For example, a review by Lister et al. (2014) of gamified health and fitness apps, through the lens of the health behavior change wheel (Michie et al., 2011), found that the gamification in their sample overwhelmingly focused on motivational drivers of health behavior change, when in fact a focus on capability and opportunity drivers is also required. Similarly, a systematic review of gamification in health and wellbeing by Johnson et al. (2016) found that the majority of included studies described a behaviorist implementation of gamification, with little consideration of intrinsic motivation. Additionally, a systematic review by Cheng et al. (2019) used relatively broad criteria to capture researcher justification for including gamification in their apps or technologies for mental health, and found that 41% (39/70) of the papers in their sample did not provide any reason for doing so. More recently, Schmidt-Kraepelin et al. (2020) conducted a systematic review of studies investigating health behavior change theories and gamification and found that of the 25 papers reviewed, seven only briefly mentioned a health behavior change theoretical framework, and only five had fully integrated a health behavior change theory into the gamified technology.

As gamification is still an emerging area of inquiry, the majority of research is exploratory and solution-focused instead of evaluative. There is a relative lack of research into how effective gamification is (Sardi et al., 2017), with definitions of effectiveness naturalistically broad due to the breadth of domains gamification is researched in. A descriptive review of empirical studies on the effects of gamification (mostly in the fields of computer science, education, and management science) suggests that the implementation of gamification has positive general effects; however, the authors also suggest that this could potentially be due to a novelty effect, and that the removal of gamification could induce loss aversion (not wanting to lose already earned badges

and points) and alienate currently engaged users as a result (Hamari et al., 2014). The authors also note possible confounding effects of the context of gamification and individual differences between users, and that the effects of gamification can be more complex than is assumed.

Within the health literature, a review of games (the authors included gamification in their review) applied to diabetes could not draw a conclusive relationship between the usage of gaming concepts and clinical health outcomes (Lazem et al., 2015). A review of gamification for health and wellbeing, however, found preliminary evidence broadly suggesting a positive impact of gamification, particularly on mental wellness (Johnson et al., 2016). Another review on Web-based mental health interventions containing gamification found no significant overall difference in rates of adherence to interventions based on number of gamification features incorporated; however, the authors were limited by a lack of detail in reporting (of both adherence and gamification) in the papers reviewed (Brown et al., 2016b). In comparison, a review on physical fitness and diet mobile phone apps found that while the presence of game elements (as defined by the authors) was associated with app popularity (as quantified by the number of app reviews), the presence of gamification (again, as defined by the authors) was not (Lister et al., 2014). Lister et al. argue that this could potentially be due to inappropriate and/or incomprehensive application of gamification strategies, such as a poor balance between the effort needed to obtain a reward and the value of the reward itself. Finally, Floryan et al. (2020) found degree of implementation of gamification principles to correlate with app quality and app store rating. There is also little to no evidence on whether the effects of gamification persist in the long term (Cugelman, 2013; Sardi et al., 2017). In response, there have been calls for stronger evaluations of the effectiveness of gamification (Seaborn and Fels, 2015; Hoffmann et al., 2017).

Current evidence for the general effectiveness of gamification for health and wellbeing is, therefore, inconclusive. However, studies empirically testing individual elements of gamification have produced results more strongly suggestive of beneficial effects. For example, in a relatively large-sample ($n = 1,162$), between-subjects study, Comello et al. (2016) found that using game-inspired feedback formats (progress bars and scorecards) across various health domains (e.g., tobacco use, physical activity) led to higher comprehension and engagement outcomes in certain cases and non-inferior outcomes in others, supporting the adoption of this particular format of behavioral feedback. Similarly, there is evidence that the presence of badges (Hamari, 2017) and social comparison (measured through social media-esque "likes"; Hamari and Koivisto, 2015) are individually associated with greater engagement with a gamified service. By operationalizing gamification as the presence, or absence, of certain elements, these studies are able to directly attribute group differences between conditions to these elements. However, as a result they also do not explicitly account for the user perception of a gameful experience. In other words, it is not clear whether these studies' participants would perceive the difference between the experimental and control conditions as being more or less gamified.

Other research suggests that the effectiveness of individual gamification elements is also affected by the psychological context of the gamified technology. In their study comparing different versions of a pedometer app containing different functionalities, Zuckerman and Gal-Oz (2014) report that while a "quantified" version providing behavioral feedback outperformed baseline (the app in an inactive state with no functionality or interactions), "gamified" versions of the quantified app that added either virtual rewards (points) or social comparison (a leaderboard) did not outperform the quantified version. Similarly, an interview study by Helmefalk et al. (2020) found that participants appeared to find the data tracking capabilities of their physical activity trackers more fulfilling than the gamification aspects (badges, fireworks, and social media sharing), as the former supported their basic needs of autonomy, competence, and relatedness (from self-determination theory; Deci and Ryan, 2000). Interviews with participants in both studies found that most participants did not see the gamification elements as meaningful, with Helmefalk et al. (2020) suggesting that this could be because the added gamification elements did not directly address the basic needs of their participants. This once again suggests that gamification should be applied in a more theory-driven manner, and that more game mechanics beyond the commonly seen points, badges, and leaderboards be explored to deliver the intrinsically motivating gamelike experience that the term and its definitions promise. However, this does not mean that extrinsic motivators should be eschewed altogether, but rather that they should be implemented in ways that do not thwart feelings of competence or autonomy (Loughrey and Broin, 2018).

So far, it is clear that different studies from different academic fields (and sometimes even from the same field) conceptualize gamification differently. Establishing not just a consistent definition, but also operationalization, of gamification would empower its application and evaluation by multiple researchers across academic fields.

INTERROGATING GAMIFICATION FOR MENTAL HEALTH AND WELLBEING

Understanding Gameful Experiences Through Understanding Games

Huotari and Hamari's (2012) definition of the term "gamification" implies that for gamification to occur, a gameful experience must be had. What, then, is a gameful experience?

Landers et al. (2019) define a "gameful experience" as an "interactive state occurring when a person perceives non-trivial achievable goals created externally, is motivated to pursue them under an arbitrary set of behavioral rules, and evaluates that motivation as voluntary." In other words, they view it as a formative psychological construct made up of goal perception, rule endorsement, and voluntary motivation. Landers et al. also emphasize the difference between gameful design, gameful systems, and gameful experiences, and propose in detail a multilevel (system and individual) model of gamefulness that

connects these three constructs with behavior change moderated by individual differences. By isolating out the gameful experience as a construct separate to gameful design and systems, Landers et al. emphasize that it needs to be measured as a potential mediator of any impacts of gameful design (e.g., on adherence or mental health). As of the time of writing, however, a measure of gameful experience that aligns with their model of gamefulness has yet to be developed and validated.

Other work on developing instruments for measuring gameful experience focuses more on the characteristics of the actual experience (as opposed to the psychological characteristics that lead to it) and suggests that it is a multidimensional construct. In their work, Eppmann et al. (2018) identify six factors (enjoyment, absorption, creative thinking, activation, absence of negative effect, and dominance), while Högberg et al. (2019) identify seven (accomplishment, challenge, competition, guided[ness], immersion, playfulness, and social experience). However, while this research has established the importance of these constructs to the gameful experience, the argument can also be made that artifacts without these traits can still be considered a game (Stenros, 2016). Essentially, there is more at play. This article will, therefore, proceed to briefly review relevant literature from the field of game studies.

In contemporary culture, the word "game" most saliently conjures up impressions of digital games (also known as video games). The emergence and dominance of the label "gamer" to describe someone (usually young and male; Duggan, 2015) who spends long amounts of time playing digital games points to the widespread dominance of digital games in contemporary culture, as does the presence of (digital) game devices in over 90% of Australian households (Brand et al., 2019). Constant forecasts of the growth of the digital games (again, usually referred to as just "games") software and hardware industry (Merel, 2017), as well as related industries such as esports (Kelly, 2018), have been used to bolster claims that digital games are the foundation of current Internet technologies and have played a role in preparing the human race for the new age of human–computer interaction (Meeker, 2017). Digital games are promoted, seemingly without consideration of the other types of games that precede and exist alongside them. In a reflection of this trend, many calls for gamification for health use the term "game" while describing only digital games. While recent major industry reports have promoted (digital) games as "the most engaging form of social media" (Meeker, 2017, p. 114), they do not mention that the majority of humankind likely grew up playing games, both alone and with their peers, and that games and play are a fundamental cultural force embedded deeply in society (Caillois, 1958/2001). Games (and gamification by extension) cannot be understood without first examining the characteristics and intricacies of the game form.

The term "game" is notoriously difficult to define (Stenros, 2016). In his review of definitions of this term, Stenros (2016) identifies the common themes they share: rules; purpose; duality of being artifacts and activities; players; productivity; separation from the world; conflict; and telicity (leading to a definite end). Stenros demonstrates that considerable debate and even opposing positions on each of these themes exist, but also that

it is this debate that shows how important these themes are when conceptualizing games. From Stenros' synthesis of his findings, it is clear that games are much more than digital games, or even other forms of predigital games, such as board games, ball games, or word games. As tools of leisure, challenge, and simulation (for example, in the form of gambling, meritocracy, and entertainment, respectively), games and game-like processes are a cultural construct that have served a wide variety of purposes in human society for millennia (Caillois, 1958/2001). When creating gameful experiences, gamification designers should therefore draw inspiration from not just digital game elements, but also these broader sociocultural constructs.

According to French sociologist Roger Caillois (1958/2001), there are four types of play: *agon* (competition), *alea* (randomness and uncertain outcomes), *mimesis* (imitation; or pretending to be, or act for, someone or something else), and *ilinx* (the exhilaration of vertigo, for example, via dancing or riding roller coasters). While not all types of play are present in every game, every game contains one or more of these types of play. Referring to this framework, one can see that most mainstream applications of gamification, such as the "PBL triad" (points, badges, and leaderboards; Chou, 2015)—as well as commonly mentioned game elements such as progress markers, achievement-based rewards, and so on—rely mostly on *agon* (Sicart, 2014; Idone Cassone, 2016). There is much room for designing and implementing gamification that takes advantage of the appeal of *alea*, *mimesis*, and *ilinx*, particularly in a way that supports intrinsic motivation (Helmefalk et al., 2020) and promotes innate satisfaction with the activities the gamified service is intended to encourage (Sicart, 2014).

Reflections on How Gamified Systems Communicate Through Procedural Rhetoric

Games represent, but are also *separate* from, the world around them: they are a "voluntary safe action" with "slight consequentiality" (Deterding, 2013). This "pretend context" allows for safer rehearsal of emotional regulation (and other types of adaptive regulation) strategies (Granic et al., 2014), and can also serve educational purposes, for example, by allowing exploration of complex situations (Schrier, 2017). However, as games reflect the world around them (Stenros, 2016), like other works of fiction they are inherently biased toward communicating certain views or beliefs, whether directly via plot/narrative, indirectly via premise, setting, and visual representations, or procedurally via available actions such as rules and mechanics (Juul, 2013). The same applies for gamified systems, including gamified health technologies. For example, by only providing functionality to record performance metrics (i.e., distance, duration, and location), and rewarding based on these metrics, the Nike+ system implicitly communicates that other enjoyable aspects of running, such as the runner's high, or the mindful interaction between human and environment, are less important (Sicart, 2014). This can lead to users feeling pressured to log those types of data, potentially at the expense of what the user may instead personally find meaningful about running, and

compromise intrinsic enjoyment of, and motivation to engage in, the activity (Schmidt-Kraepelin et al., 2019). In short, these applications of gamification reward users for appearing to have done the behavior, rather than the behavior (and its intrinsically enjoyable aspects) itself.

Games and gamified systems necessarily depict real-world processes through processes of abstraction, analogy, and imitation (Juul, 2013; Idone Cassone, 2016). These processes can range from simple, abstract loops of achievement and reward (e.g., completing a task to earn points), to more concrete experiences that vary depending on the type of game. For example, a cooking game could depict "preparing spaghetti with meatballs" and ask its players to stir the sauce by drawing circles on the screen. Games and gamified systems relating more directly to mental health and wellbeing could depict a wide variety of experiences to varying levels of abstraction, such as "reframing a thought," "a day with severe depression," "injecting heroin intravenously," or "managing a panic attack." Players of these games, and users of these gamified systems, can interact with these represented experiences repeatedly and with less consequence. Given appropriate levels of reflection and critical thinking on the part of the players and users of these systems (Tyack and Wyeth, 2017), this ability to rehearse and explore otherwise distressing or unsafe experiences has potential in supporting the learning of adaptive regulation strategies (Granic et al., 2014), increasing and deepening understanding of complex issues (Schrier, 2017), and even changing attitudes (Bogost, 2007).

However, in the case of complex sociological issues such as mental health and wellbeing, and its intersections with other social categories such as (but not limited to) ethnicity, sexuality, and gender, inappropriate abstraction may unintentionally communicate an undesired message that may undermine technology aims or even harm users. For example, when representing the experience of substance addiction, it would be important to strike a balance between depicting enough of the experience to make it meaningful and abstracting it sufficiently to maintain the clarity of the intended message and the smoothness of the user experience. The ideal user experience should not be offensive to either the player or the group whose experience is being represented. The consultation of all relevant stakeholders (including but not limited to mental health researchers, technology users, clinicians, software developers, and, where involved, game and gamification designers) is crucial for the success of gamification for mental health and wellbeing (Fleming et al., 2016).

McCallum (2012) argues that while game designers can design for player experience, they cannot control it, and that each player is different and may interpret and play the game in ways the designer may not have intended or predicted. The same observation has been made for health technologies in general (Greenhalgh and Russell, 2010; Pham et al., 2016). Therefore, situations where abstract depiction could be difficult, misleading, or otherwise impractical to perform and test may not be suitable for gamification. While it is the role of the designer and testers to anticipate unintended outcomes during the design and development process, this may not be feasible,

or appropriate, for all projects. Technology designers facing situations like this should be aware of the problems with applying games to these cases and could consider alternate behavior change strategies and techniques.

Some activities, on the other hand, could be particularly complementary with gamification. As games are artifacts and activities that require active participation (or *play*) to progress, they are a natural complement to skill-building activities or those that require active participation (e.g., exposure therapy; Donker et al., 2018), as well as activities involving direct audiovisual or haptic feedback (e.g., an educational software that uses virtual reality and biofeedback monitoring to support mindful meditation; Choo and May, 2014). Designing technologies to contain more of these types of activities, and integrating gameful design concepts within these activities instead of solely applying them peripherally via progress feedback, points, and rewards (the most commonly applied gamification elements in apps and technologies for improving mental health and wellbeing; Cheng et al., 2019), could result in mental health and wellbeing technologies and interventions that are more engaging and well-received.

DEVELOPING AND EVALUATING GAMIFIED TECHNOLOGIES FOR MENTAL HEALTH AND WELLBEING

The Supportive Role of Gamification

Huotari and Hamari's (2012) definition of "gamification" implies that how gamification can "enhanc[e] a service" should be considered before it is deliberately implemented "to support [a] user's overall value creation." However, the lack of theoretically driven health gamification (Lister et al., 2014) suggests that this does not happen. Instead, gamification is seen by some as "strip-min[ing]" games of their "useful" elements (Ferrara, 2013) and superficially applying them to further pre-existing goals. This approach to gamification is reductionist and implies an assumption that individual gamification elements have additive, instead of synergistic, effects on the system or service being gamified. However, much like how digital health technologies operate within a wider psychosocial context (Ritterband et al., 2009; Greenhalgh and Russell, 2010), so do games operate within a system that players find engaging precisely because all components of the game (not just its individual elements) work together with the player, environment, and potentially other sociocultural factors to create a satisfying player experience (Deterding, 2015). Naturally, this would also apply to gamified technologies for mental health.

Sicart (2014) argues that technologies, particularly gamified technologies, should support a person in achieving "the good life." Similarly, in their definition Huotari and Hamari (2012) emphasize the supportive role of gamification. Considering their definition further leads to the conclusion that to maximize effectiveness, gamified technologies should be intentionally implemented to support their *users* (people),

value (evidence-based processes), and the *creation* of this value (user interaction with these evidence-based processes). A high-level amalgamation of the Internet Interventions Model with instructional design principles (Hilgart et al., 2012) can be used as a base from which to visualize the development of health technologies. On this model, users, value, and value creation would map roughly onto the *analysis* (user) and *strategy* (mechanisms of change and website use) phases: namely, identifying needs, formulating goals, and developing strategies to achieve those goals.

Gamification Supporting Users (People)

The Internet Intervention Model lists seven characteristics users differ on that could influence how they interact with the intervention: disease type and severity; demographics; psychological traits; cognition; attitudes and beliefs; physiological factors; and skills (Ritterband et al., 2009). The importance of tailoring user experience for both user satisfaction (Cheng et al., 2018) and improved clinical outcomes (Tregarthen et al., 2019) has been established. This can range from relatively simple (e.g., the system consistently referring to the user with the right name and pronouns after a user inputs them) to more sophisticated tailoring based on user behavior and preferences. Whether or not these are considered gamification elements, both passive, system-driven tailoring (or "personalization") and active, user-driven tailoring (or "customization") are among the most commonly implemented elements in gamified apps and technologies for the improvement of mental health and wellbeing (Cheng et al., 2019). The endorsement of both personalization and customization suggests that not only do users of these technologies want technology to support them, they also want to *help* the technology support them.

Researchers have suggested that gamification designers could consider incorporating cooperative mechanics (Helmefalk et al., 2020), thereby supporting connections between users. This could be achieved by drawing inspiration from contemporary digital games (Cheng et al., 2019). One example is *Journey* (Thatgamecompany, 2012), whose complete focus on cooperative social mechanics contrasts that of many mainstream digital games and typical cases of social gamification. *Journey's* multiplayer mode encourages social cooperation by making the game easier to play when playing with another player (given a sufficiently cooperative partner). Importantly, while multiplayer mode can make it easier to solve puzzles, it is not necessary to progress in the game. By making social cooperation optional, *Journey* preserves player autonomy and prevents its players from potentially being frustrated by circumstances they cannot control. Furthermore, instead of invoking social status and competition through elements such as badges, levels, leaderboards, and customizable avatars (usually with prestige markers such as special clothing items or accessories), *Journey* removes overt markers of difference such as language and gender, reflecting a more egalitarian philosophy of prioritizing current actions over previous achievements. This may align better with the goals of mental health and wellbeing interventions.

Gamification Supporting Value (Evidence-Based Processes)

Many mental health and wellbeing technologies, particularly those with an academic origin, adapt existing evidence-based therapies and techniques. For example, Earle et al. (2018) describe an adaptation of personalized normative feedback for problematic alcohol use, while Vella et al. (2018) describe a gamified wellbeing app that adapts techniques from acceptance and commitment therapy and positive psychology. However, previous research has identified a lack of application of health behavior change theory in gamified health and wellbeing technologies (Lister et al., 2014; Schmidt-Kraepelin et al., 2020). Furthermore, applications of gamification for health and wellbeing also appear to lack adequate reference to motivational theory (Johnson et al., 2016).

Therefore, psychological and health behavior change theories, including but not limited to self-determination theory (Deci and Ryan, 2000) or the behavior change wheel (Michie et al., 2011), should also drive the implementation of gamification for mental health and wellbeing. Designing gamified technologies with a focus on satisfying the innate psychological needs specified by self-determination theory can promote motivation that is relatively more internally regulated, and create conditions favorable for psychological wellbeing (Ryan and Deci, 2000). This could complement self-management interventions, which are a cost-effective, autonomy-promoting method of improving mental health outcomes that are helpful for people with serious mental illness (Lean et al., 2019). The choice of theory to apply during design and development would likely vary across contexts (e.g., acute vs. chronic illness; one-off assessment vs. long-term engagement), and an analysis of this context should be conducted in the early stages of gamification design.

Finally, it is important that gamification does not overshadow or distort user motivations for engaging with a health technology, and instead supports the delivery of an intervention's "active ingredient" (Vella et al., 2018). While this active ingredient can take many forms, such as an intervention principle (Mohr et al., 2015), an app, a technology, or other process, it is important that it has an evidence base showing empirical support for the techniques or mechanisms through which the technology aims to improve its users' mental health and wellbeing.

Gamification Supporting Value Creation (User Interaction With Evidence-Based Processes)

While it is crucial that a gamified health technology draws on evidence-based theories and techniques, to ideally promote an improvement of health-related outcomes, no promotion will occur if the technology is not used. Therefore, gamified apps and technologies should also support the creation of value, or the direction of user effort toward the abovementioned evidence-based processes.

When considering gamified technologies at face value, there is a tension between being easy to use via good user experience design, and being sufficiently challenging to be motivating via good game design (Deterding, 2015). Furthermore, while immersion and similar flow-inducing techniques have been cited as advantages of gamification (Baranowski et al., 2008; Helmefalk, 2019), the somewhat opposite approach of encouraging mindful, active self-reflection may also be conducive toward achieving mental health goals, for example, through learning and understanding complex situations (Tyack and Wyeth, 2017). Similarly, Cheng et al. (2018) found that participants perceived activities that required more active participation (e.g., creating, and physically typing, a message to a loved one) more helpful and meaningful than activities requiring less participation and effort. While gamified technology designers should focus on making it easy and intuitive for users to navigate certain parts of a technology (e.g., registration and setup), they can also consider where, and how, it may be appropriate to make activities more challenging. As game developers are experts in designing challenges, this seems a natural area about which to consult their expertise. A collaboration between health researchers, game studies academics, and game developers could potentially lead to a novel, engaging, and effective intervention for mental health and wellbeing.

Designing and Developing Gamified Technologies

So far, this article has outlined themes to consider when creating gamified technologies for mental health and wellbeing. However, how should this be executed in practice?

Briefly Reviewing Gamification Design Methods and Frameworks

In their systematic review on gamified apps and technologies for mental health and wellbeing, Cheng et al. (2019) provide a taxonomy of gamification elements that mental health technology developers may find a helpful frame of reference. Similarly, Helmefalk (2019) lists a number of psychological mediators synthesized from gamification articles across seven disciplines, and proposes that "gamificators," or people who gamify, consider mechanics, psychological mediators, and desired outcomes (M-PM-O) when creating a gamified technology. Additionally, Ašeriškis and Damaševičius (2014) list a number of common "gamification patterns," or design patterns commonly found in gamified systems, that can be used as reference when designing resource systems (such as for points) within gamified apps. For a more macroscopic view of the development and evaluation process, Floryan et al. (2019) merge general gamification principles with the Internet Intervention Model. Finally, Deterding (2015) describes a method of gameful design that starts with considering the core goals of the activity and brainstorming how the challenges inherent to that activity can either be removed or have motivational affordances created to support it.

A systematic review of gamification design frameworks by Mora et al. (2017) identifies iterative processes, user-centered design principles, and psychological and motivational theories (such as self-determination theory) as key principles shared by the majority of reviewed design frameworks. Mora et al. (2017) also identify common game design elements specified by these frameworks, with the most common being objectives, rules, social interaction, and fun, and the application of these

elements to effect a desired behavior. However, as described above in the section "Understanding Gameful Experiences Through Understanding Games," more recent research has shifted to explicitly consider users of gamified systems as active participants in the creation of a gameful experience (Landers et al., 2019). To that end, some psychometric scales measuring perceived gameful experience have been developed, such as GAMEX (Eppmann et al., 2018) and GAMEFULQUEST (Högberg et al., 2019), and researchers should select which instrument suits their objectives better. As GAMEFULQUEST does not explicitly measure negative affect (or lack thereof), GAMEX may be more appropriate for contexts where this would be relevant (for example, if designers want to design an experience void of negative affect). Regardless of which instrument is ultimately selected, it will be crucial for future gamification research to account for gameful experience and confirm that the gamified technologies under investigation are actually perceived as such.

Previous research has noted that evaluations of gameful experience should only be conducted when the technology reaches a certain maturity (Morschheuser et al., 2017). Early in the design and development process, it may be more helpful to obtain richer data directly from the target end user, for example through qualitative methods. While standard software design processes (e.g., the use of personas, user journeys, and A/B testing; Morschheuser et al., 2017) allow for the consideration of user perspectives, when dealing with sensitive and highly personal topics such as mental health, more equitable methods that allow for the direct contribution of rich data from the end user in an empowered context may also be needed.

Iterative Design Through Participatory Design Methods

Participatory design (PD) and other co-design methodologies are gaining traction in eHealth and mHealth, particularly for mental health and wellbeing. Simply put, these methodologies involve target end users in the design, development, and evaluation processes of technologies and interventions. While the concept of user testing is not new, and calls for applying gamification for health and wellbeing also include recommendations to test that this application is appropriate (Cugelman, 2013), a key tenet of PD is that the target end user should be present at *all* stages of the design, development, and evaluation process. This prevents their tokenistic involvement either too early or too late in the process to achieve real impact (Orlowski et al., 2015). Involving end user populations at early stages of development, for example, via evaluation of wireframes, prototypes, and design concepts (Ospina-Pinillos et al., 2018), can also help ensure that resources are not wasted on inappropriate solutions. In Australia, PD has been emphasized as a key strategy for the development of evidence-based interventions, particularly for youth mental health (Hagen et al., 2012).

Co-designing technologies that promote autonomy with healthcare consumers, particularly people with lived experience of mental illness, can also contribute toward counterbalancing their frequent experiences of unidirectional, paternalistic doctor–patient relationships. PD can help designers learn directly

from their target end users how best to present and structure technologies for mental health and wellbeing, including content, tone, frequency, and module length, if applicable (Fleming et al., 2016). When brought to its natural extension, this co-design process places target end users at the center of the process, allowing them to directly contribute to, or specify guidelines for, developing the technology. These end user guidelines can then be considered in tandem with evidence-based best practice. PD has been found to be an important and effective way of making sure that technologies are as current and suited to the target population as they can be (Ellis et al., 2014). Furthermore, as PD spans multiple phases (from the start to the end of the project), it can be conducted with a variety of research methodologies, including focus groups, PD (and co-design) workshops, surveys, and user testing (Hagen et al., 2012; Ospina-Pinillos et al., 2018). This triangulation of methods can help support the validity of the ensuing findings.

Participatory design can also be instrumental in reflecting the priorities and concerns of the target end user population into technologies designed with them, particularly those who have historically been marginalized (Hagen et al., 2012)—including but not limited to those with diverse genders and sexualities, First Nations peoples, and culturally and linguistically diverse people—as well as those who otherwise experience a sociological power imbalance such as children (Yarosh and Schueller, 2017). Similarly, as people with chronic conditions (including mental illness) are experts in their own experience, PD can facilitate the contribution of this lived experience to directly influence the development of technologies for people like them in contextualized and rich detail (Jessen et al., 2018). This is particularly important given that multiple forms of marginalization intersect to create compounded barriers to accessing mental health resources (Brown et al., 2016a). PD can also help confirm that the development of a particular technology is appropriate for the target population's needs, particularly those who face barriers to seeking information or care, such as mental health stigma (Ellis et al., 2014). In cases where resources (including time and funds) are limited, PD may also be an efficient way of both identifying the best solution given adequate communication of these constraints, as well as reflecting the concerns of the target population back to other stakeholders such as health services. Notably, through the use of PD methodologies with veteran counseling service Open Arms (including veterans, health professionals, and administrative staff), LaMonica et al. (2019) were able to identify areas of the service pathway that could be improved, leading to rapid service change.

Participatory design has also been successfully used for applying games to mental health and wellbeing. Through using a PD methodology named "experiential participatory and interactive knowledge elicitation," Sockolow et al. (2017) were able to obtain feedback on their proposed mHealth game's storyline from their target audience (13–17-year-old African American young women from under-resourced communities). Specifically, through engaging with these young women, the authors were able to identify aspects of their prototype that their intended audience found off-putting (including background

images, character body types, skin tone, and slang) and act on their participants' suggestions, increasing the credibility of the game with the target audience and the likelihood that they would play it. Though Sockolow et al. report on the development of a serious game and not a gamified technology, a similar process for a gamified technology could elicit insights into unforeseen problems with the technology, brainstorm methods on how to address these problems, and confirm the acceptability of the technology.

Finally, previous research shows the importance of bringing all stakeholders together—those with lived experience of mental illness (service users), those who deliver the care (health professionals and service workers), and those who study the phenomena (mental health researchers)—allowing all stakeholders to have an active, unique contribution to the final end product (Ospina-Pinillos et al., 2018; LaMonica et al., 2019). Involving health professionals in the PD process is particularly crucial as while their endorsement is a large motivating factor in encouraging service users to use gamified mental health interventions, health professionals are time-poor and a subset further hold negative attitudes toward incorporating digital technologies into mental health practice (Hopia and Raitio, 2016; Hickie et al., 2019). Naturally, when incorporating applied games into mental health technologies, those who build and play games (game developers and players) should also be included in PD processes.

Clinically Evaluating Technologies in Tandem With Software Development Schedules

Digital technologies are not cheap to develop. Furthermore, eHealth/mHealth research teams are often small and work on projects with strict time limits defined by funding bodies. Hence, it is important to maximize the temporal and financial efficiency of research collaboration with software developers when producing technologies for mental health and wellbeing. While it is necessary for developers to accommodate research practices (e.g., the relatively longer length of clinical evaluation trials compared to user research studies), the best outcomes arise when researchers accommodate software development practices as well, such as quick production cycles and the iterative improvement of a Minimum Viable Product (Fleming et al., 2016).

The traditional gold standard of clinical evaluation, the randomized controlled trial (RCT), was originally developed to evaluate drugs. In order to reduce possible confounders, RCTs adopt restrictive inclusion and exclusion criteria and sophisticated blinding procedures to isolate and identify causation effects. However, unlike drugs, health technologies are psychosocial and are necessarily embedded into a wider social context (Greenhalgh and Russell, 2010). By viewing these contextual factors as confounders, RCTs undermine the complex mechanisms through which health technologies operate (Pham et al., 2016). Instead, eHealth and mHealth researchers have recommended using evaluation methods that allow for reflexivity and the consideration of contextual factors such as

stakeholder interactions and power dynamics (Greenhalgh and Russell, 2010), as well as rapid methods that accommodate the naturalistic factors of technology usage and the iterative nature of technological development (Mohr et al., 2015). Depending on the nature of available data, these designs can be strengthened by incorporating more rigorous research design elements, such as case-control matching. Instead of viewing external factors as confounders, eHealth and mHealth research and researchers should reflexively acknowledge how these factors could both weaken and strengthen their research conclusions (Greenhalgh and Russell, 2010).

A key strength of the RCT is that causal relationships between the intervention being tested and the clinical outcomes under investigation can be established. However, in traditional RCT designs, this means that the intervention is "locked down" into an unchanging state and that all RCT findings relate to this state. For technological interventions, this often means that the intervention has long become obsolete by the time the RCT concludes and findings are published. To mitigate this problem while still preserving scientific rigor, Mohr et al. (2015) suggest evaluating "intervention principles" instead of the intervention itself, with this approach allowing iterative improvement of the intervention under investigation. Naturally, in order to provide future researchers with adequate knowledge of the context surrounding the intervention, any modification to the intervention must be comprehensively reported (Mohr et al., 2015).

Figure 1 shows a complete co-design, development, and evaluation process of a gamified mental health and wellbeing app that was adopted by a doctoral project (Cheng, 2019). Importantly, as researchers conducted user testing across multiple stages of development (two time points before app launch and one time point after app launch), findings fed back into the development process. As valuable insights from representative end users can be obtained during the design and testing process, involving researchers in these activities enables the contribution of this data to the literature, potentially through rigorous qualitative methodologies such as thematic analysis or grounded theory. Furthermore, the use of both qualitative and quantitative evaluation methodologies takes advantage of the strengths of each approach, and enables the triangulation of, and a higher level of confidence in, project findings.

This model identifies and delineates the individual contributions of research and industry. However, while executing this process we encountered multiple complexities. During design workshops and user testing, representative end users expressed preferences that would often be unreconcilable with existing project budget and technological infrastructure. It may have been helpful to have the software developers take part in the PD workshops alongside the representative end users. However, their presence may also have influenced workshop dynamics, as their expertise in technology development would have placed them in a relatively higher position of authority, potentially undermining the workshop's participatory nature. This dynamic would have to be managed and carefully balanced by workshop facilitators. Importantly, although some preferences

FIGURE 1 | A possible model for developing and evaluating mHealth apps.
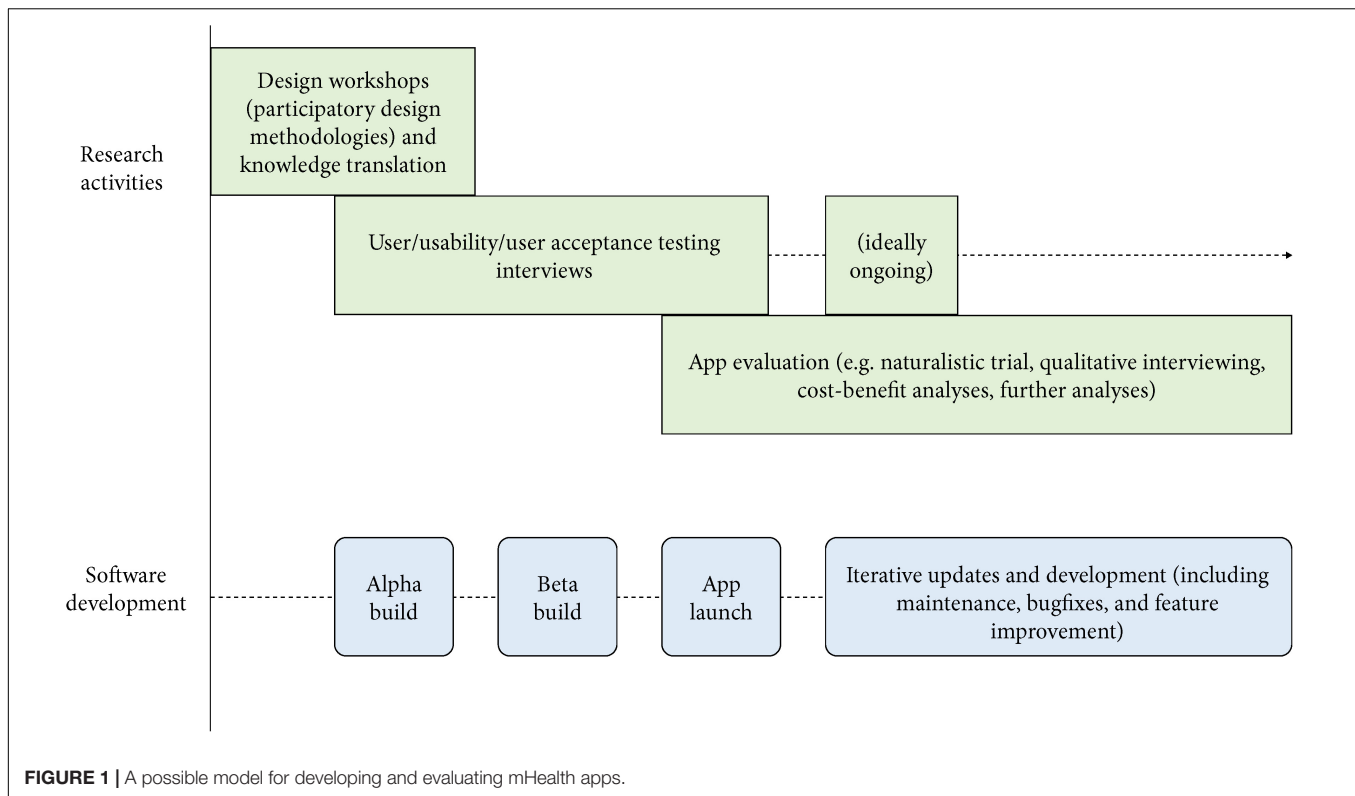
were unable to be implemented, they were still captured and disseminated for future reference (Cheng et al., 2018).

RECOMMENDATIONS FOR IMPLEMENTING GAMIFICATION FOR MENTAL HEALTH AND WELLBEING

In the first section, this conceptual analysis briefly reviewed the literature on gamification for mental health and wellbeing. Then, in the next section, "Interrogating Gamification for Mental Health and Wellbeing," it examined the complexities of the game form to demonstrate that gamification is not just implementing surface-level game mechanics such as points, badges, or leaderboards. In the following section, "Developing and Evaluating Gamified Technologies for Mental Health and Wellbeing," this article further explored the process of designing, developing, and clinically evaluating gamified technologies for mental health and wellbeing, through the application of theory, methodologies, processes, and frameworks which are standard in their fields of origin, but rarely combined (as identified by, e.g., Schmidt-Kraepelin et al., 2020).

This section summarizes the previous three sections into brief recommendations for implementing gamification for mental health and wellbeing (**Box 1**). These recommendations are not intended to stand alone, and the rest of the article should be read to understand the context within which they sit. The aim of these recommendations, and this article in general, is to provide clear guidance for researchers and practitioners interested in applying game design concepts to mental health and wellbeing initiatives, with a focus on advancing the field's collective knowledge via clear language, unified terminology, the application and evaluation of theory, comprehensive and constant documentation, and transparent evaluation of initiative outcomes.

First, the suitability of implementing gamification should be assessed. Before mental health technology designers assess how best to apply gamification to their technology, it is best to assess whether gamification should even be applied at all (see the section "Reflections on How Gamified Systems Communicate Through Procedural Rhetoric"). This assessment should concretely operationalize the intended aims of the technology and consider how gamification can be implemented to support these aims (see the section "The Supportive Role of Gamification"). Furthermore, the purpose(s) of gamification should be determined.

Second, gamification should ideally be implemented at a deeper, systemic level of the technology (see the section "The Supportive Role of Gamification"). Designers should not refer solely to digital game elements, but also draw inspiration from more fundamental characteristics of games, such as the four types of play that underlie the game form (Caillois, 1958/2001), or procedural rhetoric (see the section "Reflections on How Gamified Systems Communicate Through Procedural Rhetoric"). Multiple researchers have proposed methods of implementing gameful design that would suit different needs (Deterding, 2015; Mora et al., 2017; Morschheuser et al., 2017; Floryan et al., 2019), as well as elements and psychological mediators to consider when designing (Cheng et al., 2019; Helmefalk, 2019). Gamification

BOX 1 | Recommendations for implementing gamification for mental health and wellbeing.
1. Assess the suitability of implementing gamification and make sure it complements the technology's aims and processes
2. Implement gamification intentionally at a deeper, systemic level to support users, evidence-based processes, and user engagement with these processes
3. Assess the acceptability of the gamified technology throughout the design and development process, involving all stakeholders (including but not limited to representative end users, researchers, health professionals, software developers, and game designers)
4. Evaluate the impact of the gamified technology
5. Provide comprehensive and detailed documentation of the (co-)design, development, and evaluation process, using terminology correctly and consistently

should interact with the other components of the technology to create a coherent system (Deterding, 2015) that supports users' individual differences and preferences via passive and active tailoring as well as (optional) social connection between users via social mechanics. Cooperative social mechanics may align more with the goals of mental health and wellbeing technologies than competitive social mechanics (Cheng et al., 2019). While the choice of theory should be driven by the context surrounding the gamified technology (e.g., its purpose, whether its target mental health domain is acute or chronic, whether it aims to support one-off or sustained engagement, etc.), the gamified technology should also be deliberately designed to support the evidence-based theories and techniques that inform its content. Examples of such theories could include, but are not limited to, health behavior change theories such as the behavior change wheel (Michie et al., 2011; Lister et al., 2014) or theories of motivation such as self-determination theory (Deci and Ryan, 2000; Ryan and Deci, 2000). Finally, gamification should support user interaction with the technology by directing user effort away from components not directly related to the technology's aims (e.g., registering an account). Instead, user effort should be directed toward the evidence-based components, through activities that require active user participation and that provide engaging, interesting levels of challenge, naturally complementing the ideals of gameful design.

Third, the acceptability of the gamified technology should be assessed throughout the design and development process. Early testing of key concepts prevents wasted resources on unsuitable concepts and improves the acceptability of a technology with its target audience (Sockolow et al., 2017). Ideally, a mixture of survey and interview (including focus group) methodologies should be used. Empirically validated user experience scales such as the System Usability Scale (Lewis and Sauro, 2009) and the User Engagement Scale (O'Brien et al., 2018) can provide quick measures of user experience that can be compared across time, and PD and related co-design methodologies give all stakeholders the opportunity to contribute their unique expertise to the design process (see the section "Iterative Design Through Participatory Design Methods"). For a gamified mental health and wellbeing technology, stakeholders might include, but not be limited to: representative technology users (e.g., with lived experience of mental illness), health professionals, researchers, software developers, game designers, and game players. While it may be useful to provide opportunities for different stakeholder groups to co-design the technology with each other (e.g., a PD workshop), it is also important to be mindful of the possibility of implicit power dynamics influencing the final outcome. It is also important to confirm the acceptability of what the technology and

its gamification may be communicating, to prevent its content and functionality from being misinterpreted and misused.

Fourth, the impact of the gamified technology should be evaluated (see the section "Clinically Evaluating Technologies in Tandem With Software Development Schedules"). Ideally, the technology should be evaluated across multiple stages of implementation so that early findings can be iteratively applied toward making improvements (**Figure 1**). As above, survey and interview methodologies could be used during initial stages of development (pre-alpha, alpha, and beta) to obtain a mixture of snapshot scores that can be compared across time and rich qualitative data that provides more insights into how to further improve the technology. More comprehensive evaluations of the technology's impact (relating to the technology's specific purpose, e.g., users' depression symptoms, self-efficacy, etc.) could then be conducted at later stages. It is also crucial to assess the subjective level of gameful experience perceived by users of the gamified technology, in order to confirm that the technology has been adequately gamified (Landers et al., 2019; also see the sections "Understanding Gameful Experiences Through Understanding Games" and "Briefly Reviewing Gamification Design Methods and Frameworks"). To accommodate the fast pace of technological change and the complex contexts of technology use, a wider variety of faster and more flexible methods, such as qualitative data collection and analysis, naturalistic evaluation trial designs, and analyzing usage analytics should be employed. A mix of methods and data sources also suits different research questions and enables triangulation of findings with increased convergent validity. As there is little research on the long-term effects of gamification, this should also be evaluated, if possible.

Finally, the design (ideally co-design), development, and evaluation process should be documented comprehensively (see the sections "Briefly Reviewing Gamification Design Methods and Frameworks" and "Clinically Evaluating Technologies in Tandem With Software Development Schedules"). The theories applied and principles evaluated should be defined prior to the start of evaluation, for example, with a principle statement (Mohr et al., 2015), which should describe the purpose and functionality of both the technology and how gamification supports this (assessed and operationalized as part of Recommendation 1) in detail. While many gamified technologies integrate multiple gamification elements, making their individual impact difficult to evaluate (Johnson et al., 2016), detailed documentation of these, and other, design features will facilitate a more accurate interpretation of any resulting outcomes (Mohr et al., 2015). Cheng et al. (2019) provide a suggested taxonomy, developed from existing gamification

literature and refined following a systematic review of gamified mental health apps and technologies, for this purpose. While gamified technologies should be conceptualized as a system and should not be reduced to their individual elements (Deterding, 2015), listing individual gamification elements and using terminology consistently increases clarity and gives researchers (and designers) a more complete, accurate picture of the technology described. This is particularly relevant for researchers and designers unfamiliar with the study of games and gamification and who are encountering gamification literature for the first time. As games and play are a fundamental cultural force in society, these researchers and designers would likely have a lay familiarity with games in personal and informal contexts, with the resulting differences in conceptualization and terminology contributing to the inconsistent use of terminology reviewed earlier in this article. In this situation, clear, cohesive literature would contribute greatly toward harmonizing different conceptualizations of gamification.

FURTHER DIRECTIONS

The recommendations above provide suggestions for implementing gamification for mental health and wellbeing, summarized from a literature review primarily informed by the medical and game studies literature. While synthesized from the literature reviewed above, these recommendations overlap heavily with existing methods for designing gamification published in the field of human–computer interaction (Mora et al., 2017; Morschheuser et al., 2017). In particular, Morschheuser et al. (2017) also emphasize the importance of iterative design that takes a holistic perspective of the gamified system, a thorough context and user analysis, and sustained evaluation of the solution. As stated above, a higher level of collaboration with industry is needed to develop these gamified technologies. This conceptual analysis also argues for the usefulness and relevance of PD methodologies, personalization (also known as tailoring), and de-emphasis of social status and competition when developing gamified technologies for mental health. Social cooperation features, particularly alongside a complete absence of competition, are rarely present in the design of mental health technologies of academic origin, and the use of gamification is often poorly justified and operationalized in such technologies (Cheng et al., 2019). Future academic work in this area should, therefore, focus on addressing these gaps in research.

Furthermore, it is imperative that the developed technologies be evaluated, not just to determine their effectiveness, but also to evaluate whether the recommendations presented in this article are useful and complement standard research and software development practices. In keeping with latest developments in the study of gamification, evaluations of gameful experience (as recommended by Landers et al., 2019) should also be adopted. More evaluation could also point to which aspects or approaches toward gamification may be more compatible with certain types of technological interventions (for example, a certain approach toward gamification may be particularly compatible with a specific mental health domain or behavioral

change mechanism). Furthermore, while gamification has been deployed to support care on an individual (usually self-directed) level, it may be productive to explore the possibility of doing so on a systemic and service-directed level as well. The multilevel model of gamefulness proposed by Landers et al. (2019) that explicitly considers individual users alongside the systems (e.g., organizations) they belong to may be useful in such cases.

More research is also needed to determine the best way to study gamified technologies. While conceptualizing the study of individual gamification elements (through a taxonomical approach) may be more straightforward, games are a system (Deterding, 2015). Subscribing too closely to the taxonomical approach has a danger of implying that gamified systems are made up entirely of the sum of their parts. In addition to measuring gameful experience, the best way forward in this regard may be to apply mixed methods and document both the individual gamification elements (or features) contained in the technology, as well as the broader effect or impact of the technology (potentially through thematically analyzing interviews and focus groups, or even using grounded theory approaches). Naturalistic trial designs are also suitable as they accommodate contemporary software development schedules without necessarily sacrificing research rigor.

CONCLUSION

This article synthesizes a conceptual analysis, as well as insights from a complete co-design, development, and evaluation process using a variety of qualitative and quantitative research methods, into recommendations for implementing gamification for mental health and wellbeing. While collaboration with industry is vital for developing gamified technologies, researchers are uniquely positioned to evaluate technologies throughout the development cycle to ensure that the implementation of gamification itself is both acceptable and effective. As gamified mental health technologies represent the intersection of mental health research, human–computer interaction, and game studies, interdisciplinary collaboration, with human–computer interaction and game studies researchers, will be important in answering these questions.

In order for gamification to reflect the cultural artifact it draws its principles from, it is important that future implementations harness more fundamental, but under-utilized, types of play and game mechanics. Games scholars have described games as "unproductive" (Caillois, 1958/2001) and yet "effort[ful]" (Juul, 2005). While there has been much discussion of the high levels of engagement games (and digital games) enjoy despite their unproductivity, perhaps the discourse can be swung to focus, instead, on how to direct the effort games inspire from their players to align with the aims of mental health and wellbeing research.

AUTHOR CONTRIBUTIONS

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Being Mindful at University: A Pilot Evaluation of the Feasibility of an Online Mindfulness-Based Mental Health Support Program for Students

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University study can be a life period of heightened psychological distress for many students. The development of new preventive and intervention programs to support well-being in university students is a fundamental challenge for mental health professionals. We designed an 8-week online mindfulness-based program (eMBP) combining a face-to-face approach, text, audio, video components, and support psychotherapy principles with a unique intensive reminder system using the Facebook Messenger and Slack applications in two separate runs (N = 692). We assessed the program's effect on mindful experiencing, perceived stress, emotion regulation strategies, self-compassion, negative affect, and quality of life. The results of the presented pilot study confirmed that eMBP is a feasible and effective tool in university students' mental health support. The students who completed the eMBP reported a reduction of perceived stress with a large effect size ($_\rho\eta^2$ = 0.42) as well as a decrease of negative affect experience frequency and intensity ($_\rho\eta^2$ = 0.31), an increase of being mindful in their life (Five Facet Mindfulness Questionnaire subscales: $_\rho\eta^2$ = 0.21, 0.27, 0.25, 0.28, 0.28), and a higher rate of self-compassion ($_\rho\eta^2$ = 0.28) with a medium effect size. A small effect size was found in the frequency of using a cognitive reappraisal strategy ($_\rho\eta^2$ = 0.073). One new result is the observation of an eMBP effect ($_\rho\eta^2$ = 0.27) on the decrease in attributed importance to the quality-of-life components replicated in two consecutive runs of the program. The study affirms that mindfulness-based interventions can be effectively delivered in an eHealth form to university students.

Keywords: mindfulness, online intervention, self-compassion, emotion regulation, life satisfaction, eHealth

INTRODUCTION

Current research and clinical experience show that the time of university study can be a life period of heightened psychological distress for some students (Garlow et al., 2008; Bewick et al., 2010; Keyes et al., 2012). Research suggests that, at any given time, 20–25% of students are stressed (Kumaraswamy, 2013), and 50% of students may experience stress in the form of anxiety and

depression (Regehr et al., 2013). Alarming results have been repeatedly documented, especially among medical students (Dahlin et al., 2005; Dyrbye and Shanafelt, 2016). Almost half of them experience severe stress-related symptoms, and 5–10% of them report suicidal ideation during their studies (Dyrbye et al., 2006). A negative relationship between the low mental health of students and their academic performance has been documented (Mortier et al., 2015). The capacity of university advisory services to help students is often limited by the number of sessions. The waiting time for psychotherapy treatment or psychological counseling for non-urgent problems, such as stress associated with studies, is often between 8 and 16 weeks, and some students cannot afford it financially if there is a charge for the service. Long waiting times exceeding 7 months for psychotherapy represent a general problem (Cavanagh, 2014; Beck et al., 2015). Furthermore, face-to-face counseling or psychotherapy is not appropriate for everyone (Wong et al., 2018). Moreover, based on our clinical experience in the outpatient unit of the psychiatry department of a university hospital, many students do not realize that their stress is severe; medical students often believe that severe stress is a normal part of the study, and many students from varied disciplines are ashamed to seek help in a timely manner.

In this context, the development of new approaches to preventive and intervention programs to support well-being in university environments is a fundamental challenge for mental health professionals.

eHealth Programs to Support the Mental Health of University Students

In the last two decades, information and communication technology have been rapidly incorporated into traditional physical and mental healthcare practices (Andersson, 2018). The term eHealth refers to health services and information delivered or enhanced through the Internet and related technologies (Eysenbach, 2001). This direction of healthcare practice reflects an increasing financial pressure on healthcare budgets across the world to look for effective approaches to delivering healthcare with minimal economic costs and maximum selected population impact (Donker et al., 2015). A recent meta-analysis showed that eHealth programs are also increasingly used by university students, and they are effective and feasible for a range of conditions such as stress, anxiety, depression, sleep problems, well-being, and eating disorders (Harrer et al., 2019; Bolinski et al., 2020). No superiority of specific approaches used in eHealth intervention for students is described. To our knowledge, no meta-analyses comparing active treatments with each other in eHealth intervention have been conducted yet. The low-intensity structured interventions [typically cognitive–behavioral therapy (CBT)] are most suitable for eHealth mental health support (Mulder et al., 2017). For example, Hedman et al. (2012) reported that Internet-delivered CBT produced similar outcomes to conventional face-to-face CBT for various diseases.

While most eHealth programs for students are based on cognitive–behavioral therapy (e.g., Lattie et al., 2019), there is also increasing evidence that eHealth mindfulness-based programs

(eMBP) represent a beneficial approach to mental health support for university students (Cavanagh et al., 2013; Kvillemo et al., 2016; Danilewitz et al., 2018; Lee and Jung, 2018).

Mindfulness in eHealth Context

The effectiveness of face-to-face mindfulness-based interventions on improving mental and physical health has been repeatedly documented in healthy people (Keng et al., 2011; Tomlinson et al., 2018) and in people with various psychiatric and somatic conditions (Goldberg et al., 2017; Rahimi-Ardabili et al., 2018). In terms of eMBP delivery modes, systematic reviews and a recent meta-analysis have documented that eMBPs have a significant impact on depression, anxiety, well-being, mindfulness, and stress reduction (Cavanagh et al., 2014; Fish et al., 2016; Spijkerman et al., 2016).

eMBPs have the potential to deliver the benefits of mindfulness-based programs to previously inaccessible large groups of participants. eMBPs (1) are easily accessible, (2) are anonymous, (3) are available 24/7 to people during the course of their daily life, (4) do not necessarily require the involvement of a therapist educated in mindfulness, (5) are less expensive; and (6) save time (Andersson and Cuijpers, 2009; Andersson and Titov, 2014; Spijkerman et al., 2016). In terms of the university students' mental health support specifics "mentioned above," eMBPs seem to be an appropriate tool. The demand for online mindfulness delivery is reflected in the increasing number of mindfulness-based mobile apps (Mani et al., 2015). Almost half of the people in one study would prefer an online format of mindfulness meditation intervention to a face-to-face format (Wahbeh et al., 2014).

eMBPs have been documented as effective in supporting mental health in healthy subjects (Cavanagh et al., 2018; Querstret et al., 2018), in patients with cancer (Zernicke et al., 2014; Kubo et al., 2018), and in patients with depression (Lappalainen et al., 2015), anxiety (Krusche et al., 2013), tinnitus (Hesser et al., 2012), chronic pain (Dowd et al., 2015), and fibromyalgia (Davis and Zautra, 2013).

Mechanisms of Mindfulness and Beneficial Effects on Well-Being

The new skills obtained in mindfulness-based programs are broad, and they are not associated with any particular syndrome (Hayes et al., 2011). The therapeutic change does not occur through a mechanistic alteration of problematic cognition and behavior (Mulder et al., 2017). It is induced by moving the participants toward a more open, curious, aware, and active approach to dealing with psychological blockages to adaptive living; the result is a broad set of positive life benefits (Hayes et al., 2011). The components proposed to describe the mechanisms through which mindfulness works are attention regulation, body awareness, emotional awareness, emotion regulation, change in perspective on the self, self-compassion, and self-transcendence (Neff, 2003; Hölzel et al., 2011; Vago and David, 2012; Tang et al., 2015; Alsubaie et al., 2017; López et al., 2018). Mindfulness and self-compassion are considered to be transtherapeutic and transdiagnostic phenomena that play roles in the development

and maintenance of mental health and quality of life (Schanche, 2013; Greeson et al., 2014). Enhanced emotion regulation, considered a transdiagnostic factor, may underlie many of the beneficial effects of mindfulness meditation (Aldao et al., 2010; Tang et al., 2015). Reappraisal has been suggested to be one of the core emotion regulation strategies during mindfulness practice (Hölzel et al., 2011). Another proposed mechanism of change induced by mindfulness training is value clarification (Shapiro et al., 2006). Mindfulness makes it possible to see clearly what is important for a satisfying life. Through mindfulness training, people start to recognize the infinite and transitory nature of reality and the independence of happiness from external things (Mingyur, 2007).

Components of Effective and Feasible eMBP

There are important differences in the construction, length, and delivery modes of eMBPs (Fish et al., 2016). These programs vary on the spectrum of delivery modes, ranging from audio CDs combined with regular phone call reminders (Altschuler et al., 2012) to web-based programs combined with periodic email reminders (Krusche et al., 2012; Cavanagh et al., 2018). They also vary between synchronous modes (where the therapist and the client correspond in real time) to asynchronous modes (where the therapist and the client each spend time in some contact during the program, but not necessarily at the same time). Although it cannot yet be concluded which mode of delivery is the most effective because of the enormous heterogeneity of studies, some common factors appear. A review by Fish et al. (2016) revealed some elements that should be included in future programs, such as a modular course structure, use of varied materials within the same course (e.g., text, audio, videos, and printouts), and an e-learning approach. Kelders et al. (2012) also documented the importance of social support by peers through the opportunity to contact others using the same program. Another significant part of eMBP programs is a reminder system. The reminder system through emails, text messages, or messages on a smartphone is a unique option of eHealth technology (Schwebel and Larimer, 2018). For instance, Wells et al. (2020) documented the importance and effectivity of smart messaging in reminding oncology patients in a mindfulness-based cognitive therapy (MBCT) program of prescribed between-session activities. The program completion was eight times greater for patients using smart messaging than for non-users. Appointments, homework reminders, assessment, and feedback may also help to develop and foster the therapeutic alliance (Clough and Casey, 2011). The therapeutic alliance, a common factor in psychotherapy, is supposed to be an essential factor in its outcomes (Mulder et al., 2017). It is characterized by unconditional acceptance, warmth, mutual trust, empathy, shared expectations, beliefs about each other and the therapy, and also safe cooperation on the shared goals of psychotherapy. In the eHealth area, the therapeutic alliance is not a dyadic but a triadic relationship among the users, the e-mental health program, and the program supporter (Cavanagh and Millings, 2013). Some data in the literature indicate that a therapeutic alliance with the

e-mental health program can be stated (Ormrod et al., 2010). Although we do not yet know how much the therapeutic alliance matters in e-mental health program effectivity and research and discussion are still in their early stages (Cavanagh and Millings, 2013), everything that supports mental health should be incorporated in eMBPs to maximize their effectivity.

Aims of the Study

This study aimed to evaluate the feasibility of eMBP, incorporating some of the most effective eHealth program components such as an introductory lecture, a reminder system, text, audio, and video, social support by peers, and lectors in a university setting. We designed an 8-week mindfulness-based program with an innovative intense reminder system incorporating supporting psychotherapy principles (encouraging, advising, reassuring, and self-compassion support) to foster a therapeutic alliance with a team of lectors behind the eMBP and to promote mindfulness practice. In this study, we examined the effect of the program on perceived stress, negative affectivity, self-compassion, quality of life, basic emotion regulation strategies, and mindfulness skills in university students. We hypothesize that participants completing an 8-week eMBP will report significantly lower levels of stress and negative emotional experience and higher levels of mindfulness facets and self-compassion than they report at the start of the intervention. We also hypothesize that the completion of the eMBP will induce a significant change in the frequency use of cognitive reappraisal (higher) and suppression (lower) in the process of emotion regulation in comparison to its measure at the start of the program. In the context of the observed value clarification induced by mindfulness training, it could also be assumed that the importance attributed to the quality of life components could be lower at the end of the intervention than its level at its start.

MATERIALS AND METHODS

Development of eMBP for Stress Reduction in University Students

We developed an 8-week eMBP based on MBCT (Segal et al., 2002). eMBP was run in precise accordance with the content and structure of the book *Mindfulness: A Practical Guide to Finding Peace in a Frantic World* (Williams and Penman, 2011). The program integrates a face-to-face approach (introductory lecture), text, audio, and video components, synchronous social support by peers and lectors, and a unique intensive reminder system supporting formal and informal mindfulness practice and using support psychotherapy principles. eMBP delivery platform used Facebook Messenger in the first run of the program; the Slack messaging application (Slack Technologies, Inc.) replaced Facebook Messenger in the second run. The Slack application allows reminders and weekly programs to be sent automatically; Facebook requires continual personal assistance for sending of reminders. Slack also allows for private conversations between an unlimited number of people; Facebook has a limit of 200 people in an individual group.

The program was divided into three parts: (1) face-to-face introductory lecture, (2) eMBP according to the book program mentioned above, and (3) the reminder system. The introductory lesson lasted 120 min and had eight parts: (1) introduction of the program team, (2) assignment to program run (for ethical and legal reasons, each student had to be personally included in the Facebook and Slack group to prevent anyone outside the university from signing up to the program), (3) motivation section explaining the positive effect of mindfulness on mental and physical health, (4) introduction to the attitudinal foundation of mindfulness practice (Kabat-Zinn, 2013a, p. 21–30), (5) focus on the importance of commitment, self-discipline, intentionality, and personal vision for adherence to the program, (6) introduction to formal and informal mindfulness practice, (7) introduction of the program structure and delivery modes, and (8) discussion.

The course was organized into eight modules. Each week's module started on Monday morning with a pdf file sent through the mobile application that described the program plan for the whole week. The first week started on Tuesday because of the introductory lecture on Monday. The pdf files ranged from three to seven pages. The program structure was based on Williams and Penman (2011, chapter 4); the structure is described in **Supplementary Appendix A**. The participants were asked to practice mindfulness formally and informally 6 days of the week. The 1-day retreat was not included in the eMBP.

The reminder system consisted of short messages delivered throughout the day to promote the everyday formal and informal practice. The specific messages were created by the authors of this study based on their clinical experience and on the books *The Mindfulness Solution: Everyday Practices for Everyday Problems* (Siegel, 2010) and *Full Catastrophe Living (Revised Edition): Using the Wisdom of Your Body and Mind to Face Stress, Pain, and Illness* (Kabat-Zinn, 2013a). They consisted of encouragements, reminders, incentives, explanations, metaphors, and recommendations for formal and informal mindfulness practice. In total, there were 456 reminders delivered in the program (7–12 reminders per day). The first reminder was always sent at 7:30 a.m. and the last one at 9 p.m. The other reminders were delivered with 1- or 2-h spacing within the day. Examples of the structure and content of the reminders are presented in **Table 1**.

The students were encouraged to download audio recordings recommended in the program sourcebook (Williams and Penman, 2011) at the "Mindfulness and Meditation Downloads" website (Random House, 2020), where each recommended meditation is freely available (Meditation 1, Mindfulness of Body and Breath; Meditation 2, The Body Scan; Meditation 3, Mindful Movement; Meditation 4, Breath and Body; Meditation 5, Sounds and Thoughts; Meditation 6, Exploring Difficulty; Meditation 7, Befriending; and Meditation 8, The Three Minute Breathing Space). The foundations of mindfulness practice and its basic attitudes were presented *via* short videos (from 2 min 19 s to 4 min 14 s) on YouTube.com, with each attitude presented by Jon Kabat-Zinn (2015).

Moreover, the students had the opportunity to share their experiences and questions with others within the Facebook group or separate Slack channel, respectively. Sharing was repeatedly encouraged *via* reminders aimed at helping the participants get social support from the group. The participants also had the opportunity to exchange messages with the lecture team regarding any questions or difficulties with formal and informal practice. Participation in the program was completely free.

Participants

All subjects were students at Masaryk University recruited through advertisements on the website and the Facebook page of the Department of Psychology and Psychosomatics of the Faculty of Medicine. The advertisement was also posted on the web news portal of the university 1 month before the program started. The opportunity to participate in the program was also announced during lectures at the department and on notice boards at the university faculties. The inclusion criterion was that the participants were students at Masaryk University. No exclusion criteria were applied.

In total, 227 students participated in the first run of the program delivered through Facebook messenger ("Facebook group," mean age 22.3 ± 2.1, 82% women), and 465 students participated in the second run of the program delivered through Slack ("Slack group," mean age 23.3 ± 2.9, 81% women). The Facebook group program ran in the period between March and May 2018, and the Slack group program ran in the period between October and December 2018. The participants were not randomly assigned to the Facebook and Slack groups.

Both samples consisted of students of medicine (40.4%), humanities (35.8%), and natural sciences (23.8%). No differences in measured variables such as age, gender, and questionnaires were found among these subgroups.

The university ethics committee approved the study (application number 18/2017), and all participants signed informed consent forms at the introductory lecture at the start of the program. Every participant got two matching stickers with a unique number. One sticker was put on the informed consent form and outcome measure questionnaires, and the participant kept the other. This unique code was used as the control measure at the end of the program in a Google Forms version of the outcome measures to anonymize data.

Outcome Measures

The participants completed the outcome measures questionnaires before the introductory lecture (pen-and-pencil method). The control measurement at the end of the program was created in Google Forms. The link to the questionnaires was sent individually through email to each participant. The notification was sent three times, with 3-day spacing between each notification. Mindfulness, negative and positive affectivity, perceived stress reactivity, self-compassion, emotion regulation, and quality of life were assessed as outcome measures using the following questionnaires.

The Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2008; the Czech version, Kořínek et al., 2019) is a widely used tool that measures mindfulness. The questionnaire has five subscales representing the specific mindfulness facets: Describe, Observe, Act With Awareness, Non-judging of Inner Experience, and

TABLE 1 | Reminder system structure and content.

Type of intervention	Intervention examples	Total[a]	Total original[b]
Welcome message	Good morning. Today is the first day of your mindfulness journey. Please read today's pdf file, "The First Mindfulness Week" which you can find on the news feed right now. You will get a clear idea of what is waiting for you in the first week and where our shared path will take us.	33[c]	33
Formal practice reminder	Have you had time yet today to practice the *mindful body and breathe* exercise? It is hard to find time and there is no need to feel guilty if you haven't done it yet. But try to find 8 min today.	26	24
Informal practice reminder	Maybe you are having lunch, drinking coffee, going somewhere, or waiting for something. Try to be in fully aware contact with this activity. Without judgment, with patience, with curiosity and acceptance of everything that is happening.	33	31
Be in the present moment reminder	Take a moment to stop and look around. Just be fully aware of where you are and whether your mind is in this place.	71	60
Focus on breathing reminder	Take a moment to acknowledge your breath. Inhale and exhale, nothing more. Do not rush and do not try to change; just acknowledge it fully.	53	31
Focus on body sensations reminder	Take a few moments to realize what feelings you feel in your body. Be aware of where your clothes are touching your body. If you are standing, be aware of the feelings of your legs and feet. If you are sitting, note the sensations at the point where your body touches the chair.	24	20
Focus on sensory inputs reminder	Look around you. Take a moment to be aware of what you see, what you hear, what you smell, the taste in your mouth.	17	5
Observe thoughts and feelings reminder	Stop for a little while and notice from moment to moment what is happening, how your thoughts and feelings appear and how they disappear.	29	25
Basic attitudes reminder	Patience means to be open to every moment, to receive it in its fullness, and to know that things can only take place in their own time. Give this principle 2 min today.	22	20
Personal vision reminder	Maybe you are not following the instructions. Maybe the instructions are just frustrating and upsetting. Maybe you wonder what it's all about. Try to return to your vision before going to bed, remember why you are in the program and what is important to you.	6	4
Mindfulness metaphors	In the ocean, at a depth of three to six meters, only subtle waves and tranquility are felt, even when there is a great storm on the surface. It is similar when we focus on breathing in the belly. We perceive an area of the body that is far from the head, and thus far below the surface of our raging mind.	9	9
Mindfulness education	The mindfulness exercise begins with focusing attention on breathing and continues on to body sensations, feelings, thoughts, and ultimately comes the experience of self. Gradually, we react increasingly less reactively to everything that appears and gain a greater sense of freedom. Instead of running away from difficult emotions, we are increasingly able to cope with any reaction.	59	56
Time, sleep, work, and study stress	Sometimes it is difficult to sleep in the evening because we cannot get rid of some thoughts. The more we try, the worse it is. Letting things and thoughts be, letting them go at the right time is an important life skill. Remember the principle "let it go."	11	11
Compassion and gratitude reminder	Try to say to yourself: *May I be free from suffering. May I be as happy and healthy as it is possible for me to be. May I have ease of being. May I learn to not be stuck in the past. May I be able to accept everything that life brings to me.* Whatever you eat today, try to acknowledge where the food comes from, the laws of nature and the people to whom we owe gratitude.	10	9
Self-compassion reminder	In this moment, let yourself be as you are.	27	23
Change in perspective on the self-reminder	Often we are unhappy because we cling to a particular image of ourselves. But if everything is transient, no picture actually exists. So why bother with something that is not real?	9	9
Summary at the end of the day	The evening is a time of peace, a return from the outside world to the inner realm. It is also a time when we often admit many more things that are troublesome to us. Be sensitive and note how many past or future concerns there are. Try the *three-minute breathing space* exercise. Let yourself be led by Mark Williams or do it by yourself, if you know it now. Good night.	17[c]	17

[a] *Total number of reminders.* [b] *Total number of original reminders that were not repeated.* [c] *This number does not match the total number of days in the entire program. It would otherwise be 48 days. Some welcome messages, however, included more than just greetings and so they were included in other type of intervention subgroups.*

Non-reactivity to Inner Experience. The items are rated from 1 = "never or very rarely true" to 5 = "very often or always true." Higher scores indicate higher mindfulness. All items from the Act With Awareness and Non-judge subscales and half of the items in the Describe subscale are reverse-worded. The internal consistency of the subscales ranges between Cronbach's alpha

(Cα) = 0.69 and 0.83; total = 0.77 (Kořínek et al., 2019). The FFMQ scale showed good internal consistency at baseline in this sample (Cronbach's alpha = 0.88).

The Subjective Emotional Balance Questionnaire (SEBQ; Kožený, 1993) assesses prevailing positive and negative emotional experiencing. The questionnaire has two subscales: Positive Emotional Experiences (e.g., I felt calm and relaxed; I was cheerful) and Negative Emotional Experiences (e.g., I was in a bad mood; I was unhappy), with 18 items in each subscale. The items are evaluated on a scale from 1 = "almost never" to 5 = "very often." Higher scores indicate higher positive or negative emotional experiencing. The internal consistency was found to be Cα = 0.93 for both scales (Kožený, 1993). The SEBQ scale showed good internal consistency at baseline in this sample (Cronbach's alpha: negative experiencing = 0.93, positive experiencing = 0.95).

The Perceived Stress Reactivity Scale (PSRS; Schlotz et al., 2011) is a questionnaire assessing typical individual reactivity to everyday life stressors. The scale was translated into Czech by the authors of this study. The scale has 23 items (with 12 items reverse-worded) and five subscales: Prolonged Reactivity (four items), Reactivity to Work Overload (five items), Reactivity to Social Conflict (five items), Reactivity to Failure (four items), and Reactivity to Social Evaluation (five items). The items are rated from 0 = "low-stress reactivity" to 2 = "high-stress reactivity." The PSRS scale showed good internal consistency at baseline in this sample (Cronbach's alpha = 0.85).

The Self-Compassion Scale (SCS-SF; Raes et al., 2011; the Czech version, Benda and Reichová, 2016) measures individual compassion for oneself. The SCS-SF is a short form of the 26-item Self-Compassion Scale (SCS) and has a high correlation with the full SCS ($r \geq 0.97$; Neff, 2003). The items for the short form of SCS were chosen from the standardized and validated Czech version (Benda and Reichová, 2016). The SCS-SF has 12 items and six subscales, with two items in each subscale: Self-Kindness, Self-Judgment, Common Humanity, Isolation, Mindfulness, and Over-identified. The items are rated from 1 = "never" to 5 = "always." The internal consistency of the subscales ranges between Cα = 0.65 and 0.86; total 0.89 (Benda and Reichová, 2016).

The Emotion Regulation Questionnaire (ERQ; Gross and John, 2003; the Czech version, Marsova, 2016) measures individual differences in the habitual use of two types of emotion regulation strategies: cognitive reappraisal and expressive suppression. The ERQ consists of 10 questions. The items are rated from 1 = "strongly disagree" to 7 = "strongly agree." The ERQ scale showed good internal consistency at baseline in this sample (Cronbach's alpha: suppression = 0.86, reappraisal 0.67).

The Subjective Quality of Life Analysis (SQUALA; Zannotti and Pringuey, 1992; the Czech version, Chrastina et al., 2014) measures the quality of life defined as a difference between importance and satisfaction. The tool has 23 areas mapping both internal and external factors affecting everyday life. The questionnaire has two parts: rating of importance and rating of satisfaction in the given areas. The respondents assess both on a scale from 1 = "very satisfied" to 5 = "very disappointed." The

internal consistency was found to be between Cα = 0.82 and 0.90 (Chrastina et al., 2014).

Data Analysis

Data analysis was conducted with IBM SPSS, version 25, and Jamovi 1.1.0. A dropout analysis by 2 (Facebook group vs. Slack group) × 2 (dropout vs. completed) ANOVAs was calculated for both groups to ensure that dropouts did not differ from completers in baseline outcome measures, gender, or age. The effect of the program was analyzed by 2 × 2 repeated-measures ANOVAs with Bonferroni *post hoc* tests with program as a within-subject variable (before vs. after the program) and group as a between-subject variable (Facebook group vs. Slack group). The Pearson correlation analysis was utilized to determine the relationships between the variables.

RESULTS

Dropout

The dropout rate was 97 (43.7%) students (22 men, 75 women, mean age 22.4 ± 2.2) in the Facebook group and 262 (56.3%) students (55 men, 207 women, mean age 22.98 ± 2.7) in the Slack group. These subjects dropped out during the program or did not complete the post-program test battery (program-dropout group).

The 2 (Facebook group vs. Slack group) × 2 (dropout vs. completed) ANOVA was performed to check for possible initial differences between the participants who completed the program and those who dropped out. For this analysis, we looked at whether the dropout factor effect (alone or in interaction) was significant; differences between group 1 and group 2 were not examined. No significant effects of dropout were found in the questionnaires, age, or gender.

Program Effectivity Analysis

The descriptive statistics of all questionnaire scores are displayed in **Table 2**. Only participants who completed the program are included in this table. The distribution of all scales was normal. The effect of the program was analyzed by 2 × 2 repeated-measures ANOVA with Bonferroni *post hoc* tests with program as the within-subject variable (before vs. after the program) and group as the between-subject variable (Facebook group vs. Slack group). The results are displayed in **Table 3**.

The pre- and post-program comparison in both experimental groups showed that the eMBP led to a decrease of the perceived stress reactivity (see pη^2 in **Table 2**), an increase of positive and decrease of negative emotional experiencing, an increase in subjective mindful experiencing in each measured facet, and an increase in self-compassion. Furthermore, the comparisons in both groups revealed that the eMBP led to an increase in the use of cognitive reappraisal as an emotion regulation strategy. In contrast, the use of suppression was not affected by the program. Finally, the importance attributed to the quality of life components decreased after the program, while satisfaction with life remained unchanged.

TABLE 2 | Descriptive statistics of dependent variables in both groups before and after eMBP.

Variables	Group 1						Group 2					
	Before			After			Before			After		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD
PSRS	130	52.81	6.96	130	47.26	7.41	203	53.85	6.87	203	48.72	7.91
SEBQ[a]	130	91.80	22.98	130	79.62	21.23	203	99.92	22.92	203	84.11	21.53
SCS-SF	130	34.31	7.59	130	38.45	7.82	203	33.53	7.03	203	37.64	6.97
FFMQ describing	130	24.36	6.58	130	27.15	5.94	203	24.38	6.74	203	27.06	6.41
FFMQ observing	130	25.51	5.83	130	28.42	4.59	203	24.02	6.07	203	27.98	4.96
FFMQ acting aware	130	22.22	5.49	130	25.45	5.54	203	21.47	5.24	203	24.31	5.05
FFMQ non-judging	130	24.85	6.87	130	28.53	6.45	203	23.36	6.71	203	27.98	6.68
FFMQ non-reacting	130	18.75	4.46	130	21.33	4.11	203	18.07	4.24	203	20.77	4.18
ERQ reappraisal	130	26.61	6.44	130	27.95	6.20	203	25.86	6.99	203	27.99	6.05
ERQ suppression	130	13.06	4.36	130	12.62	3.83	203	13.23	3.51	203	13.16	3.70
SQUALA satisfaction	130	47.92	7.66	130	47.45	9.25	203	45.41	8.23	203	45.41	8.04
SQUALA importance	130	57.04	9.90	130	51.88	11.37	203	57.77	10.73	203	52.32	10.94

[a]Higher values indicate more negative experiences; PSRS, The Perceived Stress Reactivity Scale; SEBQ, The Subjective Emotional Balance Questionnaire; SCS-SF, The Self-Compassion Scale-Short Form; FFMQ, The Five Facet Mindfulness Questionnaire; ERQ, The Emotion Regulation Questionnaire; SQUALA, Subjective Quality of Life Analysis.

Besides the significant effect of program, a significant effect of group was found in the subjective emotional balance, driven by a significant difference between the groups before the program, but not after the program, while in both groups negative affectivity (SEBQ) decreased significantly. A significant effect of group only was found in satisfaction with life (SQUALA), driven by a borderline significant difference in satisfaction between the groups before the program, but not after the program. However, none of the groups improved significantly in satisfaction after the program.

Correlation Analysis

The correlation analysis revealed a significant negative association between mindfulness as measured by all subscales of FFMQ and perceived stress and prevailing positive and negative emotional experiencing at the start of the program (see **Table 4**). The higher the level of mindfulness experienced, the less that stress and negative emotivity experiences are reported; positive emotivity experience increases. The same trend of association, but a stronger one, was found between self-compassion, stress, and prevailing positive and negative emotional experiencing. Correlations show that the higher the level of reported self-compassion, the less stress and negative emotivity are experienced.

Interestingly, a significant correlation was found between the FFMQ subscales Acting Aware, Non-judging and Non-reacting, and Importance attributed to the quality of life components (SQUALA importance subscale). The association between these variables is even closer at the end of the eMBP (**Table 5**). Self-compassion is also negatively associated (at a medium level) with the importance attributed to the quality of life components at the start and the end of the program (**Tables 4, 5**).

The analysis also revealed a significant positive association (small to medium) between reported mindfulness experiencing and cognitive reappraisal and a negative association with suppression before and after the program. At the same time, this association is stronger for suppression at the end of the program (**Table 5**). A significant positive association can also be observed between cognitive reappraisal (medium) and negative with suppression (low).

Cognitive reappraisal is associated with positive emotivity, and suppression is related to negative emotivity (**Tables 4, 5**).

The Component Adherence Analysis

The control measure at the end of the eMBP in the Facebook and Slack groups contained some partial questions about adherence to the program. **Table 6** presents self-reported adherence measures. The results show that 3.1% of students never and 28.3% rarely finish the task at the time when it was sent *via* the messaging application (answer 2 in **Table 6**). It further showed that 4.4% of students never and 22.1% once managed to do the exercises recommended for the concrete week. Regardless, they filled out the questionnaires at the end of the program. Answers for question 5 show that an irregular pattern of formal mindfulness practice is prevalent in 73.4% of students. Some negative effect of mindfulness practice was reported by 1.2% of students. Self-reported data also show (questions 7 and 8; **Table 6**) that a higher rate of students completed the program at the level of the reminder system (53.4%) than the recommended formal practice for each week (38.6%).

At the end of the data collection in the Slack group, a short version (three close questions and one open question) survey was sent to the dropout group to get information about how long they followed the program and if they finished it. One hundred sixty-one students from the dropout group answered. One hundred fourteen of them did not complete the eMBP. The average time of the attrition rate was 2.78 ± 1.62 weeks (minimum, 0; maximum, 7). Even though they dropped out of

TABLE 3 | The effects of program and group and interaction effects for ANOVA.

Variables	Program effect			Group effect			Program*Group effect			Bonferroni *post hoc* tests
	$F(1, 331)$	p	$_p\eta^2$	$F(1, 331)$	p	$_p\eta^2$	$F(1, 331)$	p	$_p\eta^2$	
PSRS	**237.394**	**< 0.001**	**0.418**	2.814	0.094	0.008	0.355	0.552	0.001	*Program change in group 1 t(331.000) = 10.249, p < 0.001 Program change in group 2 t(331.000) = 11.853, p < 0.001*
SEBQ	**151.547**	**< 0.001**	**0.314**	**8.081**	**0.005**	**0.024**	2.551	0.111	0.008	*Program change in group 1 t(331.000) = 6.861, p < 0.001 Program change in group 2 t(331.000) = 11.129, p < 0.001 Group difference before program t(437.941) = −3.258, p = 0.007 Group difference after the program t(437.941) = −1.801, p = 0.433*
SCS-SF	**126.857**	**< 0.001**	**0.277**	1.168	0.281	0.004	0.002	0.967	0.000	*Program change in group 1 t(331.000) = −7.239, p < 0.001 Program change in group 2 t(331.000) = −8.980, p < 0.001*
FFMQ describing	**87.047**	**< 0.001**	**0.208**	0.003	0.960	0.000	0.037	0.848	0.000	*Program change in group 1 t(331.000) = −6.098, p < 0.001 Program change in group 2 t(331.000) = −7.313, p < 0.001*
FFMQ observing	**126.749**	**< 0.001**	**0.277**	3.361	0.068	0.010	2.905	0.089	0.009	*Program change in group 1 t(331.000) = −6.118, p < 0.001 Program change in group 2 t(331.000) = −10.373, p < 0.001*
FFMQ acting aware	**107.820**	**< 0.001**	**0.246**	3.342	0.068	0.010	0.453	0.501	0.001	*Program change in group 1 t(331.000) = −7.081, p < 0.001 Program change in group 2 t(331.000) = −7.771, p < 0.001*
FFMQ non-judging	**127.041**	**< 0.001**	**0.277**	2.465	0.117	0.007	1.643	0.201	0.005	*Program change in group 1 t(331.000) = −6.397, p < 0.001 Program change in group 2 t(331.000) = −10.046, p < 0.001*
FFMQ non-reacting	**129.376**	**< 0.001**	**0.281**	2.203	0.139	0.007	0.066	0.797	0.000	*Program change in group 1 t(331.000) = −7.119, p < 0.001 Program change in group 2 t(331.000) = −9.308, p < 0.001*
ERQ reappraisal	**26.000**	**< 0.001**	**0.073**	0.300	0.584	0.001	1.349	0.246	0.004	*Program change in group 1 t(331.000) = −2.522, p = 0.073 Program change in group 2 t(331.000) = −5.010, p < 0.001*
ERQ suppression	1.250	0.264	0.004	0.971	0.325	0.003	0.701	0.403	0.002	–
SQUALA satisfaction	0.447	0.504	0.001	**6.962**	**0.009**	**0.021**	0.447	0.504	0.001	*Group difference before program t(437.941) = 2.696, p = 0.044 Group difference after the program t(437.941) = 2.191, p = 0.174*
SQUALA importance	**119.780**	**< 0.001**	**0.266**	0.280	0.597	0.001	0.093	0.760	0.000	*Program change in group 1 t(331.000) = 6.813, p < 0.001 Program change in group 2 t(331.000) = 9.003, p < 0.001*

PSRS, The Perceived Stress Reactivity Scale; SEBQ, The Subjective Emotional Balance Questionnaire; SCS-SF, The Self-Compassion Scale-Short Form; FFMQ, The Five Facet Mindfulness Questionnaire; ERQ, The Emotion Regulation Questionnaire; SQUALA, Subjective Quality of Life Analysis. Bold values indicate the statistically significant result.

the program, 46 of them reported that eMBP had influenced their life positively (45 reported no influence, and the rest of them did not respond).

Forty-seven students of the 161 who dropped out and answered the short version of the survey completed the program, but they did not have enough time or will to complete the final battery of questionnaires. The open question concerned the reasons for dropout. The reasons of the 161 drop-out students were very heterogeneous, and there were usually combinations of several reasons. The most prevalent reasons were as follows: (1) lack of time for formal and informal practice (56.7%), "If I can't do it for one hundred percent, I won't do it at all", (2)

TABLE 4 | Correlations between dependent variables before the eMBP.

	1	2	3	4	5	6	7	8	9	10	11	12
1. FFMQ describing	–	0.27***	0.27***	0.22***	0.30***	–0.36***	0.30***	–0.21***	0.22***	–0.25***	–0.08*	–0.17***
2. FFMQ observing		–	0.13***	0.00	0.34***	–0.14***	0.25***	–0.19***	0.29***	–0.08	–0.09*	–0.08*
3. FFMQ acting aware			–	0.37***	0.35***	–0.37***	0.31***	–0.27***	0.12**	–0.09*	0.01	–0.24***
4. FFMQ non-judging				–	0.41***	–0.48***	0.56***	–0.44***	0.18***	–0.20***	0.02	–0.33***
5. FFMQ non-reacting					–	–0.55***	0.61***	–0.40***	0.41***	0.00	–0.05	–0.22***
6. PSRS						–	–0.63***	0.47***	–0.31***	0.11**	–0.07	0.33***
7. SCS-SF							–	–0.52***	0.49***	–0.12**	–0.06	–0.36***
8. SEBQ[a]								–	–0.40***	0.22***	0.12**	0.57***
9. ERQ reappraisal									–	–0.07	–0.16***	–0.29***
10. ERQ suppression										–	0.13***	0.19***
11. SQ satisfaction											–	0.20***
12. SQ importance												–

[a]Higher values indicate more negative experiences; PSRS, The Perceived Stress Reactivity Scale; SEBQ, The Subjective Emotional Balance Questionnaire; SCS-SF, The Self-Compassion Scale-Short Form; FFMQ, The Five Facet Mindfulness Questionnaire; ERQ, The Emotion Regulation Questionnaire; SQ, Subjective Quality of Life Analysis; *p < 0.05, **p < 0.01, ***p < 0.001.

TABLE 5 | Correlations between dependent variables after the eMBP.

	1	2	3	4	5	6	7	8	9	10	11	12
1. FFMQ describing	–	0.37***	0.35***	0.34***	0.39***	–0.39***	0.34***	–0.30***	0.15**	–0.31***	–0.09	–0.26***
2. FFMQ observing		–	0.36***	0.28***	0.46***	–0.28***	0.35***	–0.38***	0.29***	–0.26***	–0.14*	–0.26***
3. FFMQ acting aware			–	0.50***	0.43***	–0.45***	0.42***	–0.42***	0.18**	–0.19***	–0.02	–0.25***
4. FFMQ non-judging				–	0.48***	–0.47***	0.58***	–0.55***	0.26***	–0.17**	–0.04	–0.28***
5. FFMQ non-reacting					–	–0.60	0.61***	–0.48***	0.36***	–0.11*	–0.11*	–0.31***
6. PSRS						–	–0.69***	0.56***	–0.33***	0.10	0.11*	0.41***
7. SCS-SF							–	–0.62***	0.44***	–0.13*	–0.15**	–0.38***
8. SEBQ[a]								–	–0.43***	0.19***	0.16**	0.61***
9. ERQ reappraisal									–	–0.06	–0.19***	–0.26***
10. ERQ suppression										–	0.09	0.14**
11. SQ satisfaction											–	0.34***
12. SQ importance												–

[a]Higher values indicate more negative experiences; PSRS, The Perceived Stress Reactivity Scale; SEBQ, The Subjective Emotional Balance Questionnaire; SCS-SF, The Self-Compassion Scale-Short Form; FFMQ, The Five Facet Mindfulness Questionnaire; ERQ, The Emotion Regulation Questionnaire; SQ, Subjective Quality of Life Analysis; *p < 0.05, **p < 0.01, ***p < 0.001.

realizing that the program was not suitable for them in its content or form (7.2%), (3) loss of motivation (42.3%), (4) dissatisfaction with Facebook or Slack that requires being online (10.3%; they would prefer offline app), and (5) too intensive reminder system (17.2%; they would prefer about four messages per day). These respondents often explained that the reminder system was not too intense in its content. They appreciated it; however, the higher frequency of the reminders reminded them that they were not fulfilling the program tasks according to the recommendations, and it was stressful for them.

A correlation analysis was performed to find any evidence of a relationship between the self-reported percentage of adherence to the eMBP formal and informal practices and the positive psychological outcomes. Small significant correlations, presented in **Table 7**, partially imply that the more students were adhering to the program, the more they experienced some aspects of a mindful approach to reality, self-compassion, and increased use of cognitive reappraisal; they experienced less stress and negative emotivity.

In the partial adherence analysis in the Slack group (Facebook manager does not allow this analysis), we were interested in how many students react to each reminder on different days, what the average reaction time to it was, and the total number of participants who confirmed all the daily reminders on each particular day (**Figure 1**). Each reminder had a small green checkmark below it. The students were instructed to check it as soon as possible after reading each reminder.

DISCUSSION

Program Effectivity Analysis

The pre–post completer analysis indicates the large eMBP intervention effect on the decrease of perceived stress and a medium effect on affect experience, self-compassion, and mindful approach to the entire experience. These results were observed in both runs of the program repeatedly. The effect sizes detected in our study are comparable with the mean results of other studies

TABLE 6 | The self-reported parameters of adherence to eMBP (*n* = 333).

Always	Very often	Sometimes	Rarely	Never	
1. Were you able to read the reminders at the time of delivery?					
7.5%	37.8%	29.8%	22.1%	2.8%	
2. Were you be able to finish the task in time when it was sent via the messenging app?					
2.7%	17.4%	48.5%	28.3%	3.1%	
3. Were you be able to read the pdf file each week of the program?					
32%	22.4%	21.1%	19.5%	5%	
4. How often did you manage to do the exercises for the week?					
Exactly as <u>recommended</u>	Exactly as recommended, but just a few times a <u>week</u>	Just some exercises, but <u>every day</u>	Just some exercises, but not <u>every day</u>	I tried it once, but I did not <u>continue</u>	I never tried <u>any</u>
0.6%	5%	15.2%	52.8%	22.1%	4.4%
5. When did you most often practice mindfulness during the day?					
In the morning <u>and evening</u>	<u>In the morning</u>	<u>In the evening</u>	Irregularly during the day <u>when I had time</u>		
7.6%	4.7%	14.3%	73.4%		
6. Mindfulness practice in eMBP has influenced me:					
It has not influenced me <u>in any way</u>	It has influenced me <u>negatively</u>	It has influenced me <u>positively</u>			
18.3%	1.2%	80.5%			
7. What percent of the program do you think you completed (reminder system)?					
53.4 ± 25.3					
8. What percent of the program do you think you completed (formal practice)?					
38.6 ± 22.5					
9. How much do you believe that you will be able to practice mindfulness in your life after the program ends? (1 = "I will not continue" to 10 = "I will continue")					
6.1 ± 2.5					

conducted on university students using mindfulness-based interventions and participants from the non-clinical population in eHealth version (Krusche et al., 2012; Cavanagh et al., 2018;

TABLE 7 | Correlations between dependent variables and the self-reported percentage of adherence to the eMBP formal and informal practice.

	Self-reported % of informal practice completed (reminder system; question 7 in Table 6)	Self-reported % of formal practice completed (whole program; question 8 in Table 6)
1. FFMQ describing	0.24**	0.20**
2. FFMQ observing	0.28**	0.32**
3. FFMQ acting aware	0.10	0.10
4. FFMQ non-judging	0.20**	0.12*
5. FFMQ non-reacting	0.22**	0.24**
6. PSRS	−0.10	−0.19**
7. SCS-SF	0.13*	0.22**
8. SEBQ[a]	−0.23**	−0.22**
9. ERQ reappraisal	0.20**	0.26**
10. ERQ suppression	−0.04	0.05
11. SQ satisfaction	0.04	−0.07
12. SQ importance	−0.08	−0.09

[a]*Higher values indicate more negative experiences; PSRS, The Perceived Stress Reactivity Scale; SEBQ, The Subjective Emotional Balance Questionnaire; SCS-SF, The Self-Compassion Scale-Short Form; FFMQ, The Five Facet Mindfulness Questionnaire; ERQ, The Emotion Regulation Questionnaire; SQ, Subjective Quality of Life Analysis; *p < 0.05, **p < 0.001.*

Danilewitz et al., 2018; Querstret et al., 2018) and in face-to-face programs as well (Rosenzweig et al., 2003; Lynch et al., 2011; Warnecke et al., 2011; Barnes et al., 2017). This partial comparability of the eMBP to other mindfulness therapies delivered face to face is hopeful. It corresponds with the challenge to find a useful program for mental health support for a broad group of students. It also shows the meaningfulness of further initiatives in this area. The increasing interest of students in completing the eMBP at our university (first run 227 students and second run 465 students) also shows that the eHealth mode of delivery is feasible for them.

Our study presents the finding that students who underwent the eMBP significantly increased the use of cognitive reappraisal with a small effect size. Although increased emotion regulation induced by mindfulness probably involves a mix of the many implicit and explicit regulation strategies and processes comprehensively described by Gross (2014), this corresponds with previous suggestions and results that cognitive reappraisal seems to be one of the core emotion regulation strategies during mindfulness training (Feldman et al., 2007; Garland et al., 2011; Hölzel et al., 2011). Garland et al. (2011) documented that mindful emotion regulation works through positive reappraisal. Under mindfulness practice, stress is reinterpreted, such as being beneficial and meaningful. At a higher level of emotion regulation organization, mindfulness can also be understood as cognitive reappraisal at a process level rather than at a content level (Chambers et al., 2009). Through the practice, the meaning of a whole experience (thoughts, emotions, sensations) is cognitively reappraised.

FIGURE 1 | The average time of reactions to reminders (gray columns) and the total number of participants who confirmed all the daily reminders on each particular day (gray line). In this figure shows the average time of reactions to reminders (gray columns; each column represents 1 day in the program from Monday to Saturday). Only the students who confirmed reading all the reminders on each particular day were included in this analysis. The gray line in the figure represents the total number of participants who confirmed reading all the daily reminders each day.

In the open monitoring mode of mindfulness practice, no particular aspect of the continuously changing experience is chosen to influence emotions. Attention is paid instead to everything in a non-judgmental and accepting manner. Immediate emotional responses are not regulated; they are simply accepted. Emotional responses are observed with interest and curiosity, becoming objects of observation themselves. This notion supports our partial finding of a moderate significant correlation ($r = 0.41$, **Table 3**) between the Non-reacting subscale of FFMQ and cognitive reappraisal. Despite the fact that mindfulness seems opposed to expressive suppression (Chambers et al., 2009) and the mindful way of experience processing is associated with less experiential avoidance and thought suppression (Feldman et al., 2007), the expected reduction of suppression was not found in our study. Nevertheless, there was an observable trend in small negative correlations between suppression and FFMQ subscales, which suggests the expected contradiction of suppression and the mindful approach to the entire experience. The measurement of emotion regulation strategy frequency use is still sporadic in the context of eMBP research. However, Cavanagh et al. (2018), for example, documented a decrease of perseverative thinking under a brief eMBP.

We found some supportive data showing that the importance attributed to the quality of life components would be lower at the end of the program, with an unchanged satisfaction with partial components of quality of life proposed in SQUALA. The decrease of importance, with a medium-sized effect, while maintaining unchanged components of life satisfaction, represents a specific

shift induced by the program, and it is a new result in this area. These results were replicated in two consecutive runs of the same program. Mindfulness techniques, as part of the "third wave" of cognitive and behavioral therapies, help to target contexts and functions of psychological phenomena, not just their form (Hayes, 2016). Unlike other therapeutic strategies, such as cognitive–behavioral therapy, mindfulness-based interventions do not emphasize changing the contents of mental events as much as changing the awareness of and relationship to them (Segal et al., 2002). The participants learn to disempower emotionally charged thoughts or attitudes by bringing to their experience a sense of "allowing" it to be just as it is, without a constant need for the situation to match their desired states (Segal et al., 2002). It could be suggested that, by staying in the experience of a present moment in a non-reactive and accepting way and by witnessing the impermanence of mental phenomena, the participants learn to strengthen their inner resources and trust the ever-changing conditions of everyday life, instead of constantly relying on external factors to make their life better. This could make them less overly dependent on these factors and therefore mark the factors as less important in terms of life satisfaction. In this context, for instance, Shapiro et al. (2006) proposed that one mechanism of change induced by mindfulness training is value clarification. Mindfulness makes it possible to see clearly what is essential for a satisfying life. This change could also be related to the process of "decentering" (Fresco et al., 2007), defined as disengaging the self from the event, which is commonly reported as an important factor regarding mindfulness mechanisms (Lebois et al., 2015). For example, decentering mediated a decrease in anxiety in an MBSR program with university students (Fresco et al., 2007). We could hypothesize that a decrease of importance could be a specific marker of mindfulness-induced change, and it could be a co-mediator between mindfulness and its positive outcomes. Interestingly, the significant negative correlations between the FFMQ subscales Acting Aware, Non-judging and Non-reacting, and Importance that were even more closely attributed to the quality of life components at the end of the eMBP indirectly open this explanation.

Dropout and Adherence

Of the 227 subjects who participated in the first run of the program and the 465 who participated in the second run, 51.95% (43.7% first run, 56.3% second run) completed the eMBP in that they completed the post-program test battery. This rate of attrition corresponds approximately to the findings of similar studies. Cavanagh et al. (2013) reported that 52.3% of web-based study participants completed the questionnaires at pre- and post-intervention. The same research group documented that 68% completed questionnaires at pre- and post-intervention in another study (Cavanagh et al., 2018). Forbes et al. (2018) presented similar results (53.3%). Howells et al. (2016) used a smartphone app to deliver mindfulness training and reported a 77% dropout rate. A dropout rate of 25% was described by Querstret et al. (2018) in their 4-week mindfulness online program. The 10% attrition cutoff

is recommended by the Cochrane risk of bias tool (Higgins et al., 2011). In this background, it seems quite conservative in eHealth interventions as higher attrition rates are usually reported. The optimal attrition cutoff level is still waiting for the specification in this field.

Thanks to the short-version survey addressed to the dropout group (359 students in sum), we obtained additional partial information from 161 of them. We found out that still 47 students completed the program without completing the final questionnaire. In this context, the attrition rate is a little bit lower (45.1% in sum). One possible explanation is that the program ends before the exam period, and many students may have decided that they did not have time for it. This finding documents that there is a discrepancy in some subgroups of participants between adherence to the program and the motivation to complete a relatively time-consuming test battery. The common methodological problem is that programs are effective for people who stayed in them (Van Dam et al., 2018), but who are those who dropped out? In this context, one of the fundamental characteristics and methodical challenges in the evaluation of eHealth and mHealth applications is thus the phenomenon of participants stopping usage and/or being lost to follow-up, termed as the law of attrition by Eysenbach (2005). He argued that non-usage data themselves should be of great interest to researchers, as describing patterns and predictors for attrition and non-adherence research offers much information about treatment itself as well as data on system usability. According to his proposal, attrition can be split into two different processes: dropout attrition or the phenomenon of losing participants to follow-up (47 students completed the program but did not fill out the survey) and non-usage attrition or the proportion of participants who do not drop out (e.g., they still fill in questionnaires) but who are no longer following the program. They are non-adherent, in other words. As can be seen in **Table 6** (questions 1–4), almost 30% of the participants reported that they never or rarely followed the formal and informal parts of the program, and they still completed the final survey.

According to a partial analysis of reactions to reminders in the Slack group (**Figure 1**), the steepest dropout in the sense of response to reminders on time was during the first 2 or 3 weeks. Then, it decreased slowly. Unfortunately, we do not know if the dropout from the reminder system also meant a dropout from the program itself in the sense of recommendations from the pdf file for each week. This trend is similar as what was observed in another study (Forbes et al., 2018). A higher dropout rate during the first 3 weeks of an Internet-based 8-week mindfulness program was also reported by Kvillemo et al. (2016). It also indeed indirectly documents the finding that 114 students did drop out on average during the first 3 weeks (2.78 ± 1.62; minimum, 0; maximum, 7). Even though they dropped out of the program, 46 of them reported that eMBP had influenced their life positively. If we use MBCT or MBSR programs as a golden standard in this intervention area, there is some consensus among experts, also supported with some experimental data, that 4-week mindfulness programs seem to be efficacious for promoting well-being and stress reduction, and this length of completion can be considered as a minimum adequate "dose" (Demarzo et al., 2017; Crane

and Hecht, 2018). The feasibility and effectiveness of shorter online self-guided mindfulness-based interventions have been demonstrated (Cavanagh et al., 2013). The question of what is enough (length and content) for the eMBP positive effect on mental health in the eHealth area is still open.

The partial results from **Table 6** (questions 7 and 8) reveal that the students followed the reminder system in higher percentages (53.4 ± 25.3) than they followed the formal practice part of the program (38.6 ± 22.5). There is growing evidence in the literature about positive results associated with reminders (text messages) in a variety of settings of healthcare services (Schwebel and Larimer, 2018). Wells et al. (2020) documented the importance and effectivity of smart messaging reminding oncology patients in an MBCT program of prescribed between-session activities. The program completion was eight times greater for patients using smart messaging compared with non-users. A study comparing intervention arms with and without reminders is still missing in the field of eMBPs generally. In this context, the correlations between dependent variables and the self-reported percentage of adherence to reminders (**Table 7**) show that they can support the change of attitudes, beliefs, and behavior. Reminders should continue to be evaluated and improved to find out the most effective timing and frequency of messages for improving program outcomes (Schwebel and Larimer, 2018). The effectiveness and attrition rates of our program are comparable with the results of other studies that did not use such an intensive reminder system (Krusche et al., 2012, 2013; Cavanagh et al., 2013, 2018; Querstret et al., 2018). In this context, it is necessary to provide some eMBP to a large sample of students to have an opportunity to manipulate the various variables in different study arms (e.g., reminders vs. without, introductory lecture with the facilitator, online chat, web, app or its combination, reward, etc.).

Previous studies raised expectations that high mindfulness traits at the start of the program would predispose the participants to adherence (Forbes et al., 2018), but our results differed. No significant difference between the program and dropout groups was found in the mindfulness traits measured by FFMQ. This confirms the investigation by Cavanagh et al. (2018) showing no significant differences between participants who completed the study and those who dropped out in the mindfulness baseline. The current study also found that adherent and non-adherent participants did not significantly differ in any of the remaining measured variables. Levels of perceived stress, use of emotion regulation strategies, and subjective emotional balance did not predict who would complete the questionnaires at the post-intervention stage.

Although we did not conduct any mediational model among monitored variables, our results indirectly support that the effect of eMBP on the decrease of stress and negative affect experiencing could be mediated by mindfulness and self-compassion (see **Tables 4**, **5**). Mindfulness and self-compassion are considered to be transtherapeutic and transdiagnostic phenomena that play roles in the development and maintenance of mental health and quality of life (Schanche, 2013; Greeson et al., 2014). The increase of mindful ways of experience processing and self-compassion was found to significantly mediate the effects of eMBP on stress (Gu et al., 2017).

VALUES, LIMITATIONS, AND FUTURE DIRECTIONS

The results of the presented pilot study confirmed that eMBP is a feasible tool in university students' mental health support. It revealed that the students who completed the eMBP reported a reduction of perceived stress, a decrease of negative affect experience frequency and intensity (*vice versa* with positive affectivity), an increase of being mindful in their life, and a higher rate of self-compassion. A significant change in the frequency of using some adaptive emotion regulation strategies and feelings of life satisfaction was also observed. Our study provides a new result in the observation of a significant decrease in attributed importance to the quality of life components. The study documented that mindfulness-based interventions can be effectively delivered *via* eHealth form to university students. In our study, we introduced an online eMBP based on MBCT, combining a face-to-face approach (introductory lecture) with text, audio, video, and e-learning components integrated into a unique intensive reminder system using support psychotherapy principles. The study used Facebook as a popular tool for social networking and also the less widespread tool for team communication Slack, which offers many options and benefits for use in eHealth intervention settings.

The pilot study design does not allow us to eliminate the possibility that the positive results of online mindfulness programs could be explained by the fact that everyone who did not benefit dropped out (Forbes et al., 2018). We did not use a randomized wait-list and active control design, so the change cannot be readily attributed to the eMBP rather than to non-specific processes of change (e.g., participant expectation of benefit). The missing comparison of our MBP with similar supporting interventions (online and face to face) also does not allow us to attribute a program effect to this very MBP. The external validity of the study cannot be adequately assessed at this time because of the greater potential for bias in subject selection. We are also aware that high dropout is a risk of bias. Excluding students who do not adhere to the research protocol (did not get their intended content of eMBP) from the analysis can have significant implications that would impact the study's results and analysis. The most effective way to establish a causal relationship between an intervention and outcome is through a randomized controlled trial (RCT) study design combined with the intention-to-treat analysis (McCoy, 2017). In this context, a recent RCT study by El Morr et al. (2020) has revealed that an 8-week web-based mindfulness intervention for university students effectively reduces common mental health conditions such as depression and anxiety symptoms and in increasing mindful approach to the entire experience. Our pilot study did not include any follow-up control, so we were not able to evaluate the reported induced change over time. We also did not assess any possible mediation effects among variables. We also are not able to separate the effect of the 8-week mindfulness program based on MBCT and the possible simple effect of the intensive reminder system. We have no evidence of how much added value the intensive reminder system *via* Facebook and Slack had.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation, to any qualified researcher.

ETHICS STATEMENT

The study protocol was approved by the ethics committee at the Faculty of Medicine of Masaryk University, Brno, CZ EU (application number 18/2017) and informed consent was obtained from each participant before participation. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MS designed and executed the study, prepared the online program, assisted with data analysis, and wrote the manuscript. PL collaborated in analyzing the data, wrote part of the "Results" section and edited the final manuscript. TK, BK, JK, VH, KJ, and KL converted the program to Facebook and Slack and executed the study. AS and RŠ collaborated in the writing and editing of the final manuscript. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.581086/full#supplementary-material

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Can a Commercial Video Game Prevent Depression? Null Results and Whole Sample Action Mechanisms in a Randomized Controlled Trial

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Depressive symptoms and disorders are major public health concerns, affecting many adolescents and young adults. Despite extensive research, depression prevention programs for youth show limited effectiveness. Moreover, the maximal potential of youth psychotherapy — on which depression prevention programs are based — may have been reached. Commercial video games may offer an engaging alternative vehicle for youth to practice emotional and social skills vital to mental health. The current study investigated the potential for the commercial video game Journey to prevent the exacerbation of depressive symptoms. A pre-registered randomized controlled trial tested the effectiveness of Journey as an indicated depression prevention approach compared to a control game condition and a passive control condition (Dutch Trial Register: NL4873, https://www.trialregister.nl/trial/4873). Additionally, potential action mechanisms for depression prevention using video games were examined. Participants aged 15 to 20 years old with elevated depressive symptoms ($n = 244$, $M_{age} = 17.11$, $SD_{age} = 1.76$, 66.4% female) were given 4 weeks to play Journey ($M_{duration} = 3$ h 20 min) or the control game, Flower ($M_{duration} = 2$ h 36 min). Results showed no beneficial effects of playing the commercial video game, Journey, on youth's change in depressive symptoms above and beyond the active and passive control conditions up to 12-months after the intervention. Additionally, no action mechanisms were found specifically for Journey. Nevertheless, over the whole study, participants decreased in depressive symptoms, became less sensitive to rejection, and experienced more hope and optimism. Moreover, participants who during the study decreased in rejection sensitivity or rumination or who increased in hope and optimism or in distraction and problem solving showed the strongest decrease in depressive symptoms. Although results do not support the use of the studied commercial game as an effective indicated depression prevention strategy, our results do suggest that rejection sensitivity, hope, optimism, rumination, distraction, and problem solving are promising targets for future

depression prevention efforts. We conclude with important lessons for future research on games to promote mental health. Particularly, encouraging careful consideration of research designs to explore for whom and how potential action mechanisms and associated game mechanics may be effective.

INTRODUCTION

Both depressive symptoms and depressive disorders are major public health concerns, negatively impacting individuals' achievements, social interactions, and future mental health (Wesselhoeft et al., 2013; Hetrick et al., 2016; Carrellas et al., 2017). During adolescence and young adulthood individuals are most at risk for the emergence of depression (Merikangas et al., 2010; Avenevoli et al., 2015), with over 10% of youth experiencing depression in the past year (Weinberger et al., 2018). Unsurprisingly, research on depression prevention programs for youth is extensive (e.g., Horowitz and Garber, 2006; Merry et al., 2011; Hetrick et al., 2016). However, effect sizes are limited and even indicated prevention programs may not be superior to attention control groups (Hetrick et al., 2016). Moreover, a recent meta-analysis shows that the maximal benefit of youth psychotherapy — on which depression prevention programs are based — has been reached (Jones et al., 2019), suggesting the need for genuine innovations in content and delivery of prevention approaches (Kazdin, 2019). In an attempt to explore alternatives to traditional depression prevention in youth, this study tested the effectiveness of a commercial video game hypothesized to affect a number of empirically supported action mechanisms.

In contrast, most traditional depression prevention programs are based on cognitive behavioral therapy (Hetrick et al., 2016). Cognitive behavioral therapy assumes that depression results from cognitive distortions that lead a person to see themselves, their environment, and their future negatively (Beck, 1976). These biases are associated with learned helplessness in which individuals withdraw or react passively due to their sense of not being in control of negative events (Seligman et al., 1979). Many traditional depression prevention programs use psychoeducation, written exercises, role-playing exercises, and homework assignments to address these cognitive distortions and their associated behaviors (e.g., the Penn Resiliency Program; Gillham et al., 2006; Hetrick et al., 2016).

These prevention programs are often didactic and highly cognitive group versions of depression treatment (Hetrick et al., 2016), which limits their appeal for youth. Digitalization of these programs into websites and serious games is sometimes seen as a solution to enhance effectiveness through engagement and personalization (Scholten and Granic, 2019). This form of digitalization, however, has not enhanced effectiveness and in fact may be less effective without human guidance (for review, see Scholten and Granic, 2019). Rather than appealing to youth and utilizing options for interaction and personalization, digitized programs are associated with considerable program attrition,

leading researchers to call for critical reflection on engagement when developing these interventions (Välimäki et al., 2017; Garrido et al., 2019; Scholten and Granic, 2019).

Commercial video games in contrast are highly effective in engaging youth for multiple hours a week and maintaining this engagement (Pew Research Center, 2018; Limelight Networks, 2019). And while commercial games are not designed to address mental health, limited research has shown beneficial effects of commercial video games on depressive symptoms (Ferguson and Rueda, 2010; Russoniello et al., 2013). Specifically, a randomized controlled trial showed a decrease in depressive symptoms in adults with elevated depressive symptoms when they played a casual video game (i.e., a quick, fun, and accessible game) three times a week for 30 min during 1 month compared to an active control group (Russoniello et al., 2013). This effect was attributed to the introduction of a pleasant activity. Indeed, the mere experience of motivation and engagement which video games evoke may support mental health benefits through flow (immersion in an activity that engages all your attention), intrinsic motivation, experienced autonomy (i.e., the freedom to choose), and competence (i.e., the experience of capability to overcome challenges) which have all been linked to mental health benefits (see Ryan et al., 2006; Nakamura and Csikszentmihalyi, 2009; Zuroff et al., 2012).

Furthermore, commercial video games can possess a number of additional characteristics that may enhance their potential to improve mental health (Granic et al., 2014). Intense emotions which can be evoked by narrative techniques, may allow youth to practice coping strategies while facing negative emotions in a safe environment (Granic et al., 2014). Similarly, the social nature of video games allows for a relevant practice of social interactions.

Journey (Thatgamecompany, 2012b) is a commercial game that has been praised for eliciting intense emotions, its visual beauty, and unique social gameplay (Metacritic, 2012; Thatgamecompany, 2012a). Essentially the game chronicles the journey of the player's avatar from a desert wasteland to a distant mountain in eight levels (see **Figure 1**)[1]. Interestingly, Journey was designed to evoke feelings of being relatively powerless (Lowthorpe and Taylor, 2017), allowing the player to experience fear and a struggle for freedom. Additionally, anecdotal evidence in the form of player accounts linked Journey to overcoming grief, loneliness, and depressive episodes (e.g., Asgeek2012, 2012; Journey Stories, 2012). Rather than designing game mechanics of a serious game using evidence based action mechanisms (e.g., exposure; see for an example Scholten and Granic, 2019), the anecdotal evidence inspired us to reverse this process
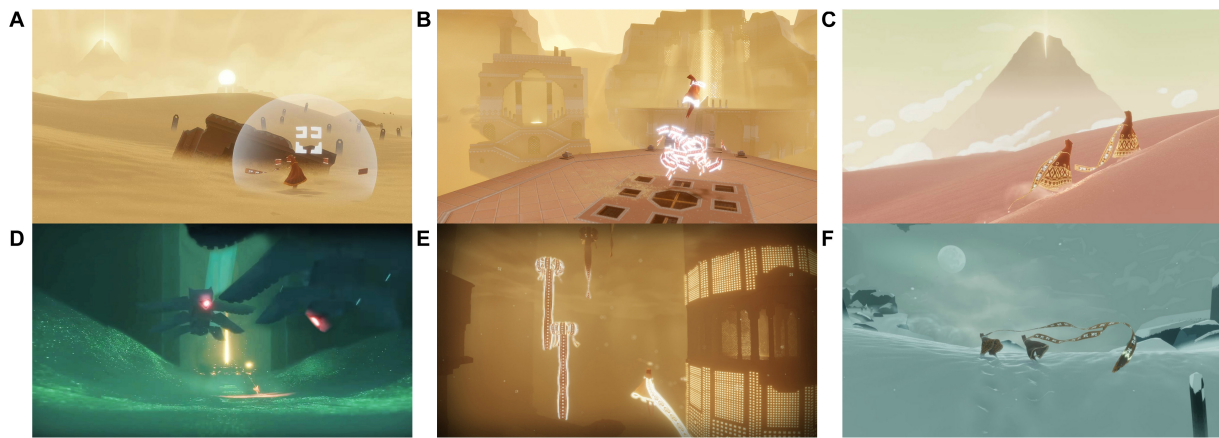
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[1] https://youtu.be/61DZC-60x20

FIGURE 1 | Gameplay in Journey. Players travel through the desert **(A–C)** and underground areas **(D,E)** to the top of a snowy mountain **(F)**. Players communicate with a single tone **(A)** and can fly if energized by cloth **(B)** or other players **(C)**. These images are reproduced from Journey by Thatgamecompany (2012b) with the permission of the copyright holder Sony Interactive Entertainment.

and identify game mechanics which could affect empirically supported action mechanisms. Specifically, we hypothesized that Journey may prevent the exacerbation of depressive symptoms through the game's social interaction, narrative, and quick succession of negatively and positively valenced scenes affecting four mechanisms: (a) rejection sensitivity, (b) narrative identity, (c) hope, and (d) coping strategies. The research supporting each action mechanism and their potential to improve depressive symptoms is reviewed below, with a rationale of how Journey's game mechanics may impact depressive symptoms through each mechanism.

First, research has suggested that rejection sensitivity – the anticipation and perception of rejection followed by a strong emotional reaction to perceived rejection – underlies deficits in social skills in depression and is a maintaining factor for depressive symptoms (Marston et al., 2010). Interestingly, video gameplay and particularly cooperative gameplay was found to influence elements of social competence in a number of studies (Gentile et al., 2009; Greitemeyer et al., 2010). In Journey specifically, players are encouraged to bond together through a mechanic that makes them more powerful when they are close to another player. The cooperative play leaves no room for explicit negativity between players, yet allows for very limited communication open to interpretation (see **Figure 1A**). Thus, when players are disconnected from another, this unexpected loss can feel compelling (e.g., Lowthorpe and Taylor, 2017), particularly for players who are rejection sensitive. A repeated confrontation with ambiguous rejection and reconnection with another player may allow players to reinterpret the loss experience as less catastrophic or personal, potentially re-training their interpretation of rejection.

Next, narrative identity and feelings of hope and optimism may be additional action mechanisms in the game which are promoted by the same game mechanics. Narrative identity — a person's life story that provides them with meaning and coherence — has been theorized to be essential for mental health (McAdams and McLean, 2013). Research on narrative development has shown that those who ascribe more redemptive meaning to suffering in their narrative identity (i.e., negative events are redeemed by causing or being followed by a positive event) have greater mental health and those finding more examples of personal agency over the course of treatment had greater mental health improvements (McAdams et al., 2001; Adler, 2012; Adler et al., 2015; Granic et al., 2020). Relatedly, hope and optimism are negatively associated with depressive symptoms (Alarcon et al., 2013) and Irving et al. (2004) showed that increases in hope positively predicted symptom improvement early in treatment.

Importantly, media are used by adolescents in their identity construction (Arnett, 1995) and strong narratives in video games can provide players with meaning and insight (Oliver et al., 2016). Although research is limited, media may increase hope through 'underdog' narratives (i.e., a character's struggle toward a nearly unachievable goal; Prestin, 2013). The 'underdog' narrative may also promote hope in Journey players, who tumble from an idyllic desert into an eerie underground area filled with monsters. Situations like these can create a struggle for agency in players, being small, vulnerable, and having a limited range of action options. It may be exactly these challenging and limiting circumstances that make each choice feel meaningful (e.g., putting yourself at risk to save a co-player), allowing players to reflect on the meaningful agency in their own life.

As players continue playing Journey, each struggle is overcome and followed by brighter, more positive areas. The clear sequence of highs and lows may encourage players to find redemptive meaning in the game events. Through repetition players may transfer such a narrative arc to their own life's story. Importantly, the use of redemptive sequences to provide meaning to past experiences has been associated with more optimism in emerging adults (McLean and Pratt, 2006).

Finally, coping strategies and emotion regulation play an essential role in the onset and maintenance of depressive

symptoms (Nolen-Hoeksema, 1991; Silk et al., 2003; Aldao et al., 2010; Evans et al., 2015; Lo et al., 2017). Specifically, rumination has been repeatedly linked to the onset, maintenance, and recurrence of depression (Nolen-Hoeksema, 1991; Davis and Nolen-Hoeksema, 2000; Huffziger et al., 2009; Aldao et al., 2010; Lo et al., 2017). In contrast, a combination of distraction and problem solving seems to be associated with lower occurrence of depressive symptoms (Abela et al., 2007; Hilt et al., 2010).

Interestingly, a recent literature review concluded that commercial video games may be particularly well suited to improve emotion regulation (Villani et al., 2018), foster positive mood (e.g., Ryan et al., 2006; Russoniello et al., 2009; Osmanovic and Pecchioni, 2016; Reer and Krämer, 2018), and are used by youth to regulate their mood (Olson, 2010; Ferguson and Olson, 2013). Specifically, playing games is commonly linked to distraction and experimental research shows that more distracting video games indeed have beneficial effects on mood (Bowman and Tamborini, 2012). Journey is expected to similarly promote distraction among youth as it offers a relatively short, engaging, and rewarding play experience. Furthermore, initial evidence also relates playing strategic games to an increase in problem-solving skills (Adachi and Willoughby, 2017). While not a strategy game, negative emotional scenes in Journey require players to persevere despite negative emotions and overcome confrontations with monsters and other obstacles. We therefore hypothesize that problem solving matches an effective play style in Journey and rumination is discouraged.

A randomized controlled trial was conducted to test the effects and potential action mechanisms of Journey as an indicated depression prevention approach compared to another commercial game — Flower — and a passive control group. Comparing Journey to both Flower and a passive control group allowed us to distinguish non-specific effects of commercial video games and specific action mechanisms in Journey on depressive symptoms. Made by the same game studio, Journey and Flower are games with similar design and aesthetic. However, where Flower is a relaxing single-player game in which the player transforms their environment unopposed in a number of unrelated levels, Journey includes a narrative arc, is designed to evoke a range of both positive and negative emotions, and is a social, cooperative game. These specific design features of Journey (which are not present in Flower), correspond exactly to the action mechanisms we hypothesized prevent the exacerbation of depressive symptoms.

Participants were youth with elevated depressive symptoms aged 15 to 20 years old, as we expected the abstract nature of Journey to be more suited to this age range. We expected that youth who played Journey would show lower levels of depressive symptoms during post-test and six and 12 month follow-up, compared to the passive control group. In comparison, after playing Flower, participants were expected to experience less depressive symptoms than participants in the passive control group due to non-specific effects of game play, yet more depressive symptoms than participants playing Journey.

In regard to the action mechanisms, we hypothesized that after playing Journey participants would report feeling less rejection sensitivity, identify more redemptive sequences and agency in their narrative identity, have more hope and optimism, use less rumination, and use more problem solving and distraction. Moreover, we expected changes in these action mechanisms to mediate the effects of Journey compared to the active and passive control groups. Additionally, if conditions showed equal effects on depressive symptoms, exploring whether the action mechanisms explained variability in depressive symptoms over time would be illuminating. In that case, moderation analyses would allow us to examine whether action mechanisms moderated the effect of the conditions. Furthermore, exploring Journey's immersive environment can promote the experience of intrinsic motivation, autonomy, competence, and flow thereby potentially promoting beneficial effects on depressive symptoms. Therefore, we tested whether a positive experience with Journey or Flower (i.e., experienced intrinsic motivation, autonomy, competence, and flow) moderated the effects of the games on depressive symptoms.

MATERIALS AND METHODS

Participants

Participants were 244 adolescents and young adults with a mean age of 17.11 years ($SD = 1.76$). Two-thirds of participants were female (66.4%) and the vast majority was born in the Netherlands (93.4%). Overall participants' education level was high, as only 9.1% of participants received vocational education, 32.1% received higher vocational education, and 58.8% received (pre-) university education. Finally, participants were quite positive about video games ($M = 5.31$, $SD = 1.44$ on a 7-point scale; $1 = Do\ not\ like\ them\ at\ all$, $4 = Like\ them\ somewhat$, $7 = Like\ them\ very\ much$) and most played games at least once a week (71.7%) with only a few participants indicating not playing video games at all (3.7%).

Procedure

Between November 2014 and June 2016 4,695 youth were screened for elevated depressive symptoms using a 10-min questionnaire (t0; see **Figure 2** for the participant flow chart). Youth under the age of 18 were recruited through schools which had agreed to participate following an information letter and visit (17 secondary schools and one vocational tertiary school). Additionally, older youth were also recruited through flyers, social media posts, and the research participation system of the Radboud University. All youth and parents of secondary school students received written information regarding the study. Inclusion criteria and hypotheses were not communicated until the end of the study to reduce the potential for stigmatization and socially desirable answers. Parents provided passive consent for screening and youth were free to stop at any point.

We aimed for a strict inclusion of high-risk youth between the ages of 15 and 20 who were unfamiliar with Journey or Flower. Youth were invited for participation if they: (a) indicated elevated depressive symptoms on the Children's Depression Inventory (CDI $\geq$ 13; Kovacs, 2001) and (b) indicated experiencing at least one of the core symptoms of a depressive disorder — depressed mood and anhedonia — the majority of the time over

FIGURE 2 | Flow chart participants from screening to 12 month follow-up.
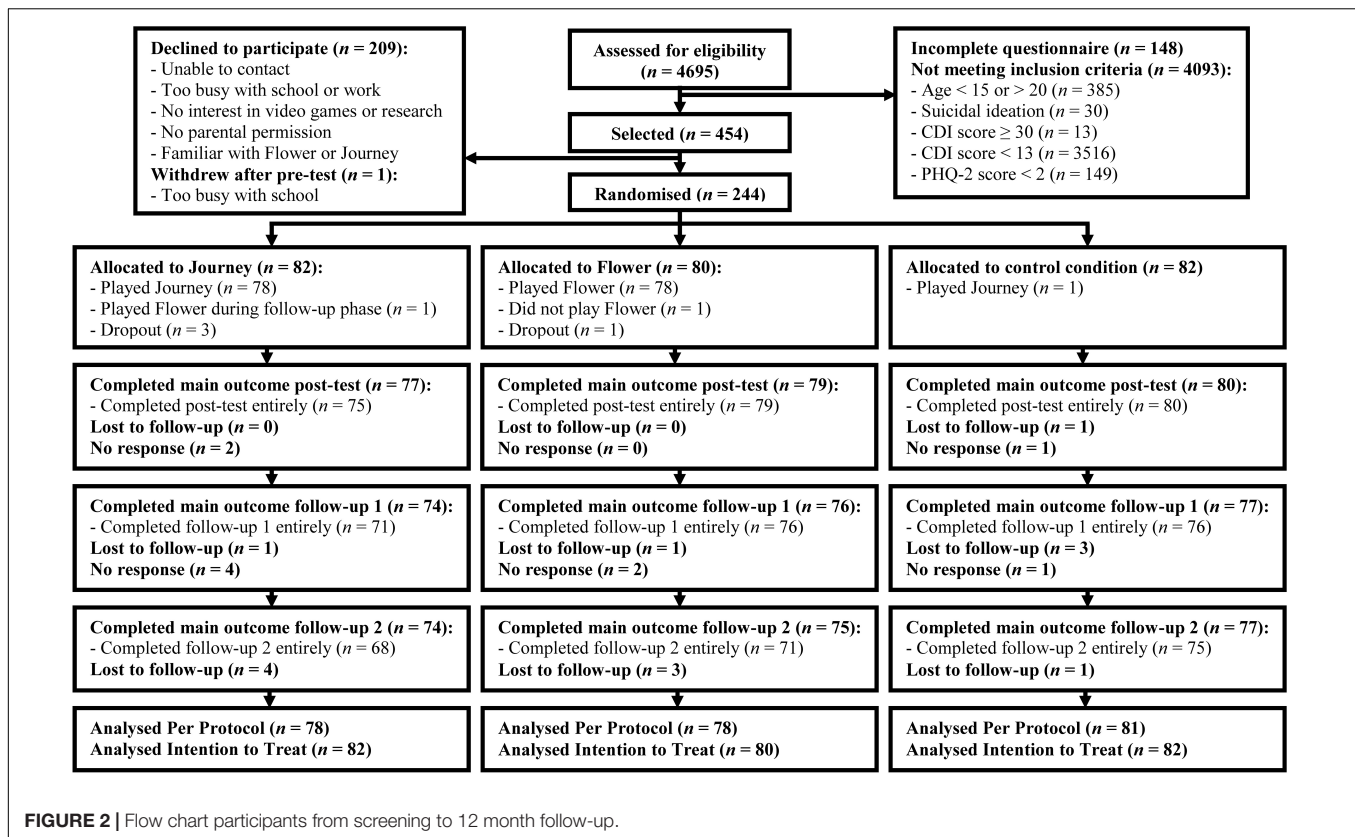
the past 2 weeks or alternatively experiencing both of the core symptoms on several days using the Patient Health Questionnaire 2 (Patient Health Questionnaire 2 $\geq$ 2; α = 0.54; Kroenke et al., 2003; Richardson et al., 2010)[2]. Youth were excluded at screening (n = 50) if they reported extremely severe depressive symptoms (CDI $\geq$ 30) and/or suicidal ideation (CDI item 9 = 2) as they were deemed in need of clinical assessment and/or intervention. These youth and youth scoring similarly during participation (n = 19) were contacted to discuss options for mental health services and parents of adolescent participants were involved if deemed appropriate. Medication use and receiving therapy were not exclusion criteria.

To detect a small effect size (f = 0.10) with a power of 0.90 while accounting for 10% attrition (correlation among repeated measures = 0.40; non-sphericity correction ε = 0.83; based on data from Poppelaars et al., 2016) 290 participants were required (GPOWER 3.9.1.2; Faul et al., 2007). Less youth met inclusion criteria and more declined participation than expected, therefore the original upper age limit was changed from 18 to 20 and the recruitment period was almost doubled. In the end, 454 youth were selected to participate and 244 participants were randomized. Selected youth often cited a busy schedule, no interest in scientific research or video games when declining participation (see **Figure 2** for further information). Participants

were more highly educated and liked video games more than youth who declined participation, while the two groups were similar otherwise (see **Table 1**).

Participants filled in the 45-min pre-test questionnaire (t1) online after they and, if applicable, their parents had provided informed consent. At pre-test, depressive symptoms and all action mechanisms were assessed (i.e., rejection sensitivity, narrative identity, hope and optimism, and coping strategies; see Instruments). Additionally, in order to ensure participants on average had similar expectations regarding potential benefits of playing Journey and the control game Flower, all participants were shown trailers for Journey and Flower with similar messages at pre-test (see Boot et al., 2013 for the importance of equal expectations in active control conditions). Expectations regarding well-being were checked using self-developed items (based on Scholten et al., 2016) on a 7-point scale (1 = *Not at all* to 7 = *Definitely*; Flower: α = 0.82 and Journey: α = 0.83).

Next, an independent researcher randomized participants to a passive condition (n = 82) or to play either Journey (n = 82) or Flower (n = 80). Initially, randomization was done once a month stratified by gender. After the age range was adjusted, blocked randomization lists with a random block size order (blocks of three, six or nine participants) were created separate for gender and school or other recruitment.

Participants in the game conditions were given a logbook and a PlayStation 3 console pre-installed with their assigned game for 4 weeks. They were requested to complete the game at least once, but no further restrictions were given to encourage

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[2]This strategy excluded 904 youth that did not report elevated depressive symptoms (n = 755; CDI < 13; Patient Health Questionnaire 2 $\geq$ 2) or core depressive symptoms (n = 149; CDI $\geq$ 13; Patient Health Questionnaire 2 < 2).

TABLE 1 | Descriptives (Means and Standard Deviations or Percentages) and χ² or *F*-values of demographic variables for participating and non-participating youth separately.

	Participants		Non-participating youth		χ^2 (1, *n* = 454)	*t* (452)
	M/%	*(SD)*	*M/%*	*(SD)*		
Age	17.11	(1.76)	16.97	(1.64)		0.92[a]
Gender					0.46	
Female	66.4%		63.3%			
Male	33.6%		36.7%			
Education level					**26.03[b]***	
Vocational	9.1%		21.4%			
Higher vocational	32.1%		41.9%			
(Pre-) University	58.8%		36.7%			
Born in the Netherlands					1.36	
Yes	93.4%		90.5%			
No	6.6%		9.5%			
Frequency of video game play					9.33[c]	
Never	3.7%		6.2%			
Once a month	8.2%		15.7%			
Multiple times a month	16.4%		16.7%			
Every week	21.3%		20.5%			
Multiple times a week	26.6%		22.9%			
Every day	23.8%		18.1%			
Liking video games	5.31	(1.44)	4.85	(1.67)		**3.12[d]***
Depressive symptoms	17.27	(3.75)	17.63	(3.98)		−0.97
Core depressive symptoms	2.78	(1.02)	2.75	(0.97)		0.37

*Significant effects are printed in bold. [a]df = 442.28. [b]df = 2, n = 453. [c]df = 5, n = 454. [d]df = 416.01. **p < 0.01, ***p < 0.001.*

naturalistic gameplay. Flower takes 2 to 3 h to complete compared to approximately 3 h for Journey. Meanwhile, passive control participants continued their normal routine.

Within 2 weeks after the intervention period, participants filled in an online post-test questionnaire (t2) which was repeated six (t3) and 12 months (t4) later. All questionnaires repeated the assessment of depressive symptoms and the action mechanisms. For participants who played Journey or Flower game engagement measures were included at post-test (see Instruments). Outcomes that are less theoretically relevant to this paper are not reported, however an overview of all measures is provided in the **Supplementary Materials** (see **Supplementary Table 1**) and the full data is available at the DANS EASY online data repository (Poppelaars et al., 2020). Moreover, all questionnaires included a number of filler items (e.g., items regarding academic achievements) to distract from the study's purpose. Questionnaires without an official Dutch translation were translated into Dutch separately by two researchers and back translated by a third researcher. Any discrepancies were solved through discussion.

In total, 217 participants (88.9%) completed all five assessments of depressive symptoms. This resulted in a power of 0.77 to detect small effects (f = 0.10) and a power of 0.99 to detect small to medium effects (f = 0.15; ANOVA repeated measures and within-between interaction; correlation among repeated measures = 0.36; non-sphericity correction ε = 0.77; GPOWER 3.9.1.2; Faul et al., 2007).

Participants received course credits, monetary rewards (€35,- in gift certificates) or a combination as compensation for the

questionnaires. After the last questionnaire, passive control participants were offered Flower and/or Journey. Ethical approval for the study was granted by the ethical committee of the Faculty of Social Sciences at Radboud University ECSW2014-1003-201) and the trial was pre-registered at the Dutch Trial Register (Nederlands Trial Register: NL4873).

Control Game

Similar to Journey, Flower was designed by Thatgamecompany (2009b) and combines minimalistic game controls with powerful game mechanics. Both games have pleasing aesthetics and immersive music and are appealing to frequent and non-frequent players. In Flower players explore six levels or landscapes controlling the wind on which a growing string of flower petals float (see **Figure 3**)[3]. With each flower that the player's petals touch more flowers bloom and the landscape becomes more vibrant. Although players cannot die, in the penultimate level they lose some petals if they fly too close to electricity poles. Critics and the majority of players received Flower positively (Metacritic, 2009; Thatgamecompany, 2009a).

Instruments
Depressive Symptoms

Severity of depressive symptoms was measured with the CDI (Kovacs, 2001) using 27 items consisting of three related statements. Participants indicate the statement reflecting their experience in the past 2 weeks (e.g., 0 = *I get sad from time to*

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[3]https://youtu.be/s1oZnf3475c

FIGURE 3 | Gameplay in Flower. Players steer flower petals toward **(A)** and past flowers **(B)** which then bloom and transform the environment **(C)**. These images are reproduced from Flower by Thatgamecompany (2009b) with the permission of the copyright holder Sony Interactive Entertainment.

time, 1 = *I get sad often*, 2 = *I'm always sad*). To account for the extended age range of the study, slight adaptations made items suitable for all participants (e.g., "I'm as good as other children." became "I'm as good as other youth."). A sum score is calculated ranging from 0 to 54 with 13 reverse scored items; higher scores indicate more severe depressive symptoms. Reliability was acceptable to good (α = 0.75–0.86).

Action Mechanisms

Rejection sensitivity

The tendency to anxiously expect rejection was measured using the eight item Rejection Sensitivity Questionnaire (Downey and Feldman, 1996). Participants were presented with possible rejection situations (e.g., "You ask a friend to do you a big favor.") and asked how concerned they would be over the reaction on a 6-point scale (1 = *very unconcerned* to 6 = *very concerned*; rejection concern) and to what extent they would expect a positive reaction on a 6-point scale (1 = *very unlikely* to 6 = *very likely*; acceptance expectancy). For each item the rejection concern score is multiplied by the reverse score of acceptance expectancy. A mean score with a possible range of 1 to 36 is calculated with higher scores indicating more rejection sensitivity. Reliability was acceptable to good (α = 0.73–0.80).

Narrative identity

Participants wrote approximately five lines each on a high, low, and turning point in their life based on the Life Story Interview (McAdams, 2008). Three graduate students trained by the first and second author coded redemptive sequences and agency (McAdams, 1999, 2002). Coders could score one point for agency for: (a) gaining insight or control in life, (b) gaining status or victory, (c) attaining an achievement or taking responsibility, and (d) feeling empowered by an authority figure. A redemptive sequence was coded (0 = *no*, 1 = *yes*) when a clearly negative state resulted in a positive state or outcome. An extra point per category was scored for additional positive outcomes for: (a) agency, (b) social relationships, or (c) spiritual experience. Sum scores for redemptive sequences and agency were calculated from the three prompts with a potential range of 0 to 12. In total 819 sets of narrative fragments were coded of which 128 (15.6%) were coded independently by two coders. Intraclass Correlation Coefficients based on a single rating, absolute agreement, 1-way random effects model showed poor to moderate interrater reliability (Intraclass Correlation Coefficients = 0.58, 95% CI [0.45,0.68]) for agency and moderate

to good reliability (Intraclass Correlation Coefficients = 0.67, 95% CI [0.56,0.75]) for redemptive sequences (Koo and Li, 2016). Complete agency and redemption data were available for 161 (66.0%) and 160 (65.6%) participants, respectively.

Hope and optimism

Hope and optimism were measured using the Global Positive Expectancies scale (Carvajal, 2012). A mean score is calculated from the eight items (e.g., "I always look on the bright side of things.") measured on a 4-point scale (1 = *None of the time*, 2 = *Some of the time*, 3 = *Most of the time*, 4 = *All of the time*). Reliability was acceptable to good (α = 0.75–0.84).

Coping strategies

Participants' response to depressed moods was measured using the Children's Response Styles Questionnaire (Abela et al., 2007). Specifically, 13 items measured rumination (e.g., "When I am sad, I think about how sad I feel.") and eight items measured distraction and problem solving (e.g., "When I am sad, I think of a way to make my problem better.") on a 4-point scale (0 = *Almost never*, 1 = *Sometimes*, 2 = *Often*, 3 = *Almost always*). Reliability was good for the Rumination subscale (α = 0.85–0.88), however reliability for the Distraction and Problem-Solving subscale was questionable to acceptable (α = 0.67–0.74).

Game Engagement

Intrinsic motivation

The Interest/Enjoyment subscale of the Intrinsic Motivation Inventory (Ryan, 1982; McAuley et al., 1989) assessed intrinsic motivation experienced during gameplay with excellent reliability (α = 0.95). The seven items (e.g., "I would describe this game as very interesting.") were assessed on a 7-point scale (1 = *Not at all true*, 4 = *Somewhat true*, 7 = *Very true*) at post-test. A mean score was calculated after reverse scoring two items, where higher scores indicated more motivation.

Autonomy and competence

The Player Experience of Need Satisfaction questionnaire (Ryan et al., 2006; Immersyve, 2007) measures the experience of autonomy (e.g., "I experienced a lot of freedom in the game.") and competence (e.g., "I feel very capable and effective when playing."). A mean score was calculated for each three-item subscale measured on a 7-point scale (1 = *Strongly disagree* to 7 = *Strongly agree*) with good reliability (Autonomy: α = 0.84 and Competence: α = 0.88).

Flow

Participants were given a description of flow and the way people experience it (Novak et al., 2000). Next, participants rated on 9-point scales if they had ever experienced flow (1 = *Not at all sure* to 9 = *Completely sure*), how frequently they had experienced flow (1 = *Never* to 9 = *Very frequently*), and if most of the time they had experienced flow (1 = *Strongly disagree* to 9 = *Strongly agree*) while playing Journey or Flower. Higher mean scores indicate a stronger experience of flow during gameplay with excellent reliability (α = 0.91).

Statistical Analyses

To start, the descriptive statistics reported below include all available data (we checked that excluding participants who did not follow protocol or who dropped out did not change the significance of any reported descriptive statistics). Randomization success was checked using one-way ANOVAs and chi-square tests on demographic variables. Next, both depressive symptoms and action mechanisms at each time point and game engagement variables were compared between conditions using one-way ANOVAs. Furthermore, correlations between age, depressive symptoms, and action mechanisms at pre-test and the game engagement variables were examined. As the age range in our study was extended and many of our dependent variables showed significant correlations with age, we used age as a covariate in all further analyses.

Mixed Effects Models were used for both the intention to treat and per protocol analyses. Mixed effects models is a recommended method to analyze longitudinal data with missing data points and can model the covariance structure of participants' repeated measurements over time (Gueorguieva and Krystal, 2004; Krueger and Tian, 2004), while the interpretation is similar to commonly used Repeated Measures ANOVAs (Littell et al., 2000). Using Residual Maximum Likelihood the best fitting solution is estimated based on all available data, including participants missing one or more of the repeated assessments. Moreover, rather than assuming sphericity for repeated measurements, mixed effects models allow for more appropriate modeling of the correlations between repeated assessments from subjects through the covariance matrix (Gueorguieva and Krystal, 2004). For each dependent variable the best fitting covariance matrix was selected based on the Akaike information criterion and the Schwarz Bayesian criterion (following Littell et al., 2000). A selection was made from 7 common covariance matrices: (a) Unstructured, which uses the covariance and variance values from the sample; (b) Compound Symmetry, which specifies equal covariance between repeated measures; (c) Autoregressive; and (d) Toeplitz, which both specify that covariance between repeated measures decrease with more time between assessments in specific ways; (e) Compound Symmetry Heterogeneous; (f) Autoregressive Heterogeneous; and (g) Toeplitz Heterogeneous, the last three of which allow variances to differ between repeated measures compared to their counterparts (see Littell et al., 2000).

Next, the effect of condition on depressive symptoms and the action mechanisms over time was tested. Mixed effects models used all available time-points for depressive symptoms (t0-t4) and each action mechanism (t1-t4), entering time and condition as categorical variables and age as a continuous covariate. In order to use age as a covariate, the variable was mean centered. The model included fixed effects for time, age, condition, Time × Age, and Time × Condition.

Further, mediation of the action mechanisms could not be tested as the effect of condition on change in depressive symptoms was not significant. Therefore, we instead tested for moderation effects of the action mechanisms. Separate mixed effects models were used to test whether change in the action mechanisms as well as game engagement moderated the effect of condition on depressive symptoms over time. To this end, the original mixed effects model for depressive symptoms was extended by adding the centered action mechanism change variable or centered game engagement variable as a continuous covariate. Additionally, the interactions of the action mechanism or game engagement variable with condition, time, and Time × Condition were included as fixed effects. For all action mechanisms, centered change variables were created by subtracting pre-test scores from the final follow-up scores and mean centering these scores. Moderation analyses only included data from participants with a valid centered action mechanism change variable or centered game engagement variable.

The per protocol analyses included only participants who followed protocol and played Journey or Flower or neither game as prescribed by the randomization. These analyses were only reported if they deviated from the intention to treat analyses. To reduce the possibility of chance findings α = 0.01 was used for the moderation analyses. All analyses were performed in SPSS 25 (Ibm Corp, 2017) and Bonferroni corrections were applied to all *post hoc* tests.

RESULTS

Descriptive Statistics

Randomization was successful as there were no significant differences between conditions on the demographic variables, expectations of Journey, expectations of Flower, and on receiving other treatment during the study period (see **Table 2**). In addition, a RM-ANOVA of expectations showed participants had similar expectations of the potential effect of Journey and Flower at pre-test ($F(1, 241) < 0.01$, $p = 0.97$, $\eta^2_p < 0.01$) and this was not moderated by the condition to which participants were randomized ($F(2, 241) = 0.05$, $p = 0.95$, $\eta^2_p < 0.01$). Participants in both game conditions on average recorded approximately three sessions of gameplay in their logbooks (Flower $M = 3.03$, $SD = 1.76$; Journey $M = 3.25$, $SD = 1.93$; $t(148) = 0.73$, $p = 0.47$), but Journey on average was played longer than Flower (Flower $M = 2$ h 36 min, $SD = 1$ h 55 min; Journey $M = 3$ h 20 min, $SD = 2$ h 16 min; $t(145) = 2.09$, $p < 0.05$). Additionally, on average playing Journey was experienced as more engaging than playing Flower, as participants playing Journey on average reported experiencing more intrinsic motivation (Flower $M = 3.66$, $SD = 1.54$; Journey $M = 4.73$, $SD = 1.53$; $F(1, 151) = 18.40$, $p < 0.001$), autonomy (Flower $M = 3.40$, $SD = 1.52$; Journey

TABLE 2 | Descriptives (Means and Standard Deviations or Percentages) per condition and χ^2 or F-values for demographic variables at T0, intervention expectation at T1, and other treatment during the study.

	Total	Journey	Flower	Passive control	χ^2	$F(2, 241)$
	M (SD)/%	M (SD)/%	M (SD)/%	M (SD)/%		
Age	17.11	17.13	17.16	17.05		0.09
	(1.76)	(1.81)	(1.79)	(1.71)		
Gender					0.07[a]	
Female	66.4%	65.9%	67.5%	65.9%		
Male	33.6%	34.1%	32.5%	34.1%		
Education level					5.87[b]	
Vocational	9.1%	6.1%	10.1%	11.0%		
Higher vocational	32.1%	32.9%	24.1%	39.0%		
(Pre-) University	58.8%	61.0%	65.8%	50.0%		
Born in the Netherlands					0.87[a]	
Yes	93.4%	93.9%	95.0%	91.5%		
No	6.6%	6.1%	5.0%	8.5%		
Frequency of video game play					10.30[c]	
Never	3.7%	2.4%	3.8%	4.9%		
Once a month	8.2%	11.0%	8.8%	4.9%		
Multiple times a month	16.4%	15.9%	21.3%	12.2%		
Every week	21.3%	22.0%	23.8%	18.3%		
Multiple times a week	26.6%	24.4%	18.8%	36.6%		
Every day	23.8%	24.4%	23.8%	23.2%		
Liking video games	5.31	5.35	5.20	5.37		0.33
	(1.44)	(1.43)	(1.53)	(1.37)		
Expectation						
Flower	4.28	4.22	4.33	4.30		0.19
	(1.22)	(1.29)	(1.06)	(1.31)		
Journey	4.28	4.20	4.33	4.32		0.30
	(1.23)	(1.30)	(1.16)	(1.24)		
Other treatment					1.13[d]	
No	58.9%	57.5%	63.9%	55.7%		
Yes	41.1%	42.5%	36.1%	44.3%		
Core depressive	2.78	2.78	2.78	2.79		
symptoms at screening	(1.02)	(1.02)	(0.94)	(1.11)		0.01

[a] χ^2 (2, n = 244). [b] χ^2 (4, n = 243). [c] χ^2 (10, n = 244). [d] χ^2 (2, n = 224).

$M = 4.48$, $SD = 1.49$; $F(1, 151) = 19.85$, $p < 0.001$), competence (Flower $M = 3.71$, $SD = 1.60$; Journey $M = 4.67$, $SD = 1.37$; $F(1, 151) = 15.59$, $p < 0.001$), and flow (Flower $M = 3.94$, $SD = 2.10$; Journey $M = 4.96$, $SD = 2.20$; $F(1, 151) = 8.60$, $p < 0.01$) than participants playing Flower. Further, no significant differences were found on depressive symptoms or any of the action mechanisms between conditions on their first assessment nor on any other time point (see **Supplementary Table 2**).

Correlations between age, depressive symptoms, and action mechanisms at pre-test and the game engagement variables are provided in **Table 3**. Notably, age correlated significantly with several dependent variables, showing that older participants on average showed more depressive symptoms, more rejection sensitivity, more agency in their identity narratives, less hope and optimism, and more rumination than younger participants. Furthermore, it stands out that depressive symptoms were not found to be related to agency in identity narratives or distraction and problem solving in this sample.

Depressive Symptoms

Next, a mixed effects model was used to test if condition was associated with differences in depressive symptoms over time. First, the best fitting covariance matrix was determined to be Toeplitz with heterogeneous variances as indicated by the second lowest Akaike's Information Criterion (6819.13) and the lowest Schwarz's Bayesian Criterion (6864.62; following recommendations of Littell et al., 2000). While a significant main effect of time ($F(4, 295.52) = 16.44$, $p < 0.001$) and a significant Time × Age interaction ($F(4, 296.29) = 7.85$, $p < 0.001$) were found, no Time × Condition interaction was found ($F(8, 295.55) = 0.85$, $p = 0.56$; see **Figure 4**). Thus, results indicate that participants in all conditions showed a similar decrease in depressive symptoms over the study period (t0-t4: $\beta = -2.78$, $SE = 0.75$, 95% CI $[-4.26, -1.30]$).

When comparing screening and the final follow-up, age did not influence the decrease in symptoms (t0-t4: $\beta = -0.03$, $SE = 0.25$, 95% CI $[-0.52, 0.46]$). Rather, *post hoc* analyses

TABLE 3 | Correlations between age, depressive symptoms, and action mechanisms at pre-test and game engagement variables.

	Age	DS	RS	NR	NA	H&O	RUM	D&P	IM	AT	CM
Age											
DS	**0.26*****										
RS	**0.16***	**0.47*****									
NR	−0.01	**−0.15***	−0.04								
NA	**0.18****	0.06	**0.13***	**0.40*****							
H&O	**−0.28*****	**−0.63*****	**−0.44*****	0.08	−0.01						
RUM	**0.18****	**0.39*****	**0.34*****	0.02	0.11	**−0.29*****					
D&P	0.04	−0.10	**−0.16***	**0.18****	**0.15***	**0.26*****	−0.02				
IM	−0.03	0.08	0.14	−0.15	−0.02	0.01	0.07	0.08			
AT	−0.04	< 0.01	0.14	−0.04	< −0.01	0.12	0.02	0.14	**0.80*****		
CM	0.08	−0.05	0.11	−0.03	0.07	0.10	0.07	**0.18***	**0.67*****	**0.66*****	
FL	−0.01	< 0.01	0.03	−0.08	0.05	**0.18***	< −0.01	0.07	**0.72*****	**0.64*****	**0.59*****

*Significant effects are printed in bold. DS, Depressive Symptoms; RS, Rejection Sensitivity; NR, Narrative Redemptive Sequences; NA, Narrative Agency; H&O, Hope and Optimism; RUM, Rumination; D&P, Distraction and Problem Solving; IM, Intrinsic Motivation; AT, Autonomy; CM, Competence; FL, Flow. *p < 0.01, **p < 0.01, ***p < 0.001.*

FIGURE 4 | Trajectories of mean depressive symptoms (CDI) scores by condition. Error bars represent standard errors.
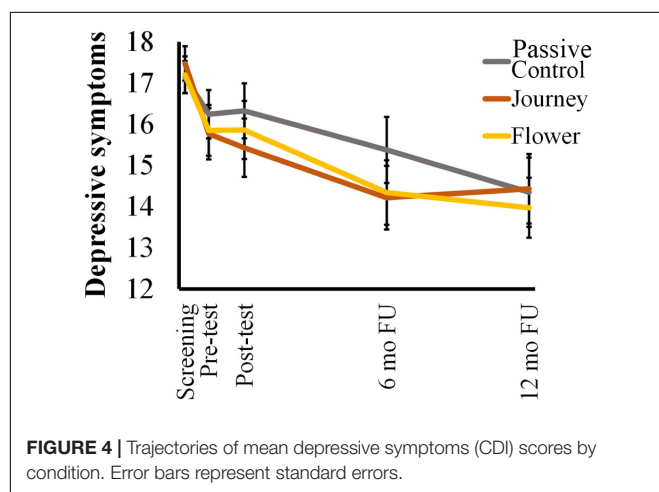
indicated that age had an effect on the timing of the change in depressive symptoms. Younger participants showed an early decrease in depressive symptoms between screening and pre-test (15-year olds $p < 0.001$; 16-year olds $p < 0.001$; 17-year olds $p < 0.001$) that was not found for older participants. A significant decrease in symptoms later on in the study was only seen in participants aged 17 years and older (17-year olds t2-t3 $p < 0.01$ 18-year olds t2-t3 $p < 0.01$; 19-year olds t2-t3 $p < 0.05$; 20-year olds t2-t4 $p < 0.001$). Thus, younger participants decreased in depressive symptoms earlier but not more compared to older participants. Moreover, despite the overall decrease in depressive symptoms, approximately 50.2% of the participants still met the inclusion criteria for elevated depressive symptoms at the final follow-up with no differences between conditions ($\chi 2$ (2, $n = 223$) = 0.47, $p = 0.79$).

Action Mechanisms

The results of the mixed effects models for all action mechanisms are reported in **Table 4**. Main effects of time were found for (a) rejection sensitivity and (b) hope and optimism. Time × Age and

Time × Condition interactions were not found for either variable. Findings indicate that participants in all conditions and of all ages showed a mean decrease in rejection sensitivity (t1-t4: $\beta = -1.11$, $SE = 0.46$, 95% CI [−2.01, −0.21]) and mean increase in hope and optimism (t1-t4: $\beta = 0.13$, $SE = 0.06$, 95% CI [0.02, 0.24]) during the study. The mixed effects models of all other action mechanisms showed no significant effects of time, Time × Age, and Time × Condition. This indicates that narrative redemptive sequences, narrative agency, rumination, and distraction and problem solving remained stable for all conditions and all ages during the study period.

Moderation of Action Mechanisms

As there was no effect of condition on change in depressive symptoms, no mediation analyses could be performed. Therefore, we tested whether change in the action mechanisms moderated the effect of condition on depressive symptoms. Mixed effects model results are reported in **Table 5** and show that all moderation analyses replicated the main effect of time and the Time × Age interaction on depressive symptoms. The Time × Age interaction can be interpreted the same way as in the main outcome. However, when hope and optimism was added as a moderator we additionally saw a significant decrease in depressive symptoms for the 16-year olds later in the study (t1-t3 $p < 0.01$).

Further, results indicated that both change in narrative redemptive sequences and change in narrative agency did not moderate the effect of time or the interaction of Time × Condition on depressive symptoms. Indicating that change in narrative aspects had no effect on the decrease in depressive symptoms over time in the current study.

On the other hand, change in (a) rejection sensitivity, (b) hope and optimism, (c) rumination, and (d) distraction and problem solving were found to moderate the change of depressive symptoms over time (see **Figure 5**). First, participants who decreased more in rejection sensitivity showed a larger decrease in depressive symptoms across the study (t0-t4: $\beta = 0.68$,

TABLE 4 | The effect of condition on action mechanisms over time using mixed effects models.

	Covariance matrix	Fit indices		Time		Time × Age		Time × Condition	
		AIC	BIC	df	F	df	F	df	F
RS	TP	4896.52	4915.78	3, 394.78	**5.65*****	3, 394.69	1.16	6, 394.65	0.85
NR[a]	CS	2696.81	2706.19	3, 596.94	2.45	3, 595.90	0.05	6, 596.57	0.61
NA[a]	CS	2376.05	2385.43	3, 601.33	0.98	3, 600.27	0.49	6, 600.94	0.34
H&O	TP	949.02	968.29	3, 381.33	**5.90*****	3, 380.64	1.51	6, 381.09	0.90
RUM	TP	5903.23	5922.49	3, 397.57	1.21	3, 396.96	0.03	6, 397.48	1.65
D&P	TP	4873.53	4892.79	3, 417.53	1.77	3, 415.56	1.78	6, 417.47	0.35

*Significant effects are printed in bold. AIC, Akaike Information Criterion; BIC, Schwarz Bayesian Criterion; RS, Rejection Sensitivity; NR, Narrative Redemptive Sequences; NA, Narrative Agency; H&O, Hope and Optimism; RUM, Rumination; D&P, Distraction and Problem Solving; TP, Toeplitz; CS, Compound Symmetry. [a] Excluding 7 participants without any codeable narrative data. ***p < 0.001.*

TABLE 5 | The effect of condition on depressive symptoms over time moderated by action mechanisms or game engagement using mixed effects models.

	Fit indices		Time		Time × Age		Time × Δ AM/GE		Time × Condition		Time × Δ AM/GE × Condition	
	AIC	BIC	df	F	df	F	df	F	df	F	df	F
RS	6345.68	6390.41	4, 278.17	**16.13*****	4, 278.84	**6.24*****	4, 278.14	**9.87*****	8, 278.17	0.69	8, 278.23	1.52
NR	5384.50	5427.72	4, 230.97	**13.70*****	4, 231.67	**5.32*****	4, 229.74	1.94	8, 231.00	0.54	8, 229.96	0.94
NA	5401.58	5444.86	4, 231.27	**13.59*****	4, 231.94	**5.22*****	4, 230.15	0.77	8, 231.29	0.65	8, 230.34	1.16
H&O	6254.26	6299.04	4, 290.39	**20.42*****	4, 290.85	**5.89*****	4, 289.70	**32.97*****	8, 290.40	0.94	8, 289.81	0.36
RUM[a]	6305.04	6349.73	4, 280.13	**15.25*****	4, 280.90	**6.25*****	4, 280.18	**12.57*****	8, 280.14	0.77	8, 280.22	1.97
D&P[b]	6332.73	6377.43	4, 276.18	**15.63*****	4, 276.78	**6.04*****	4, 275.81	**5.19*****	8, 276.18	0.72	8, 275.80	0.43
IM	4305.96	4347.22	4, 194.73	**10.60*****	4, 195.11	**5.86*****	4, 194.00	0.45	4, 194.73	0.26	4, 193.96	1.23
AT	4300.89	4342.15	4, 194.30	**9.01*****	4, 194.91	**6.40*****	4, 194.35	0.34	4, 194.26	0.23	4, 194.36	2.86
CM	4304.21	4345.47	4, 193.76	**10.08*****	4, 194.12	**5.86*****	4, 193.30	0.67	4, 193.75	0.26	4, 193.35	0.95
FL	4314.04	4355.30	4, 193.96	**11.60*****	4, 194.33	**5.91*****	4, 194.71	0.77	4, 193.92	0.25	4, 194.70	0.41

*Significant effects are printed in bold. The covariance matrix Toeplitz with heterogeneous variances was used for all analyses. $^{\Delta}$AM, Change in Action Mechanisms; GE, Game Engagement Variables; AIC, Akaike Information Criterion; BIC, Schwarz Bayesian Criterion; RS, Rejection Sensitivity; NR, Narrative Redemptive Sequences; NA, Narrative Agency; H&O, Hope and Optimism; RUM, Rumination; D&P, Distraction and Problem Solving; IM, Intrinsic Motivation; AT, Autonomy; CM, Competence; FL, Flow. [a]The interaction Time × Change in Rumination × Condition was significant in the per protocol analysis, however with the exclusion of an extreme multivariate outlier the effect was not significant in both the per protocol and intention to treat analyses. [b]The interaction Time × Change in Distraction and Problem Solving was not significant in the full sample, however with the exclusion of an extreme multivariate outlier the effect is significant. ***p < 0.001.*

SE = 0.19, 95% CI [0.31, 1.05]). Second, participants who showed a larger decrease in rumination also showed a larger decrease in depressive symptoms (t0-t4: β = 0.38, SE = 0.10, 95% CI [0.19, 0.58]). In the opposite direction, participants who showed a larger increase in hope and optimism, showed a larger decrease in depressive symptoms (t0-t4: β = −7.96, SE = 1.27, 95% CI [−10.48, −5.45]). Similarly, an increase in distraction and problem solving was related to a larger decrease in depressive symptoms (t0-t4: β = −0.45, SE = 0.18, 95% CI [−0.80, −0.10]). Importantly, none of these action mechanisms moderated the interaction of Time × Condition on depressive symptoms. This indicates that the associations between changes in action mechanisms and changes in depressive symptoms were not specific to any condition.

Moderation of Game Engagement

Finally, we tested if the experience participants had playing Journey or Flower impacted their change in depressive symptoms or moderated the effect of condition on change in depressive symptoms (see **Table 5**). These analyses again confirmed the decrease in depressive symptoms over time and the age related differences in trajectories. The only discrepancy was that when competence was added as a moderator we saw the decrease in depressive symptoms for 17-year olds later in the study was no longer significant at α = 0.01 (t2-t3 p = 0.02). The same effect was seen for motivation (t1-t4 p = 0.02) and autonomy (t1-t4 p = 0.01) in the per protocol analyses. Importantly, none of the engagement variables moderated the effect of time or Time × Condition.

DISCUSSION

This study showed no beneficial effects of playing the commercial video game, Journey, on progression of depressive symptoms of adolescents and young adults with elevated depressive symptoms above and beyond an active and passive control. Nevertheless, youth in all conditions decreased in depressive symptoms, became less sensitive to rejection, and experienced more hope and optimism over the study period. Participants who, over time, experienced less rumination, less rejection sensitivity, more distraction and problem solving, and particularly more hope and optimism showed the strongest decrease in depressive symptoms.
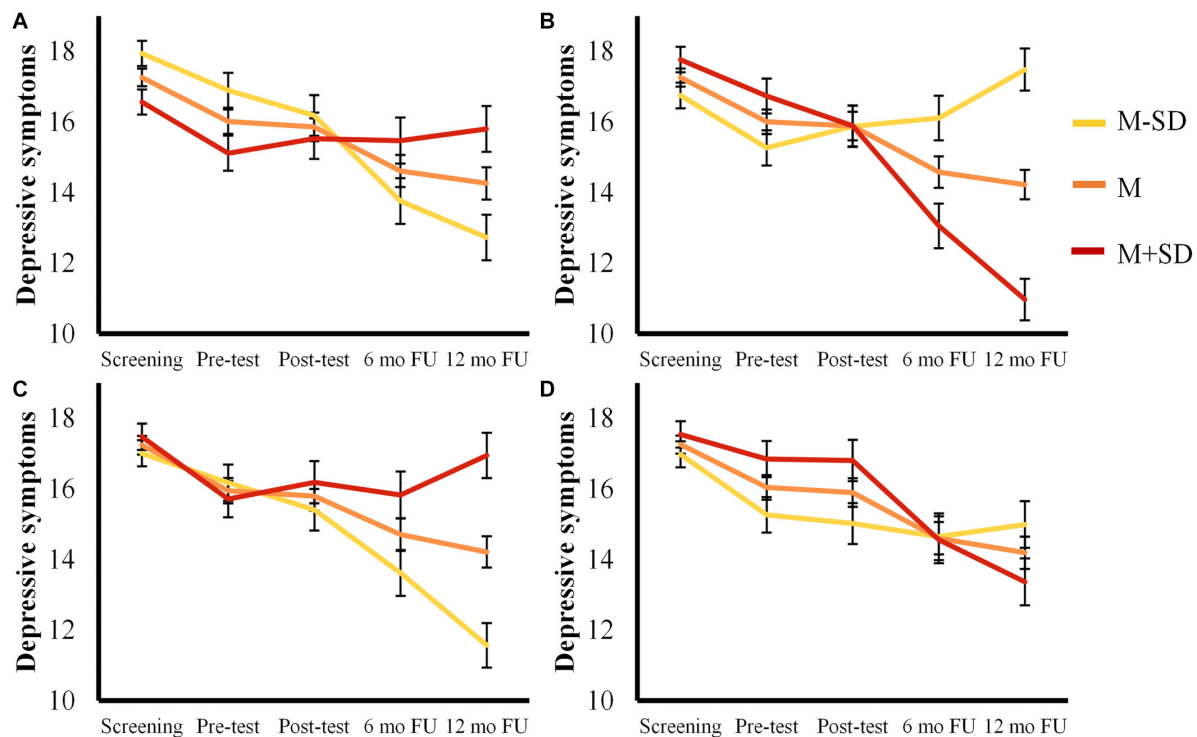
FIGURE 5 | Estimated mean trajectories for depressive symptoms moderated by **(A)** Rejection Sensitivity, **(B)** Hope and Optimism, **(C)** Rumination and, **(D)** Distraction and Problem solving. Error bars represent standard errors.

Thus, while no action mechanisms could be identified for Journey specifically, we confirmed that hope and optimism, rumination, rejection sensitivity, and distraction and problem solving are promising targets for future depression prevention efforts.

Journey Effects

Contrary to our hypothesis youth assigned to play Journey in the present study did not improve more or faster in their depressive symptoms compared to youth in the other two conditions. Thus, anecdotal evidence of Journey players reporting mental health benefits did not translate to benefits for a larger sample of youth with elevated depressive symptoms. This may suggest that the anecdotal evidence was based on people misattributing their mental health improvement to Journey. Alternatively, it may be that only a very small number of individuals are capable of benefiting from Journey as it is and the game mechanics would need to be strengthened considerably before the game could be used as a viable intervention.

However, elements of this trial may have also limited the potential for Journey to be effective. Specifically, selecting an appealing game can encourage the experience of autonomy, which when experienced more during therapy has been related to better treatment outcomes (Zuroff et al., 2012). The random assignment used within this trial may thus have reduced potential benefits. Therefore, research designs that allow for autonomous game selection are needed. Specifically, researchers may preselect youth interested in playing a specific game and use a reversal baseline design with (somewhat) reversible proximal outcomes

during iterative game design (Kazdin, 2016), a matched control group design for distal outcomes (Nguyen et al., 2007) or a qualitative design to gain insight into youth's experiences with specific games or game mechanics (Ribbens and Poels, 2009).

Moreover, the relatively short intervention period may have also limited the chance of Journey to be effective. We aimed to provide a naturalistic gameplay experience — allowing participants to play in their homes at a time of their choosing — however, the 4 week intervention period was based on logistics and participant burden rather than prior knowledge of how often youth would play Journey or how much time was needed for Journey to be effective. While most participants reported completing the game, few participants played through the game more than once. Thus, we cannot exclude that Journey would have been effective at a higher dose. However, had we made participants play through Journey or Flower several times, the results would likely not have been relevant to how youth interact with these games outside of a research context. Still in hindsight, more information regarding the way Journey is played outside of a research context could have helped in determining an optimal intervention period.

Additionally, Journey did not have a more beneficial effect on any of our proposed action mechanisms than our active and passive control conditions. Given that Journey was not designed to promote the hypothesized action mechanisms, a single playthrough may not have provided enough practice with these mechanisms to change existing thought and behavior patterns. For example, we hypothesized that repeated exposure to

ambiguous losses that could be interpreted as rejections followed by reconnection to another co-player would reduce rejection sensitivity. However, as a single playthrough may at most contain three or four interactions with a co-player that are long enough to form a bond, this is understandably not enough for youth to change an ingrained sensitivity to rejection. Had Journey been more accessible to a younger target audience with more malleable action mechanisms (e.g., by using a less abstract narrative), the limited dose of the action mechanisms may have resulted in stronger effects.

Furthermore, this study's results may be an indication that for games to impact action mechanisms the mechanics in these games need to be specifically designed. Particular attention in the design process should be given to: (a) allowing for repeated practice, (b) allowing for reflection, and (c) not giving opposing messages. Given the example of rejection sensitivity, the mechanic of interrupted social interactions is still promising, yet may need to be built in such a way that the player is guaranteed multiple rejection experiences. Additionally, the mechanic may be strengthened by providing room to reflect on ambiguous rejection experiences being less personal and/or less catastrophic.

Reflection, cognitive elaboration, and meaning making may be particularly important when targeting overarching cognitive interpretations such as rejection sensitivity, hope, and narrative identity. Narrative, meaningful choices, and social connections in video games have been shown to be vital to meaningful video games (Rogers et al., 2017), yet may have very little effect if the player rushes past these experiences. Similarly, meaningful experiences in everyday life can become an intricate part of one's narrative identity or be forgotten and have no effect. Further processing of experiences through reflection and discussion with important others is vital for the experiences' impact (McLean et al., 2007). Therefore, stimulating reflection and providing room for reflection during or after the gameplay experience may enhance the effectiveness of game mechanics.

Furthermore, opposing messages may make knowledge, insight, and skills harder to learn. For example, while the opportunity to find agency in challenging circumstances is a theme in Journey, this message may be overshadowed by the superficial uncontrollability and helplessness of players toward the environment and monsters. Thus, in the design process messages need to be carefully considered. Finally, for certain mechanisms or target groups, the connection to daily life may have to be made more explicit. Although repeated exposure and in-game reflection may be enough for some to connect a redemptive arc to their own experiences, others will need more assistance in understanding the redemptive meaning of the story line and to talk about experiences from their own life that may fit that same structure.

Trajectories of Depressive Symptoms and Action Mechanisms

Although Journey had no influence on depressive symptoms, overall, participating youth did show a significant decrease in depressive symptoms. Rather than decreasing symptoms, prevention is intended to avoid expected symptom increases and the onset of depressive disorders over time (Gillham et al., 2000). Thus, we may have failed to include participants most at risk to develop a depressive disorder, despite selecting on both elevated depressive symptoms and presence of core symptoms of depression. However, the observed decrease in symptoms may not have occurred outside of a research context and be related to study participation. Multiple studies have demonstrated that depressive symptoms decrease with repeated assessment, which may be due to measurement artifacts or possible therapeutic value of researcher attention, enhanced self-awareness or triggering of coping (Sharpe and Gilbert, 1998; Arrindell, 2001). Alternatively, the self-limiting nature of depressive symptoms may have resulted in an overall decrease in symptoms across the 14-month study. Indeed, a recent representative study of the Dutch adult population indicated that 79.0% of subclinically depressed and 73.6% of clinically depressed individuals recovered within 1 year (ten Have et al., 2017).

Depressive symptom trajectories in the current study may also be indicative of developmental patterns as significant decreases in symptoms occurred earlier for younger participants than for older participants. This suggests that younger participants' elevated depressive symptoms are less stable and may decrease relatively quickly with minimal intervention. In contrast, young adults seem to have more persevering symptoms which is alarming as depressive symptoms in and of themselves are damaging (Wesselhoeft et al., 2013). And while symptoms had decreased by the end of the study, more intense interventions may be needed for young adults. Maintaining mechanisms of depressive symptoms, such as rejection sensitivity, may have become more ingrained making quick symptom decreases less likely. Indeed, previous research has indicated that decreases in depressive symptoms are common in late adolescents, while depressive symptoms are more stable in young adulthood (Yaroslavsky et al., 2013). Future research is needed to explore if prevention programs need to contain different elements for older youth or youth with consistently elevated depressive symptoms.

Similar to the improvement in depressive symptoms, participants across conditions had more positive expectations for their future and were less rejection sensitive at the end of the study. Again, repeated assessment may be a factor in these positive developments, as Arrindell (2001) shows that this effect is found in a range of well-being measures. Alternatively, participants may have truly become more hopeful and optimistic and less rejection sensitive due to general aspects of participating in research mentioned above. Additionally, hope and optimism may have increased as participants expected positive outcomes from the study.

Action Mechanism Effects on Symptom Improvement

Although we could not examine the mediation of the action mechanisms, four of the action mechanisms moderated improvements in depressive symptoms. As Journey did not successfully change the action mechanisms, the direction of these effects could not be established in the current study. Further research using interventions that successfully improve hope and

optimism, decrease rumination, decrease rejection sensitivity, and/or improve distraction and problem solving is needed to confirm that depressive symptom prevention is mediated by these action mechanisms. However, it is still promising that four of the action mechanisms influenced change in depressive symptoms. Most prominently, increases in hope and optimism were strongly related to decreasing depressive symptoms. Since underdog narratives have been shown to increase hope short-term (Prestin, 2013), future studies should explore this and other game mechanics likely to promote hope and optimism and examine long-term effects.

Additionally, using more adaptive coping — less rumination and more distraction and problem solving — was associated with less depressive symptoms in the current study. Consistent with earlier research rumination was more strongly related to depressive symptoms than distraction and problem solving (Aldao et al., 2010; Hilt et al., 2010). However, a recent review indicated that the choice of coping strategy is more problematic than the ability to perform adaptive coping strategies (Liu and Thompson, 2017). Therefore, applied games may be more effective if they can steer youth away from ruminative responses and toward more adaptive coping strategies (Liu and Thompson, 2017).

Furthermore, similar to previous research, this study showed that a decrease in rejection sensitivity was related to a decrease in depressive symptoms (Marston et al., 2010). These findings are in line with the social risk hypothesis of depression which posits that subclinical depressive symptoms are an adaptive response to the threat of social exclusion, directing attention to social cues and heightening sensitivity to rejection (Allen and Badcock, 2003). If more support is found for the social risk hypothesis, rejection sensitivity and the experience of social threat can be major targets for applied depression games given the social nature of video games (Entertainment Software Association, 2019) and their strong capacity to evoke rejection experiences (Tuijnman et al., 2017).

Strengths, Limitations, and Future Directions

Despite not showing additional benefits from Journey on depressive symptom, this study has a number of valuable strengths and can serve as a source of important lessons for future studies. In terms of strengths the well powered randomized controlled trial design — the gold standard in prevention research — with an active and passive control condition allows us to draw clear conclusions from this study. Additionally, the way interventions were provided approximated naturalistic gameplay, making the outcomes relevant to the reality of commercial video game use. In future studies using a similar three-condition design can help distinguish specific and non-specific effects in effective prevention games. Another strength of this study is the use of an existing resource, a commercial video game, to study the depression prevention potential of less commonly investigated action mechanisms. Although the current study did not show beneficial effects of Journey, we could have had similar results at far greater costs with a newly developed traditional intervention or applied game.

Yet this study also has several limitations. First, approximately half of the screened youth meeting inclusion criteria decided not to participate. Participating youth liked video games more and were more highly educated, which indicates self-selection. Although youth who find games less appealing may not be the main target audience of video game interventions, Journey could have impacted these youth more as they have less previous exposure to games. Thus, our recruitment strategies may have skewed the results. Recruitment problems also resulted in a wider age range, including participants older than the intended age range of the CDI questionnaire used to assess depressive symptoms (Kovacs, 2001). Adjusting the wording of four items (see method section) appeared to result in an age appropriate measure with good reliability, yet a measure developed for the entire age range would be preferable.

A further limitation is that our shortened and written adaptation of the life story interview to assess narrative identity (McAdams, 2008) had limited reliability and considerable missing data. Despite our intent to reduce participant burden, some participants skipped the items and the data was less detailed and rich impeding reliable coding. This makes any conclusions regarding narrative identity less reliable. The current study only showed a significant negative correlation between depressive symptoms and redemptive sequences at pre-test. Yet, previous research suggests that redemptive sequences and agency are related to lower depressive symptoms over time using assessments with better reliability (McAdams et al., 2001; Adler et al., 2015).

CONCLUSION

In conclusion, the pursuit of alternative methods and action mechanisms for the prevention of depression remains valuable despite the lack of effectiveness of the commercial game in this study. Future research aimed at developing and/or testing mental health games are advised to use research designs better suited to initial exploration of action mechanisms and associated game mechanics. Ultimately, the promise of mental health video games — effective prevention tools that youth seek out and stay engaged in —can only be realized when engagement and strength of action mechanisms are both optimized.

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The data is available at the DANS EASY online data repository as 'Poppelaars et al. (2020) at https://doi.org/10.17026/dans-zhq-2qmc'.

ETHICS STATEMENT

The study involving human participants was reviewed and approved by Ethical Committee of the Faculty of Social Sciences at Radboud University. Written informed consent to participate in this study was provided by the participant and when applicable by the participant and the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

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SUPPLEMENTARY MATERIAL

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Can Worried Parents Predict Effects of Video Games on Their Children? A Case-Control Study of Cognitive Abilities, Addiction Indicators and Wellbeing

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Many parents worry over their children's gaming habits, but to what extent do such worries match any detrimental effects of excessive gaming? We attempted to answer this question by comparing children of highly concerned parents with other adolescents of the same age. A cohort of parents who identified as highly concerned over their children's video game habits were recruited for a public study in collaboration with a national television network. Using an online experimental platform in conjunction with surveys of parents' beliefs and attitudes, we compared their children to age-matched peers in an exploratory case-control study. The scores of children with highly concerned parents on tests of cognitive control (cued task-switching and Iowa Gambling Task) and psychological wellbeing (WHO-5) were statistically similar to controls, suggesting no selective cognitive or psychological detriments from gaming or otherwise in the cases with concerned parents. The case group, however, did spend more time gaming, and scored higher than controls on problem gaming indicators (Gaming Addiction Scale), which also correlated negatively with wellbeing. Within the case group, wellbeing effects seemed mainly to consist in issues of relaxation and sleep, and related to gaming addiction indicators of playing to forget real-world problems, and the feeling of neglecting non-gaming activities. Where most results of research staged for TV never get published, making it difficult to interpret both methods and results, this paper describes findings and participant recruitment in detail. The relationship between parental concern and children's gaming is discussed, as is the merits and challenges of research conducted with media, such as TV programs and their recruited on-screen participants.

Keywords: parenting, video games [psychology], video games addiction, cognitive abilities, wellbeing, screen time, executive control

INTRODUCTION

Many parents worry about the time their children spend on video games, and debates concerning the impact of video games on, e.g., mental wellbeing, behavior, and cognitive functioning have become stables in societal conversations. Parents want their children to have good lives—and regulating early adolescent behavior can be challenging. This creates dilemmas for parents to heavy gamers. While worry has been found to correlate with restrictive practices and negatively with supportive behaviors (Lieberoth and Lundsgaard, 2020), autonomy supporting parenting approaches seem to enhance acceptance of rules and reduce media use among teens (Padilla-Walker et al., 2019; Weinstein and Przybylski, 2019). Yet parents struggle to judge appropriate levels of "screen time," and popular concern augmented through media is a driver of policy preference and even research priorities in mental health and substance abuse domains (Hallam, 2002; Slater et al., 2009). Since the stakes of scientific evidence in this arena are so high, and the implications far reaching, close scrutiny of the data and interpretations is therefore crucial (Choudhury and Mckinney, 2013, p. 200). As such, a focus on the practices and beliefs of parent should be a focus for scientists and councilors alongside the potential psychological, developmental, or social effects of emerging digital media uses. This study therefore set out to investigate whether children of highly concerned parents actually displayed signs of problems related to video games including wellbeing, cognitive detriments, and the various symptoms of clinical addiction used in common diagnostic questionnaires compared with other adolescents in the same age group.

In early summer of 2018, we were approached by a television journalist, who based on a BBC program where the brains of young gamers were examined using electroencephalography (EEG), wanted to know if we could do a similar study for Danish TV2 in our lab. On further inspection, we were unable to find research supporting the technique used by the private contractor appearing on The Victoria Derbyshire program (BBC, 2018) to demonstrate that a small on-screen sample of children's brains suffered detriments from their heavy video game play. We were skeptical of the fact that no cognitive testing had been conducted in conjunction with the electroencephalographical measures for criterion validity, that the sample was too small to render statistically meaningful findings, and that the contractor used no control group to validate the notion that any of their observations should be related specifically to the gaming habits of the young subjects. In the resulting discussion with TV2, we pointed to the tendency to, with notable exceptions (e.g., Owen et al., 2010), use few people as human interest cases in television programming, taking correlation for causality, and the need for larger samples to accurately assess statistical effects of games on the players in question. We were also hesitant about using neuroimaging to illustrate differences between children who game a lot and those who do not. Instead, we converged on a series of cognitive tests combined with a commonly used gaming addiction self-report scale. The producer was positive that she would be able to do better than the BBC piece and recruit a large number of concerned parents for our re-imagined

study. Since TV pieces often revolve around concerned parents and their children, we agreed that it would be interesting to base our hypotheses on parental concern. We thus decided to ask: Are parental concerns a good predictor of negative effects of gaming? Do worried parents' children differ from other kids their age in executive functioning, downregulation of appealing but ultimately detrimental choices, or general wellbeing? Issues that commonly appear in the public debate (Størup and Lieberoth, 2020), and worry some parents quite a bit (Lieberoth and Lundsgaard, 2020).

This comparative study first and foremost investigates whether *parents' concern* about their children's (age 12–17) video game play is an accurate predictor of issues related to healthy cognitive and psychological functioning.

As a second objective, the study looks for *crossectional predictors* of issues related to healthy cognitive and psychological functioning, within data from the *children* alone.

Finally, the study is a *broad exploration* of parental concerns, looking for *predictors of worry*, as well as describing the items of two measures commonly used to map children's experiences of gaming problems and wellbeing [Game Addiction Scale (GAS) and WHO5].

Understanding Parental Concern

New technologies always come with challenges that cannot easily be solved using existing frames of interpretation and intervention (Zuboff, 2019). While concerns over screen time in general and video games in particular sometimes address media quality (Soper and Miller, 1983) or objectionable content (Kuipers, 2006), concern discourses prominently feature mental and physical health and cognitive development (Størup and Lieberoth, 2020), variously understood as direct effect of exposure to media technologies or as displacement of more worthwhile pursuits (Choudhury and Mckinney, 2013; Przybylski and Weinstein, 2017; Lieberoth and Lundsgaard, 2020). While some studies find that effects of game time are small or at least very complex (Yang et al., 2013; Przybylski and Weinstein, 2017; Ferguson and Wang, 2019; Jensen et al., 2019), others have identified quadratic relationships between game time and mental wellbeing, suggesting that any dramatic impact should be found at the very high end of daily/weekly media use (Przybylski et al., 2019). As such, there may be an important distinction between general populations with moderate use patterns and more extreme cases. Indeed, cases of physiological conditions and discomforts have been reported in high- but rarely low-involvement eSports-players (Zwibel et al., 2019), and negative relationships with prosocial behavior have been found not for gaming in general, but for people involved in high-frequency competitive gaming (Lobel et al., 2017). Such emerging patterns suggest that if contemporary youth gaming cultures have detrimental effects beyond generational conflicts and time diverted from other activities, they might be found at the very high end of gaming behavior, rather than in the broad middle of social and casual play.

In this climate, then, it can be difficult for parents to avid gamers to judge whether their children's play behavior warrants concern, and to which extent the time spent has a

detrimental impact on cognitive development and psychological wellbeing. As such, this study focused on children of parents who subjectively believed that their children were at the problematic end of the gaming spectrum and were motivated enough by their distresses to enroll themselves and their adolescent in a study about problematic gaming.

Cognitive Effects

Parental worry about games often concerns children's cognitive functioning, popularly phrased as effects "on the brain" (Størup and Lieberoth, 2020). The causal pathways by which frequency of gaming has been proposed to act as a factor in individuals' health status is extremely broad, "from the amount of time spent on these activities, from the neglect of other activities and priorities, from risky behaviors associated with gaming or its context, from the adverse consequences of gaming, or from the combination" (The World Health Organization, 2018b). To match this, an expanding body of research has found variations of fluid, often play- and game-dependent (Dale et al., 2019) associations between heavy gaming and cognitive processes ranging from perception to cognitive control, reward processing, and decision making (Bailey et al., 2010, 2011). Relationships between gaming and cognitive function have been tested using traditional measures of cognitive flexibility and control such as task-switching, Stroop, and N-back tasks (Colzato et al., 2013; Dong et al., 2014; Cardoso-Leite et al., 2016), which measure participants' ability to cope with multiple task demands requiring prolonged concentration and attentiveness to specific instructions (Logan and Gordon, 2001). Studies focused on frequent versus non-frequent players have found gamers, or subjects trained using games, to perform better on cognitive tasks, especially related to visual attention and response execution (Anguera et al., 2013; Greitemeyer, 2019), but sometimes poorer in terms of response inhibition (Colzato et al., 2013; Steenbergen et al., 2015).

Directionality has also been discussed. Addictive behaviors have been linked to impaired regulatory control in favor of rewarding behaviors in, e.g., cannabis dependence, and some studies have identified neural correlates that may underlie such dysregulation (Ma et al., 2010; Zhou et al., 2018). Based on such research, some neurobiological studies have also worked to identify issues with the structural connectivity underlying cognitive control in Internet or gaming addiction (Ma et al., 2010; Dong et al., 2014; Wang et al., 2018). In studies focusing on individuals labeled addicts, findings tend to point to impaired cognitive control (Ma et al., 2010; Dong et al., 2014; Wang et al., 2018), suggesting that certain individuals may be more at risk of developing uncontrollable gaming behaviors. This matches a recent longitudinal study of child development which, despite concluding no relationship between gaming in late childhood and later DSM symptoms, found that children with ADHD symptoms were more likely to increase rather than decrease their gaming with age (Stenseng et al., 2019).

Yet other studies have looked for more proximate effects, finding that exposure to games perceived as difficult reduced cognitive control following play (Engelhardt et al., 2015) and that relations between play behavior and adolescent adjustment is quite complex (Verheijen et al., 2019). This emerging literature suggests that when discussing cognitive outcomes, individual differences, short- versus long-term effects, and gaming uses and gratifications in response to life situations are worth considering when interpreting parents' worries about children's gaming, including when they observe behaviors like aggression toward other players (McInroy and Mishna, 2017) or stress and short temperedness (Bavelier et al., 2011; Ferguson et al., 2016).

Wellbeing

Numerous studies have examined the relationship between media use and wellbeing, variously framed in terms of happiness, general welfare, psychological distress, and psychiatric symptoms. While online video games sometimes have positive outcomes in terms of learning and social connectedness (Hanghøj et al., 2018) or on wellbeing (Pallavicini et al., 2018), the research literature also suggests correlations to depressive symptoms, suicidal ideations, alienation, eating disorders, and academic difficulties (for a review, see Strasburger et al., 2010). For games, the association with mental wellbeing seems especially prevalent for very frequent, or very infrequent, participants in the youth gaming culture (Przybylski and Weinstein, 2017). Indeed, associations between gaming and wellbeing have been found to be related to perceived social support (Sarriera et al., 2012; Kaczmarek and Drążkowski, 2014), need frustration on- and offline (Allen and Anderson, 2018), neighborhood circumstances (Kim and Ahn, 2016), and escapism motives (Kaczmarek and Drążkowski, 2014). Social alienation has been found related to the gratifications reported for violent games (Slater, 2003), but social support through player communities has also been found to be a psychological resource for gamers (Kaczmarek and Drążkowski, 2014). This complexity matches overall findings that statistical relationships between digital media use and psychosocial wellbeing are statistically small, non-monotonic and shifting over time (Yang et al., 2013; Przybylski and Weinstein, 2017; Ferguson and Wang, 2019; Jensen et al., 2019), and subject to complex mediation relationships (Rasmussen et al., 2020). Indeed, factors like cyberbullying, sleep, and physical exercise have been found to attenuate negative relationships between digital media use and wellbeing, suggesting indirect causal pathways (Viner et al., 2019). As with dysfunctional behavior in other domains, indicators of gaming addiction are also related to life satisfaction, loneliness, anxiety, depression, and academic performance (Sarda et al., 2016) raising questions of directionality in excessive gaming. That recent longitudinal research found small or no effects over time (Jensen et al., 2019; Coyne et al., 2020) and also suggests that momentary dysfunctional relationships between wellbeing and media use can be a passing state in young people's development. As such, it seems crucial to understand the relationship between media practices and various indicators of wellbeing in the context of their broader psychological and social circumstances—online, in school, and at home.

Addiction

Early research using the term "addiction" in the context of video games considered implications for families (Ishigaki, 1986) and

how student councilors should address this "junk time" issue (Soper and Miller, 1983). While referring to excessive gaming as an addiction is not new, the debate over the legitimacy of a potential diagnosis has, however, recently intensified. The American Psychiatric Association (APA) has declined to recognize gaming addiction as a distinct diagnosis (2013), whereas WHO is planning to add both "gaming disorder" and "hazardous gaming" to the next revision of the International Classification of Disease (The World Health Organization, 2018a,b). Commentators have criticized the ICD addition on grounds of weak empirical and theoretical support, stressing that games are among many behaviors and technologies that engage people for prolonged periods of time (Dullur and Starcevic, 2017; Van Rooij et al., 2018), while others have encouraged the step to formalize a diagnosis in an effort to help those who are experiencing problems (Király and Demetrovics, 2017; van den Brink, 2017). In this debate, delineation (Billieux et al., 2017; Saunders et al., 2017) and differentiation from non-pathological behaviors (Kardefelt-Winther et al., 2017; Reed et al., 2019) has therefore become a central issue, to mitigate the risk of parents or health professionals overinterpreting individual cases of recreational gaming as psychological or behavioral pathology.

Leading into this debate, a myriad of surveys and screening tools for video gaming addiction have been developed (King et al., 2013; Kuss, 2013), all employing varying conceptualizations of the supposed condition, one notably being behavioral addiction (Kuss and Griffiths, 2012). In this framework, any behavior perceived as rewarding by the individual may escalate to the point of pathology (Griffiths, 2005), and sufferers may experience symptoms much resembling addiction to psychoactive substances, such as withdrawal and relapse when prompted to cease the perceived problematic behavior. In the case of gaming, an addicted individual would thus be heavily preoccupied with gaming, experience intrapersonal and interpersonal conflicts due to engagement in the activity, and be unable to quit gaming altogether. One example of such instruments is the short-form GAS for adolescents (Lemmens et al., 2009), which has been used in numerous research studies probing the effects of games on young people (Collins and Freeman, 2013; Irvine et al., 2013; Scharkow et al., 2014; Andreassen et al., 2016). While GAS scores have been found to be low in broad gamer populations (as per Scharkow et al., 2014), changes in GAS scores over time have been found related to cognitive tests like the Iowa Gambling Task (Irvine et al., 2013) and to small changes in wellbeing (Scharkow et al., 2014).

THE PRESENT STUDY

The present study analyzes data collected in collaboration with the TV2 Denmark news network for a documentary program on worried parents, and the effects of video games on adolescents. Data was collected from dyads of parents and children and intended to compare children and parents from three typical school classes to children of parents who volunteered themselves and their child for the study because they were worried about the effect of video games on their children. Based on the broad public discourse (Haddon and Stald, 2009; Størup and Lieberoth, 2020) and the research literature outlined above, we decided to test general health and wellbeing (WHO5), cognitive control (cued task switching), resistance to detrimental choices during decision making (Iowa gambling task), problematic gaming behavior (GAS), and the child's game time per week (self-reported).

Hypotheses and Exploratory Analyses

H1: If parental worry is warranted in children assigned to the "concern" group, we hypothesized that there should be a significantly different level (*lower cognitive tests and WHO5, higher GAS*) of those scores (see pre-registration).

H2: If time displacement is a central issue, we hypothesized that game time should be treated as a mediator for the other variables investigated in the study.

H3: Finally, it may be that parents are inadequately prepared to judge the relationship between gaming and other issues. As such, if there is a simple direct relationship between time spent playing and various issues, or a more complex relationship mediated by problematic gaming behavior, then children's weekly game time may be a better predictor than parents' level of concern.

Furthermore, correlational analyses will explore the scores on, and relationships between, other variables in the dataset. Using both Likert scales and written answers to open-ended questions, we explore what outcomes of gaming parents are most concerned about.

Given the high number of tests, all *p*-values are adjusted with false-discovery rate (FDR) correction where multiple comparisons occur in hypothesis testing.

MATERIALS AND METHODS

Participants

Ninety-eight parents responded to media and online calls for "concerned parents." Out of these, 67 case dyads completed the study along with 53 comparison dyads recruited through a local school. Children's ages ranged from 12 to 17 ($M = 13.09$, $SD = 1.16$).

Recruitment and Procedure

The study was approved by lab and regional IRBs prior to data collection.

Parent–child dyads were recruited together. The TV station ran TV spots and online invitations, supplemented with Twitter adds, in order to recruit a case group of parents who were highly concerned about the gaming habits of their child of 12–17. While three families were separately recruited to appear on-screen, the larger body only contributed their data and was aware that they would not appear on-screen. The participants received no monetary compensation but were offered a brief description of preliminary results comparing the case group with controls (i.e., no data for individual children). Three school classes and their parents were also recruited to participate in the study in conjunction with a lab visit at our university. School parents and

children were blinded to the fact that they would primarily act as the control group but were given the general outline of the research questions.

Parents first filled in a separate questionnaire designed to map their concerns and rules and provide informed consent for their child's participation. Their overall concern level was of our primary interest. Parents were encouraged to reach agreement on participation with their child before starting, and call him/her to the computer straight after they finished, in order to ensure completion. Parents and children were instructed not to look at each other's answers or in other ways interfere. In order to connect children's scores to parental concern and confirm parental approval, children entered an arbitrary code linking their response to that of their parent's level of concern, supplied at the end of the parent's questionnaire. The test session for children took on average 24 min, in which participants completed computerized versions of Cued Task Switching and Iowa Gambling tasks, inside a survey which include standardized versions of GAS and WHO5 as well as questions about media use and a set of more exploratory questions about participants' own thinking about their media use and time spent gaming.

Depending on recruitment and convenience, some children filled in their test at a university lab, others at home. All parents filled in their surveys at home.

Materials

Parent Survey

Parents were presented with written descriptions of procedure and eligibility before accessing a survey in the Qualtrics platform. The children's portion of the study was conducted with the Linux-based PsyToolKit web platform (Stoet, 2010, 2016) to allow for a combination of survey questions and cognitive tests. Both contained detailed participant briefings and required informed consent.

Apart from background information, survey questions were either on a 6-point agree-disagree Likert scale or exploratory open-ended text/numbers, including hours and minutes for time use data.

Following background questions, parents were asked "how much of a problem do you, as a parent, think that your child's gaming constitutes (in general)" on an 8-point expanded Likert scale including "extremely" agree/disagree options, and a "my child never games at all (as far as I know)" option.

We then asked a series of questions about common worries over video games, roughly divided into questions of time, wellbeing and cognitive effects inspired by concurrent work with popular media discourses (Størup and Lieberoth, 2020), and a series of questions about habits and rules in the home which are not analyzed here.

Children's Survey

The children's portion alternated between exploratory agree/disagree items, cognitive tests, and the GAS and WHO5 instruments.

The WHO5 instrument was used to measure wellbeing. It encapsulates aspects of everyday experience deemed crucial to everyday health and psychological functioning (Blom et al., 2012; Topp et al., 2015) with five agree-disagree statements concerning the past week.

The seven-item version of the GAS (Lemmens et al., 2009) was used to count gaming addiction symptoms. The frequency scale was adapted for six-point Likert scale responses. Each item addresses a criteria for gaming addiction. Lemmens et al. (2009) utilizes two cut-offs, in which an individual scoring either three or four (or higher) meets the relevant criteria. A cut-off of three was maintained in the revision of the scale for the current study due to its identical wording; in both the original and revised version scoring, three corresponds to "sometimes" experiencing a given symptom. Meeting four out of seven criteria would be considered addicted. GAS-7 was chosen for its focus on adolescents and that it despite its brevity has previously been found to adequately address diagnostic criteria for gaming addiction (King et al., 2013).

A cued switching task was used to measure cognitive control: in order to avoid interactions with the training of visuospatial cognitive processes from 3D action games (Bailey et al., 2011), a non-spatial and fairly boring repetitive task was chosen to allow lapses in concentration. CTS is a multitask response time procedure of the psychological refractory period variety, in which subjects make discrete responses to punctate stimuli that appear at controlled intervals (Welford, 1952; Logan and Gordon, 2001). In cued task switching, switching between a focus on the *shape* (square or circle?) and *color* (yellow or blue?) of each stimulus imposes ongoing switch costs (Meiran, 1996). Accuracy and response time for correct responses after switches from one focus to another are used as proxy measures of general cognitive control.

The Iowa Gambling Task (IGT) was used to measure resistance to attractive but detrimental choices (Bechara et al., 1994). Participants make ongoing choices from four virtual decks of cards, each revealing either gains or losses in a virtual currency. Two decks are advantageous on average, while two decks are disadvantageous but contain occasional attractive large gains. Because it is impossible to perform an exact mental calculation of net gains or losses per deck during play, broader "information sampling" is required (Irvine et al., 2013), and the subjects must therefore rely more on impulsive "gut feeling" (Damasio, 1994). Previous studies have found that subjects with impaired response inhibition and/or high sensitivity to immediate gratifications over long-term consequences, including those with high scores on problematic gambling or gaming (Bailey et al., 2013; Irvine et al., 2013; Trotzke et al., 2019) perform worse on this task than controls, because they show higher preference for the high reward but ultimately higher-punishment decks (here, decks 1 and 2).

Data Analysis

Parent–child dyads were excluded if parent surveys were aborted before receiving codes for children's survey (11 in both groups), or if children had not provided the parent code (11 in comparison group). Out of the participants who responded to the call for concerned parents and decided to participate after reading the study instructions, two also scored only 1 or 2 on their assessment that gaming was a problem and were eliminated from the dataset

(as per the amended preregistration). Finally, eight children's surveys were aborted at the first cognitive task and excluded, for a total of 67 valid parent–child responses (34 cases, 33 controls).

Non-parametric tests were used for group comparisons, as variances were unequal for a majority of the dependent variables. Data were analyzed using R/Jamovi (R Core Team, 2018; The Jamovi Project, 2019). Instead of ANCOVA analyses planned at the time of preregistration, mediation models were run using the Jamovi MedMod module. MedMod parametric bootstrapping was used when data was insufficient to calculate standard errors for mediation using the delta method.

One hundred percent of the children who volunteered for the case group were male versus only 36% in the comparison group. This difference was significant, χ^2 = 412(2, 67), p < 0.001. Mean child age was 13.29 (SD = 1.59) for the case group and 12.88 (SD = 0.33) for the comparison group. The difference was not statistically significant.

Mean time spent on games reported is displayed in **Table 1**. The concern group spent significantly more minutes gaming per week than their peers U = 181.50 (p < 0.001, d = 1.39; 95% CI, 840–1,620) (**Figure 1**), with a larger difference reported for weekends, U = 149.00 (p < 0.001, d = 1.52; 95% CI, 180–330), than on weekdays U = 193.50 (p < 0.001, d = 1.13; 95% CI, 100–210).

Mean self-rated parent concern score was 6.18 (SD = 1.22) for the case group and 4.21 (SD = 1.56) for the comparison group. The difference was large and significant U = 179.50 (p < 0.001, d = 1.41; 95% CI, 1–3) (**Figure 2**).

RESULTS

Results of non-parametric tests between group comparison testing included in the study hypotheses are displayed in **Table 2** and values in **Table 3**. Detailed mediation analyses are supplied in the **Supplementary Materials**.

Participants chose the detrimental Iowa Gambling Task decks on average of 47.42 (SD = 19.97) out of 100 picks or just below chance level with quite a bit of variance. No significant difference was found between case and control participants (**Figure 3**). Mediation analyses did not detect significant mediation by weekly game time (see Appendix).

Participants scored a mean of 39.18 (SD = 7.68) correct responses on Cued Task Switching, with mean response times of 709 ms (SD = 205.43) and 781 ms (SD = 243.90) for repeated and switched tasks, respectively. No significant difference was found between case and control participants, neither when requiring responses that fit congruently nor incongruently with the response required for the previous task (**Figure 4**). The case group, however, had significantly lower response times both for recurring tasks and after switches. Mediation analyses did not suggest that either of these differences were significantly mediated by weekly game time (see Appendix, bootstrapping was employed for the number of correct responses).

Participants scored a mean of 4.34 (SD = 0.79) on the WHO5 measure of everyday wellbeing, suggesting general thriving in the sample. No significant difference was found between case and control participants (**Figure 5**). Mediation analyses did not detect significant mediation by weekly game time (see Table xx in the Appendix, bootstrapping was employed).

Finally, participants scored a mean of 2.38 (SD = 0.83), falling between "rarely" and "sometimes," when combining the seven experiences used in the Gaming Addiction Scale. Here, the case group scored significantly higher ("sometimes") than controls ("rarely") (**Figure 6**). The case group had a significantly higher number of individuals who would be considered addicted per GAS scores, χ^2 (1,67) = 13.22 (V = 0.44, p > 0.001). Out of 34 individuals in the case group, 21 could be considered addicted (61.8%) in comparison with 6 out of 33 in the control group (18.2%) according to the most inclusive thresholds in the literature (Lemmens et al., 2011). Conversely, when using the more conservative threshold, in which individuals must respond with 4 or higher on each criteria, just 17.6% of the case group would be considered addicted, as opposed to 0% in the control group, which still constitutes a significant group difference, χ^2 (1,67) = 6.40 (V = 0.31, p < 0.05).

We explored the relationships between dependent variables from the children's survey and time spent playing. If game time is an issue, then that variable should predict our dependent variables. Weekly game time correlated with the frequency of experiences associated with the gaming addiction scale itself (r = 0.52, p < 0.001) but with neither of the cognitive measures or wellbeing (**Table 4**).

Game Addiction Scale score was negatively related to the WHO5 score (r = −0.28, p = 0.02) but neither to CTS or IGT. Likewise, a GLM-based mediation analysis with parametric bootstrapping (**Figure 7**) revealed no direct relationships between game minutes per week and CTS or IGT, individually or combined. However, entering GAS as a potential mediator revealed an indirect negative relationship between WHO5 and weekly play time mediated by GAS score (**Table 5**). This suggests that spending time gaming *per se* was not negatively related to general wellbeing in the sample, but that gaming is related to wellbeing through "sometimes" experiencing gaming addiction indicators like conflicts with parents or facing the need to game less.

Exploratory Analyses

To understand the case group of worried parents better, we explored the survey items detailing specific concerns. As seen in **Table 6**, the parents agreed with all the concerns suggested, including games stealing time, affecting wellbeing, and having a negative impact on social and cognitive abilities. Out of these, concerns over time for family and friends both correlated significantly with parents' overall level of worry, as did concerns over social and cognitive skills. This gives us a sense of the factors that fuel worry and confirmed that our choices of measures matched popular conceptions among worried parents. As seen in **Table 4**, however, parents' worry did not correlated with any of the main measures in this study except for their children's experiences of addiction related factors like high absorption or conflicts surrounding gaming and, unsurprisngly, their game

	Group	N	Mean	Median	SD	SE
Per week	Concern	34	2,031.12	1,834	940.89	161.36
	Comparison	33	769.55	240	866.11	150.77
Weekdays	Concern	34	240.88	240	121.73	20.88
	Comparison	33	97.73	30.00	131.84	22.95
Weekend days	Concern	34	413.35	360.00	202.93	34.80
	Comparison	33	140.45	45.00	150.28	26.16
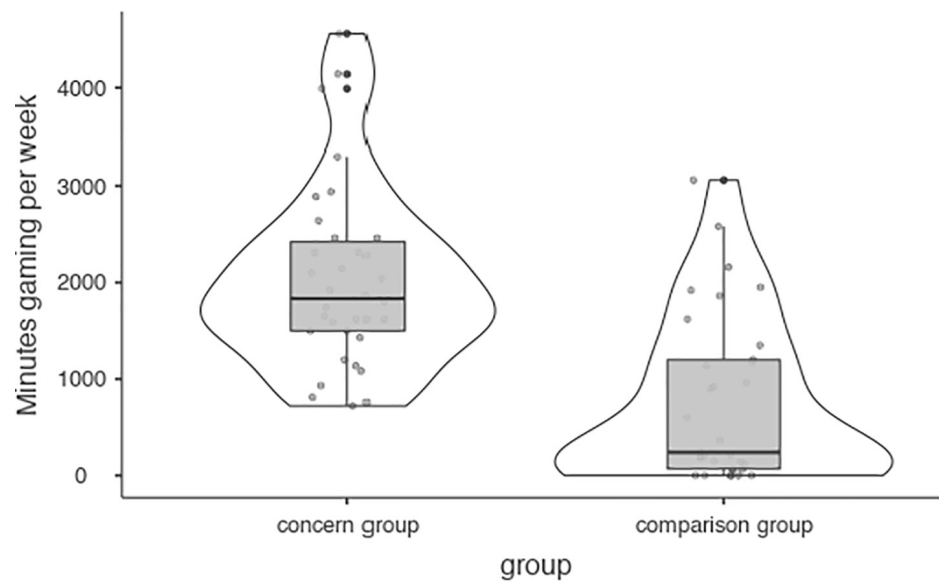
FIGURE 1 | Minutes gaming per week.
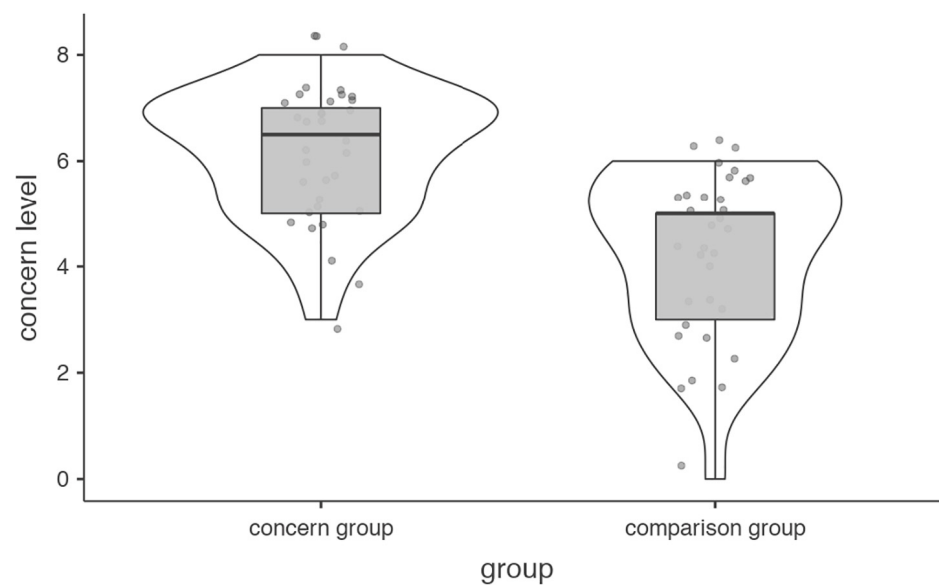
FIGURE 2 | Parents' concern level.

TABLE 2 | Group comparisons on cognitive tests, general wellbeing and frequency of addiction related experiences.

| | Mann–Whitney *U* | *p* | *q* | 95% confidence interval | | Cohen's d |
				Lower	Upper	
Iowa gambling task	**527.00**	0.67	0.76	−12.00	7.00	−0.11
Cued task switching correct	**536.00**	0.76	0.76	−2.00	3.00	0.05
Repeat response time mean	334.00	0.01	0.01	−199.02	−44.15	−0.71
Response time mean	333.00	0.01	0.01	−237.37	−61.10	−0.74
WHO5	**509.50**	0.52	0.76	−0.20	0.60	0.16
Gaming Addiction Scale (GAS)	**253.00**	<0.001	0.01	0.43	1.00	1.04

TABLE 3 | Group scores on cognitive tests, general wellbeing and frequency of addiction related experiences.

	Group	*N*	Mean	Median	*SD*	*SE*
Iowa gambling task detrimental deck picks	Concern group	34	46.35	50.50	19.86	3.41
	Comparison group	33	48.52	51.00	20.34	3.54
Cued task switching correct responses	Concern group	34	39.35	41.00	7.43	1.27
	Comparison group	33	39.00	41.00	8.05	1.40
CTS response time (repeat)	Concern group	34	640.70	634.68	179.96	30.86
	Comparison group	33	779.15	726.17	208.84	36.35
CTS response time (switch)	Concern group	34	696.89	673.37	208.94	35.83
	Comparison group	33	867.65	802.88	249.84	43.49
WHO5	Concern group	34	4.41	4.50	0.85	0.15
	Comparison group	33	4.28	4.40	0.73	0.13
Frequency of experienced Gaming Addiction Scale (GAS) indicators	Concern group	34	2.76	2.50	0.91	0.16
	Comparison group	33	1.99	2.00	0.51	0.09
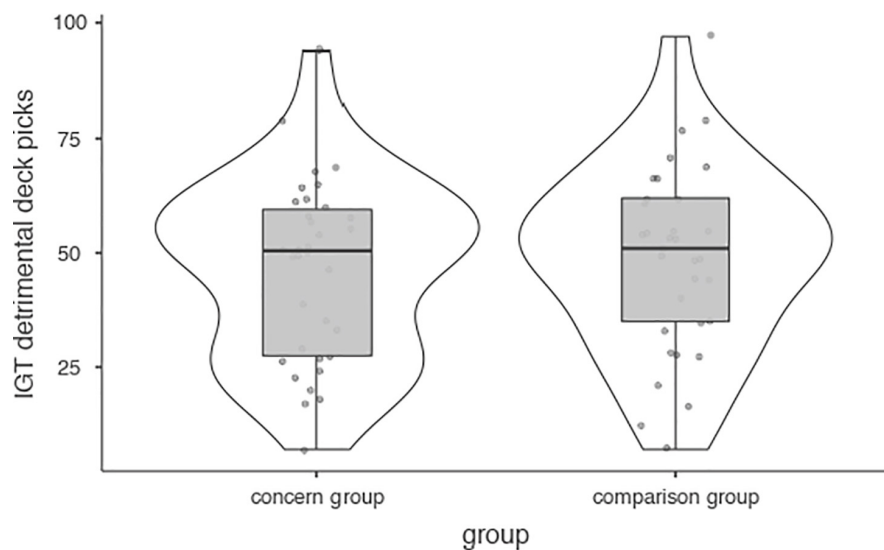
FIGURE 3 | Iowa Gambling Task detrimental deck picks.

time – especially diring the weekend, where parents are present to observe and discuss gaming habits.

To determine sources of the medium-sized negative relationship between GAS score and wellbeing observed above, we explored the relationship between parental worry and individual items constituting the WHO5 and GAS scales in the children's survey. Simple correlation analyses (**Table 7**) revealed that parents' worry correlated with GAS indicators related to their children's degree of psychological and behavioral engagement with gaming, as well as experiences of outer *conflicts with others* including *attempts by others to limit gaming* sessions. Parental worry only correlated negatively with the children's WHO5 item *of feeling relaxed*.
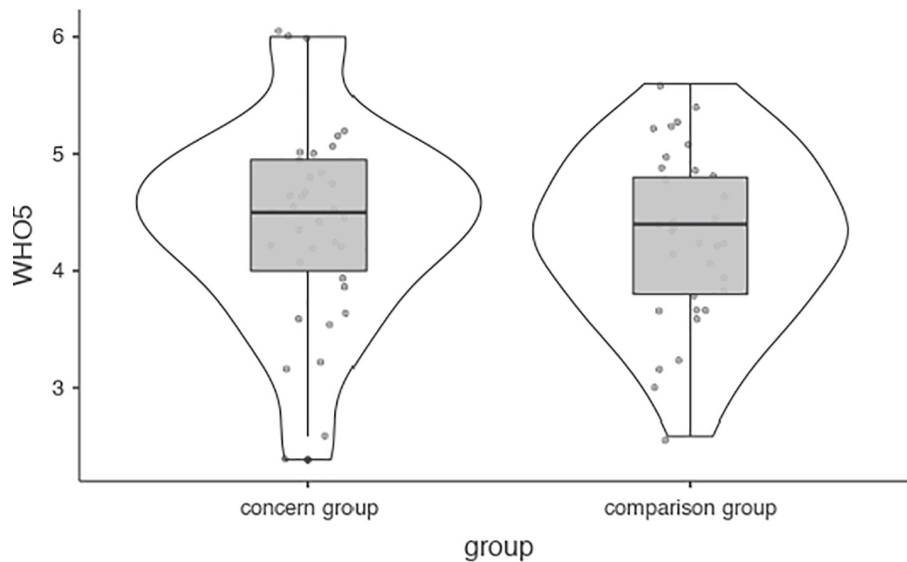
FIGURE 4 | WHO5 general wellbeing.
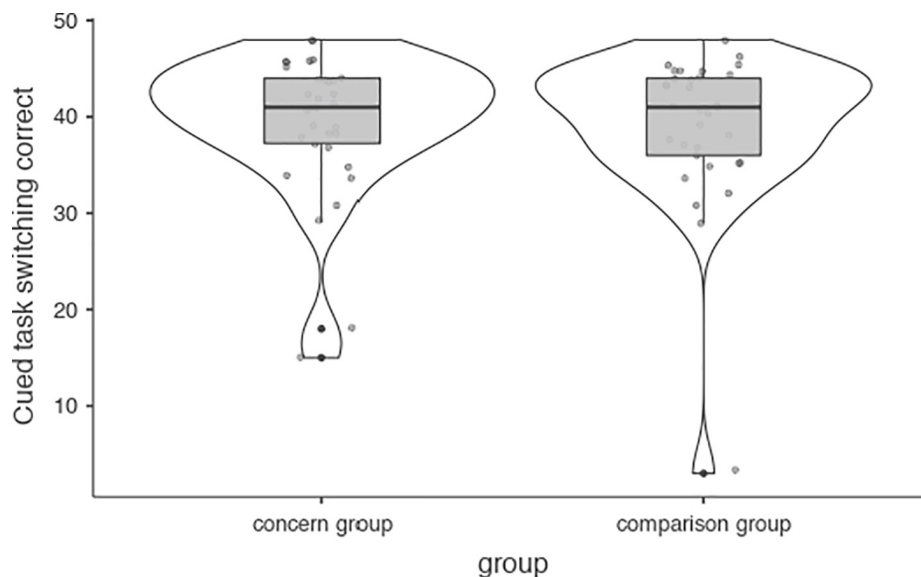
FIGURE 5 | Cued task switching task.

In the children, the relationship between GAS and WHO5 (**Table 8**) appears to largely come from WHO5 items related to *feeling rested after sleep* and *energized during the day*, suggesting that some ill-being from too much gaming could be related to lack of rest and sleep.

Conversely, WHO5 scores correlated negatively with the GAS indicators *playing to forget real-world problems* and *neglecting non-gaming activities*. This supports the idea that excessive gaming can displace activities in other arenas and can sometimes be interpreted as a psychologically attractive avoidance behavior, which might obscure other sources of distress.

DISCUSSION

We set out to compare children of especially worried parents to similar young adults, in order to test if this group suffered from detriments to wellbeing, cognitive control, and indicators theoretically related to addiction. Apart from more frequently experiencing problems associated with the Gaming Addiction survey, such as wanting to play more and conflicts with parents, the data revealed that the children of worried parents were just as happy and well-functioning as other adolescents in their age group.
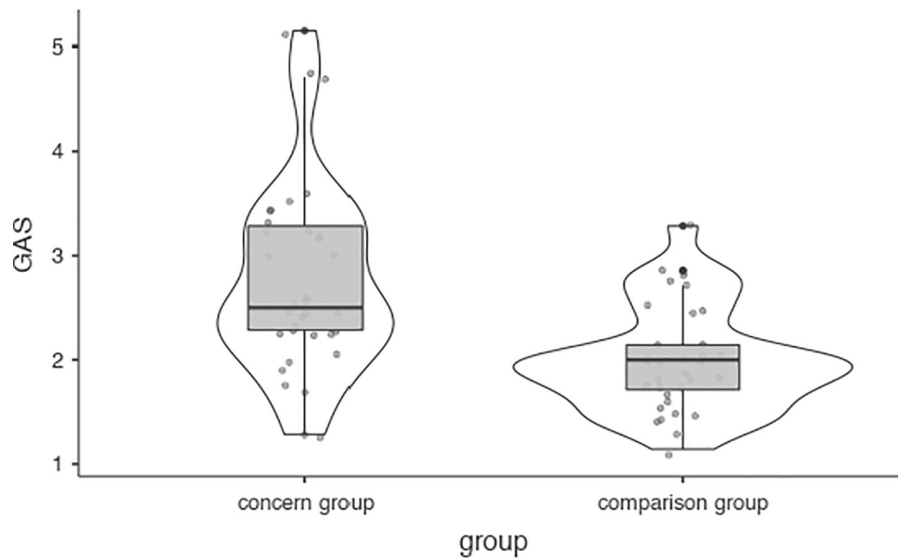
FIGURE 6 | Gaming Addiction Scale.

Overall, this suggests that many worried parents are ill equipped to judge gaming as problematic in terms of wellbeing and functional impairments.

The main difference between the groups was, unsurprisingly, that children to parents who worried about gaming played significantly more hours, and "sometimes" (as per the wording of the average response) experienced issues that the Gaming Addiction Scale takes as indicators of problems, that non-gamers rarely encounter. Instead of finding at a sample of mentally

troubled youth, we gain a sense of the kind of otherwise average children, who may get labeled as problem gamers by worried parents.

Mediation analyses suggest that time spent gaming has had little discernable impact on cognitive control or everyday wellbeing. There was, however, an interaction between game time and wellbeing that related to the experience of the gaming addiction symptoms. In other words, even though the case group on average experienced the same level of wellbeing as other kids

TABLE 4 | Correlations between main variables.

	Parent concern level	Weekly game time	Minutes gaming weekdays	Minutes gaming weekend	WHO5	IGT detrimental decks	CTS correct	GAS
Concern level	–							
	–							
Weekly game time	0.35**	–						
	0.004	–						
Minutes_gaming weekdays	0.29*	0.96***	–					
	0.017	<0.001	–					
Minutes_gaming_weekend	0.39**	0.90***	0.74***	–				
	0.001	<0.001	<0.001	–				
WHO5	0.17	−0.28*	−0.31*	−0.18	–			
	0.167	0.023	0.011	0.146	–			
IGT detrimental decks	0.09	−0.05	0.00	−0.12	0.21	–		
	0.475	0.698	0.975	0.315	0.091	–		
CTS correct	0.09	0.12	0.11	0.12	−0.08	−0.09	–	
	0.470	0.323	0.363	0.343	0.509	0.469	–	
GAS	0.39**	0.52***	0.48***	0.50***	−0.31*	−0.03	−0.05	–
	0.001	<0.001	<0.001	<0.001	0.011	0.779	0.704	–
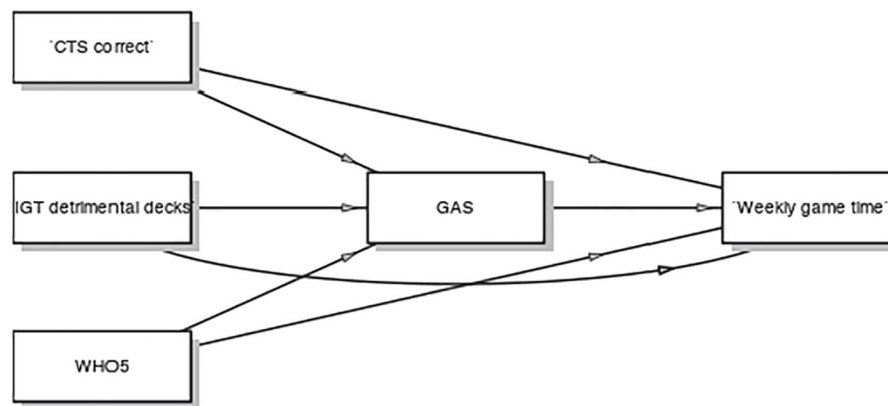
FIGURE 7 | Model diagram.

their age, those with lower wellbeing scores appeared to also experience a higher proportion of gaming addiction indicators in their day to day lives. This especially seemed to come from lack of rest and energy.

Paradoxically, parental worry correlated with the WHO5 item of feeling relaxed. The more worried the parent, the less relaxed the child reported to be in their everyday life. We are tempted to

suggest that having highly involved parents makes the life of avid gamers more stressful, but perhaps this instead hints at a conflict between the subjective relaxation children derive from digital entertainment (indeed, the on-screen participants told us, that they played especially as a way to unwind), the effects on fatigue of late-night gaming sessions, and the motives, priorities, and understandings held by their parents. Indeed, family factors are

TABLE 5 | Mediation analysis: indirect and total effects.

| Type	Effect	Estimate	SE	95% C.I. [a]		β	z	p
				Lower	Upper			
Indirect	CTS correct ⇒ GAS ⇒ weekly game time	−5.01	8.73	−22.98	11.23	−0.03	−0.57	0.57
	IGT detrimental decks ⇒ GAS ⇒ weekly game time	0.68	2.94	−5.17	6.35	0.01	0.23	0.82
	WHO5 ⇒ GAS ⇒ weekly game time	−217.59	102.22	−417.50	−16.82	−0.16	−2.13	0.03
Component	CTS correct ⇒ GAS	−0.01	0.01	−0.03	0.02	−0.07	−0.61	0.54
	GAS ⇒ weekly game time	654.31	133.06	382.63	904.22	0.49	4.92	<0.001
	IGT detrimental decks ⇒ GAS	0.00	0.00	−0.01	0.01	0.02	0.24	0.81
	WHO5 ⇒ GAS	−0.33	0.15	−0.62	−0.05	−0.32	−2.28	0.02
Direct	CTS correct ⇒ Weekly game time	19.58	12.30	−2.79	45.41	0.14	1.59	0.11
	IGT detrimental decks ⇒ weekly game time	0.29	7.75	−14.49	15.90	0.01	0.04	0.97
	WHO5 ⇒ weekly game time	−160.92	174.08	−486.03	196.36	−0.12	−0.92	0.36
Total	CTS correct ⇒ weekly game time	14.57	16.94	−18.63	47.77	0.10	0.86	0.39
	IGT detrimental decks ⇒ weekly game time	0.97	6.64	−12.05	13.99	0.02	0.15	0.88
	WHO5 ⇒ weekly game time	−378.51	167.49	−706.79	−50.23	−0.27	−2.26	0.02

[a]Confidence intervals computed with method: parametric bootstrap. *p < 0.05, **p < 0.01, ***p < 0.001.

TABLE 6 | Case group parents' worries about the effects of games.

	School	Leisure activities	Social time	Family time	Sleep	Mood and wellbeing	Social abilities	Ability to resist easy rewards	Ability to focus
N	50	52	52	52	52	52	52	52	52
Mean	3.82	4.38	4.50	4.75	3.96	4.31	3.65	3.96	3.83
Correlation with overall worry									
R	0.17	0.17	0.34*	0.39**	0.05	0.31*	0.47***	0.53***	0.40**
P	0.24	0.23	0.01	0.01	0.71	0.24	<0.001	<0.001	0.01

*p < 0.05, **p < 0.01, ***p < 0.001.

TABLE 7 | Correlations of WHO5 items.

	Parent concern level	GAS	WHO5 1 good mood	WHO5 2 relaxed	WHO5 3 energy	WHO5 4 rested	WHO5 5 meaning
Concern level	–						
	–						
GAS	0.39**	–					
	0.001	–					
WHO5 1 good mood	−0.04	−0.20	–				
	0.77	0.11	–				
WHO5 2 relaxed	0.29*	−0.10	0.41***	–			
	0.02	0.41	<0.001	–			
WHO5 3 energy	0.05	−0.27*	0.34**	0.20	–		
	0.68	0.03	0.01	0.11	–		
WHO5 4 rested	0.15	−0.26*	0.20	0.17	0.41***	–	
	0.24	0.03	0.11	0.177	<0.001	–	
WHO5 5 meaning	0.11	−0.19	0.39**	0.43***	0.27*	0.43***	–
	0.38	0.13	0.001	<0.001	0.026	<0.001	–

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

found to have a consistent relationship to issues of problematic gaming and Internet use (Nielsen et al., 2020).

We also found a negative association between children's wellbeing and gaming to escape real-world problems, as well as the feeling of neglecting non-gaming activities. This seems in line with previous research suggesting problematic gaming behavior can be a response to stressful, pre-existing problems (Snodgrass et al., 2014; Prax, 2016). Our findings thus support the notion that reasons for obsessive gaming must be sought in a broader ecological understanding of children's life worlds (Nielsen et al., 2020).

Critical researchers have previously pointed to how the addition of Gaming Disorder to IDC-11 may result in an over-estimation of non-pathological participation in, e.g., online gaming communities as an addiction, as well as a stigmatization of an activity that may not present the danger (Van Rooij et al., 2018). The current study supports this concern in the finding that, although our concern group did score somewhat higher on gaming addiction symptoms, this GAS score was not directly related to negative effects on cognition and wellbeing, or issues of cognitive control which have been known to predict other behavioral addictions. This draws the criterion validity of measures like GAS into question for identifying truly problematic cases. Given our findings, we surmise that overtly worried actions by parents actually *feed back into* the total GAS score by generating conflicts in the home, which will, in turn, lead to higher GAS scores on these criteria related to conflicts with others—not to mention adding stress in the home and souring parent–child relations.

Our results stand in contrast to previous research showing significant functional impairment and diminished psychosocial wellbeing in relation to excessive gaming (Lemmens et al., 2009; Billieux et al., 2017; Myrseth et al., 2017). Since our sample is based on identifying worried parents, rather than cutting across large populations of gamers, this result may present an important lesson on the potential problems that face, e.g., councilors when worried parents approach them for help. In

such situations, professionals therefore need screening tools that are finely tuned to distinguish between non-pathological play and pathological behaviors with functional impairment (Colder Carras and Kardefelt-Winther, 2018). In light of the case group's high scores on wellbeing, it seems unlikely that 61.8% or perhaps even 17.6% were pathologically addicted to video games. The average response was that controls "rarely" experience problem gaming indicators, and only "sometimes" for the case group, which does not convey a sense of constant struggles or functional impairment. This is supported by the Iowa Gambling Task which has previously been used as a measure of impaired decision making in individuals prone to addictions. Kids who gamed more were actually faster, if not more accurate, in their reactions to cognitive tests, but did not show the inability to defer gratification found in addicts (Bailey et al., 2013; Irvine et al., 2013; Trotzke et al., 2019).

The correlation between frequency of GAS indicators and general wellbeing in the group as a whole could be taken as a sign of poor criterion validity for the addiction measure, if the problems did not actually come from functional impairment. As such, it may be that measures like GAS are able to detect nuisances and conflicts in the lives of otherwise well-functioning families, meaning that the, perhaps over-sensitive, conflict-related criteria could lead to a danger of false positives. Indeed, while research shows that negative correlations to, e.g., wellbeing and avoidant behaviors must first and foremost be found in the extreme ends of media use bell curves (Przybylski and Weinstein, 2017; Vannucci and Ohannessian, 2019), the lack of between-group difference in present study illustrates that it may be very hard for parents to assess "how much is too much."

It must of course also be considered that this study was conducted for television. Data collection was conducted in collaboration with a national Danish TV station but with the research design at the full discretion of investigators through dialog with the journalist about the main concerns Danish parents might find interesting. The station covered the data collection process and initial research findings through the eyes

TABLE 8 | Correlations of GAS items.

	Parent concern level	WHO5	GAS01 constant thinking	GAS2 game time increasing	GAS3 playing to forget	GAS4 others attempt to limit	GAS5 feel bad if you cannot play	GAS6 conflicts with others	GAS7 neglecting other activities
Concern level	–								
	–								
WHO5	0.17	–							
	0.17	–							
GAS 1 constant thinking	0.26*	−0.23	–						
	0.03	0.06	–						
GAS 2 more and more time	0.41***	−0.11	0.56***	–					
	<0.001	0.35	<0.001	–					
GAS 3 playing to forget	−0.08	−0.38**	0.10	−0.01	–				
	0.53	0.01	0.41	0.95	–				
GAS 4 others attempt to limit	0.37**	−0.07	0.33**	0.45***	0.18	–			
	0.01	0.59	0.01	<0.001	0.14	–			
GAS 5 feel bad if you cannot play	0.46***	−0.21	0.55***	0.67***	0.13	0.54***	–		
	<0.001	0.09	<0.001	<0.001	0.30	<0.001	–		
GAS 6 conflicts with others	0.43***	−0.10	0.54***	0.67***	−0.00	0.60***	0.71***	–	
	<0.001	0.44	<0.001	<0.001	0.99	<0.001	<0.001	–	
GAS 7 neglecting other activities	0.03	−0.38**	0.38**	0.32**	0.24*	0.30*	0.38**	0.39**	–
	0.79	0.01	0.002	0.01	0.055	0.01	0.001	0.001	–

*p < 0.05; **p < 0.01; ***p < 0.001.

of four on-screen families. Although much larger than formats where one or a handful of on-screen participants are used for "studies" on television, we still only achieved a relatively small sample compared with proper research studies. There is also a good chance that, even though most participants did not appear on screen, the relationship to a known television station could introduce biases in recruitment or responses. Getting a very worried sample of parents to participate was, however, part of the point for this study: We wanted only parents who were concerned enough to respond to the media and online recruitment messages and involve their child in the process. This study should thus not be taken to be representative of parents or gamers in general, but it would be a shame to let the data go to waste, instead of drawing back the curtain of our "made for TV" study. The strenghts of this study are also its weaknesses.

Limitations

The sample of concerned parents was relatively small and based on media recruitment. While the case group was by no means representative, or amenable to recruitment based on *a priori* power analysis, results of research staged for TV rarely gets submitted to peer review, which makes it difficult for anyone to interpret their methods and results. Here, we present the preregistered procedure to ensure transparency of our work with the media and communication at the academic and popular levels alike. Furthermore, the broad media platform allowed for recruitment of highly concerned parents from across the country—a unique dataset which it would be a shame not to utilize fully. However, this recruitment opportunity also represents certain challenges. Working with parent–child dyads through online reporting runs a double risk of dropout—both for parents and children. However, once parents had consented and participated in their part of the study, most children followed suit. The greater concern might thus be to what extent the initiative of parents exacted demand characteristics on their children, even if the materials explicitly instructed them to leave their child to take part in the study alone. A few participants also disregarded the eligibility criteria and reported that they were not, in reality, very concerned. These families were eliminated from the case sample along with a number of potential participants who did not read far enough to accept the data policy and ethics instructions, suggesting that many were curious but either concerned about the nature of the study, or not motivated enough to fully participate as a parent–child dyad.

Furthermore, the technique of asking parents to fill in a survey, and subsequently pass the computer to their child, posed certain challenges. For instance, the child will likely have responded within the mental frame of existing discussions about gaming with their parents, which may have influenced the picture they paint of gaming. As described, we also lost quite a bit of data in the switches between parents and kids. Some control group kids failed to involve their parents beyond getting permission to participate, and some children in both groups responded without a code identifying the parents' level of worry. Also, in order to retain full anonymity, the codes only conveyed the parent's

level of worry and the experimental group they were assigned to, so although it might have been interesting to couple more details about parents to their children's responses, we opted not to create such a link.

This study also has the same shortfalls as other single dives into the complex lives of adolescents and their families. In the light of newer longitudinal research, long-term associations between media use and wellbeing seem tenuous (e.g., Jensen et al., 2019). As such, it is difficult to judge the extent to which our snapshot of young people's lives, media behaviors, and wellbeing will mean much in 1, 5, or 10 years.

The relevance of the measures used can also be discussed. As discussed above, the GAS measure appears to have conceptual flaws, perhaps along with issues of sensitivity and precision. Other investigations have found prevalences of gaming addiction in adolescents and children ranging from 0.2% (Festl et al., 2013), 1.6% (Müller et al., 2015; Rehbein et al., 2015) to 4.6% (Fam, 2018). We are thus operating in a field, where criteria for addiction are not clearly established (Van Rooij et al., 2018). A major part criticism directed toward the gaming addiction diagnosis revolves around the lack of thorough, in-depth investigation of clinical symptoms rooted in exploration of self-identified problematic gamers, who are often children, rather than departing in diagnoses of existing addictions such as substance abuse in adults. As such, while GAS criteria may indicate problematic use, it is not well established whether the criteria accurately and comprehensively encapsulate the most relevant criteria of gaming *addiction*. In the current study, a negative relationship between game time and wellbeing was visible only if GAS symptoms were used as a statistical mediator, but in absolute terms, the case group had the same wellbeing scores as other kids their own age. This underscores how tick-a-box screening tools should never stand alone when making important decisions, particularly in a field as contested as gaming addiction.

This supports an alternative way of interpreting GAS scores, by dividing criteria into peripheral (indicative of high engagement) and core criteria taken to be indicative of severe problems suggested by some researchers in the field (Ferguson et al., 2011; Brunborg et al., 2015). In this approach, three items on GAS are peripheral while four are core criteria of gaming addiction. This approach significantly nuances the view that all problems and conflicts related to gaming should be taken as a sign of pathology, while still respecting that non-pathological nuisances and struggles are very real in many families.

Furthermore, even though the relationship between IGT and behavioral addiction is fairly well established, some studies contest this relationship, even finding higher IGT scores for non-pathological gamers compared with controls (Metcalf and Pammer, 2014). In addition, recent research suggests that cues related to a disordered behavior interferes with decision making in IGT (Trotzke et al., 2019), suggesting that problem gamers may be worse off at making decisions only when gaming is strongly on their mind—e.g., during play or when invited to play by friends. This perhaps limits the relevance of IGT as a test of negative cognitive effects or of resultant tendencies toward addictive behaviors, in the case group.

Finally, a few amendments to the analysis plan were needed after the initial preregistration. These changes are tracked at osf.io/hwbv4.

Implications and Future Directions

Despite instances of worrying GAS scores in the present cohort, the study suggests that parents, who find themselves concerned over their child's changes toward obsessive gaming, should not assume that their child is worse off than kids with other interests, or think of their child's gaming in terms of pathology.

The commonalities between concern and control groups suggest that parents and even councilors should refrain from casually diagnosing children as "addicts," and from assuming that gaming behavior is necessarily a source of detriments to wellbeing or cognitive functioning.

In cases where gaming feels like an increasing and persistent issue, parents and councilors should, it seems, pay attention to other potential sources of problems in the home, school, or peer group, while also helping the still immature child to make time for both rest/sleep and other activities which they might down-prioritize due to their gaming interests. As increased parental worry may feed into conflicts surrounding gaming behavior, which may in turn affect the relationship between problem gaming and wellbeing as our correlational analyses suggest. As such parents may, paradoxically, help their child more by worrying less—at least overtly.

A finding that warrants deeper scrutiny is the correlation between parental worry and gaming addiction indicators related to conflicts with others over gaming and others trying to limit your game time. These are likely very common experiences in any parent–child relationship. As such, the understandable and expectable behaviors of worried parents seem to be the source of at least part of the GAS diagnostic framework. In other words, we could be looking at a circular relationship: When a health professional uses an instrument like GAS to characterize the child of a worried parent as addicted, the frequency of experienced indicators could stem at least partially from the parents' ensuing attempts at managing her media uses. In-depth studies of family experiences, conflicts, stressors, and negotiations about proper game time could be a key to understanding this paradox in depth, and perhaps to determine the appropriateness of scale items related to family conflict as diagnostic criteria for an addictive disorder in children.

Adolescence is never an easy time for anyone involved, fraught with changes and conflicts as it is. Gaming can definitely be problematic in a lot of ways, lead to practical and social conflicts, and take up enormous amounts of time, but at least in our small sample, children of worried parents were just as happy and cognitively healthy as other kids their age.

DATA AVAILABILITY STATEMENT

Pre-registration and materials available at the Open Science Framework (OSF) https://osf.io/hwbv4/.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Aarhus University, COBElab ethics committee. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

Both authors contributed to planning, executing, and writing study. AL designed stimulus materials and wrote 70% of the manuscript text.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.586699/full#supplementary-material

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Community Case Study: Stack Up's Overwatch Program, an Online Suicide Prevention and Peer Support Program for Video Gamers

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Traditional mental health services are often not enough to meet the needs of people at risk for suicide, especially in populations where help-seeking is stigmatized. Stack Up, a non-profit veteran organization whose goal is to use video games to bring veterans together, recognized a need in its gaming-focused online community and created the Overwatch Program. This suicide prevention and crisis intervention program is delivered entirely through the Internet by trained community members through Discord text and voice chat. By combining aspects of virtual gaming communities, veteran mental health, and community-based peer support, this program provides an innovative format for implementing crisis intervention and mental health support programs. We describe here the context and features of the program, an ongoing evaluation project, and lessons learned.

Keywords: suicide prevention, video games, internet, veterans, mental health services research, online communities, peer support, Discord

INTRODUCTION

Mental disorders are prevalent and potentially disabling conditions worldwide, and suicide prevention specifically remains an urgent priority for mental health research and practice (National Institute of Mental Health [NIMH], 2020). Suicide rates continue to rise in the United States, despite progress in reducing mortality from other diseases (Case and Deaton, 2015; Stone, 2018). Veterans have been identified as a vulnerable population with a higher risk of suicide (Ashrafioun et al., 2016) and large unmet mental health need (National Institute of Mental Health [NIMH], 2020). Risk factors associated with suicide, such as financial problems, loneliness/social isolation, and anxiety, may be worsened by the pandemic and exacerbate pre-existing mental or behavioral health conditions for veterans (Armstrong, 2020; Gunnell et al., 2020). Many veterans experiencing psychological distress, mental or behavioral health problems, or significant life stressors are reluctant to seek help (Spelman et al., 2012; Quartana et al., 2014). For example, a recent survey of over 4,000 veterans estimates that 41% of recent veterans, or about 1.7 million veterans, have mental health need based on well-validated mental health screeners (National Academies of Sciences, Engineering, and Medicine [NASEM], 2018). These findings also show that over half of those with potential unmet need have not sought mental health treatment, either in the Department of Veterans Affairs (VA) or elsewhere.

Barriers to receiving mental health services come from several areas, as outlined in a recent research brief summarizing the results of several studies of veteran mental health (RAND, 2019). Shortages in the mental health workforce within the VA mean that appointments may not be easily available, and there is wide variability in the delivery of evidence-based treatments within this system. Veterans express concern about the effectiveness of mental health treatment, including side effects of medication, but also express fears that their career might be affected by seeking treatment, or that looking for help is a sign of weakness. Providing a wide range of choices for mental health support and treatment makes it easier to address needs and overcome barriers (Hoge, 2016). Telemental health has been specifically recommended as a way to expand the provision of evidence-based care (RAND, 2019). Peer support (in this case, care delivered by veterans with the lived experience of mental or behavioral health problems) is another form of care provided to veterans and is a mandatory offering in the VA system (Department of Veterans Affairs [DVA] and Veterans Health Administration [VHA], 2008). Peer support is generally highly regarded by veterans and clinical leadership (Chinman et al., 2012). Although peer specialist services have promising effects on mental health symptoms for some groups of veterans who engage highly with them (e.g., those with severe mental health problems), broad implementation has been delayed by organizational uncertainty about the role and by inadequate funding (Chinman et al., 2017).

Identifying and assisting people at risk for suicide, responding effectively to crisis, increasing help-seeking, and fostering connectedness are among the recommended strategies for crisis intervention (Suicide Prevention Resource Center [SPRC], 2020). According to Joiner's interpersonal–psychological theory of suicidal behavior Joiner et al. (2009), social isolation or a feeling of alienation or lack of connectedness (low belongingness) is a robust predictor of suicidal behavior across various populations. Low belongingness is a painful emotional state characterized by not feeling connected to or cared about by others and has been a target of suicide prevention interventions (e.g., Motto and Bostrom, 2001). However, finding scalable ways to support connectedness and mental health and intervene during times of crisis are still a challenge. In the crisis intervention space, anonymous phone-based hotlines have been standard, but with increasing modes of communication, hotlines are branching out into text chat. For example, the Veterans Crisis Line now offers text messaging, online chat, and voice-based crisis intervention for veterans. In responding to over 629,000 calls (Veterans Health Administration [VHA], 2019), this service provides a crucial service to veterans in crisis. However, the one-to-one format of these interventions does not allow for a sense of belonging to a community that is protective against suicide (Chu et al., 2017).

The video gaming community has taken an alternative approach to mental health support and crisis intervention by focusing specifically on belonging. Efforts to address mental health stigma, promote good mental health, and provide mental health support have been ongoing for years through grassroots (i.e., community-developed) and non-profit organizations (History-Rise Above The Disorder, 2020; Take

This, 2020; Virtual Ability, 2020) and others. Research supports the match between hedonic (mood- or happiness-based) and eudemonic (autonomy, functioning, and meaning-based) aspects of gaming as well as of mental health. Games are fun, engaging, and often challenging. These hedonic aspects of games and gaming can contribute to wellbeing by promoting positive mood, by providing relief from everyday life stress, or by promoting the rewarding mental state of "flow" (Csikszentmihalyi, 1990; Bowman and Tamborini, 2012; Coulombe et al., 2016; Reinecke and Eden, 2017; Rigby and Ryan, 2017). These positive mood states allow for mindfulness-like decentering (Reinecke and Eden, 2017) that can offer distraction from psychological symptoms and stressors, and this distraction has been linked with adaptive coping aspects of mental health recovery (Colder Carras et al., 2018b). In addition, games offer opportunities for social connection and support, competence, autonomy, and meaningful roles, all important eudemonic aspects of mental health. The anonymity of online settings and the teamwork necessary to overcome challenges promote friendship formation (Kowert, 2014), whereas the ability to control aspects of gameplay fosters a sense of competence and autonomy (Rigby and Ryan, 2017). Leading a guild or team, starting an in-game business, or even performing a specific function in a temporary group (e.g., the healer or tank) are all ways gamers benefit from the eudemonic opportunities games provide (Yee, 2006; Rigby and Ryan, 2017; Rogers et al., 2017). Together, these factors promote mental health, resilience, and participation in the community and society. Programs that promote mental health are a good fit for the gaming community, given that games themselves can meet both hedonic and eudemonic needs. Previous work with the veteran gaming community has shown that playing video games helps veteran gamers in treatment for mental health problems cope with and recover from mental health issues while providing ways to connect and form meaningful bonds with others who play games (Colder Carras et al., 2018b).

Founded in 2015, Stack Up's mission is to fight the effects of depression, combat injuries, and post-traumatic stress by bringing veterans together through the "shared language" of video games. A "stack" is a slang term for a formation used in military or law enforcement, when an assault team forms up single file along the entrance or doorway to a room where they believe a threat is located. For Stack Up, the stack represents a strong community of friends, family, brothers and sisters in arms, and supporters, all coming together for the common mission of supporting veterans through shared online gaming experiences.

By providing mental health support through the video game community, Stack Up seeks to truly meet veterans where they are—in games and online. Stack Up leadership identified a need in the veteran and military gaming community and responded to it as grassroots organizations do. Although there are no known representative sample studies describing the prevalence or use of gaming in veterans, one study of young adults (18–40 years old) recruited samples from Facebook, targeting individuals who expressed interest in military or veteran pages and military-themed games. Of those who clicked on recruitment ads, were veterans, and met the eligibility criteria; between half and three-quarters played video games at least 1 h per week

(Grant et al., 2018). Whether a majority of young adult veterans play games or not (i.e., given the bias inherent in samples recruited through Facebook), it was the experience of the Stack Up community that their members needed a way to connect and receive support through video games.

In 2017, they implemented a new program within their veteran gaming community to provide mental health support and crisis intervention through their Discord server. This innovative program takes advantage of the anonymity, support, and connection of virtual communities based around shared experiences (military service, life stress) and interests (video gaming) to address gaps in the ability to provide support and connection to veteran and military gamers and others.

CONTEXT

Like all mental health interventions, the program can be seen as operating within a variety of contexts. This section describes some of the organizational, technological, and cultural features in which the Overwatch Program is situated.

Stack Up, a Veteran Serving Organization

Stack Up Founder and CEO Stephen "Shanghai Six" Machuga is a former Army Infantry/Military Intelligence officer and Airborne Ranger. Machuga says that video gaming "helped keep him sane" while he was deployed in Iraq with the 2nd Infantry Division and also played a significant role in his successful reintegration back into civilian life. Wanting the same for other veterans and active-duty military members, he founded Stack Up on Veterans Day, November 11, 2015.

Stack Up provides video game-related programs to support veterans and active-duty military globally. The Supply Crates and Stacks programs encourage in-person connection through co-located video game play, whereas the Air Assaults program promotes connectedness and community integration by giving selected veterans the opportunity to attend major video game and geek culture events with Stack Up leadership. Through veteran to veteran, veteran to civilian, and veteran to community connectedness, Stack Up helps veterans regain mental health and make successful transitions by providing programs that enable veterans to experience the therapeutic benefits of gaming and connections with others.

Stack Up also promotes an online community through its Discord server (see section "Discord and the Stack Up Server"). The community features several chat channels where veterans and others can connect through text or voice about games or any other topic. Weekly "Bored Room" meetings over voice chat keep members informed of the organization's events and allow for regular member input and feedback. Most importantly, the server is home to Stack Up's Overwatch Program (StOP), the first online crisis intervention program for veterans that is delivered entirely by trained volunteers through text and voice chat.

Discord and the Stack Up Server

Discord is an online communication platform originally designed for the gaming community (Chiu and Mustafaraj,

2020) that has garnered 250 million users worldwide since its launch in 2015 (Discord software, 2020). Discord offers instant messaging, voice-over-Internet chat, and other computer-mediated communication and media sharing, allowing for extensive real-time social interaction between individuals and groups. Like other social media platforms, users can remain anonymous. While it has received some media attention, it has little mental health research compared with older platforms, such as Twitter, Facebook, and Reddit (Chiu and Mustafaraj, 2020).

The platform hosts the Stack Up server, a digital community of 2,727 members, offering many channels for live chat. Anyone may join Stack Up's server; you do not need to be a veteran or even a gamer. Members use the channels to "hang out"— to talk in a lighthearted way about games and other common interests, to share memes and other visual media, and to relieve the stress of daily life during a pandemic, which now includes the traumatic stress from mandatory social isolation and fear of infection and death from coronavirus (Holingue et al., 2020; Holmes et al., 2020). These themes arise occasionally in the chat itself but are also reflected in requests for resources, information, and general help and support from veterans and other community members.

Gaming Culture

The Stack Up community reflects many aspects of gaming and Internet culture. As a virtual community, they express their group identity through their public interactions around gaming (Grooten and Kowert, 2015). Members are known by their "handles," usernames that identify them in the server and often in other social gaming spaces. Chat communication is filled with.GIFs (graphical interchange format ultra-short videos) and memes that emphasize, poke fun at, applaud, or comment on posts. During weekly voice chat member meetings, the #general channel fills with rapid-fire comments on Stack Up leadership's (verbal) reports, emojis, or comments on those comments, GIFs, and memes in response, and so on. This rich, playful multimedia content fosters emotional connection and strengthens virtual community development (Hamilton et al., 2014).

Crisis Intervention

Stack Up started its Discord server in 2015 and noticed early on that members would often voice their mental health needs in general channels that offered little to no privacy. Leadership at that time recognized that by offering crisis intervention directly, they might be able to reduce veteran suicide and promote good mental health in their virtual community. Once the Overwatch channel was started, many veterans offered to "lend an ear. Others shared their experiences, the ways they coped, and specific resources. As the program was formalized, training was developed in partnership with PsychArmor Institute, an organization providing training resources to help groups engage with and support veterans (PsychArmor, 2020). Volunteers take several modules through PsychArmor and then undergo hours of shadowing and supervised chat interaction prior to a scenario-based evaluation. Those who satisfactorily complete the

training and interviews become official StOP team members, identified by the inclusion of ["StOP"] within their username. Team members need not be veterans or people with the lived experience of mental health problems, but contributions of StOP team members in the channel reflect the broader, non-VA definition of peer support as "mutual support delivered through sharing experiences of distress, difficulty and resilience" (Penney, 2018).

Beginning the Public Health Evaluation Process

In 2018, Stack Up was selected as one of five veteran-serving organization recipients of the CDC (Centers for Disease Control and Prevention) *Veteran Suicide Prevention: Evaluation Demonstration Project*. The project team used the *CDC Evaluation Framework* (Milstein and Wetterhall, 1999*)* to build the infrastructure needed to perform evaluations of its programs. This formative evaluation focused on developing a logic model to describe the programs, conducting stakeholder engagement to identify evaluation goals and indicators, and identifying data sources needed to answer questions about how well the programs work. The logic model (**Figure 1**) was used to guide the current evaluation efforts.

ESSENTIAL PROGRAMMATIC ELEMENTS

StOP is designed to meet basic standards for suicide prevention services including assessing suicide risk, promoting coping skills, and recommending follow-up. The program is delivered as a "peer-to-peer" intervention (see section "Conceptual and Methodological Constraints" for discussion of the peer support concept) and supervised by a licensed clinician.

Staffing and Supervision

The StOP Team is led by author MB, a military veteran who obtained his graduate degree and clinical certification after his honorable discharge from the United States Air Force Security Services. Until June 2020, MB was the only paid staff member. He is supported by 25 volunteers, 15 of whom have completed training. StOP team members need not be veterans or have personal/lived experience with mental health problems or crisis. In some cases, individuals who have used StOP services have gone on to be trained to deliver the service. StOP also seeks to promote the development of a trained mental health support workforce and provide team members with valuable experience that could lead to paid work as a paraprofessional peer or

FIGURE 1 | Stack Up logic model.
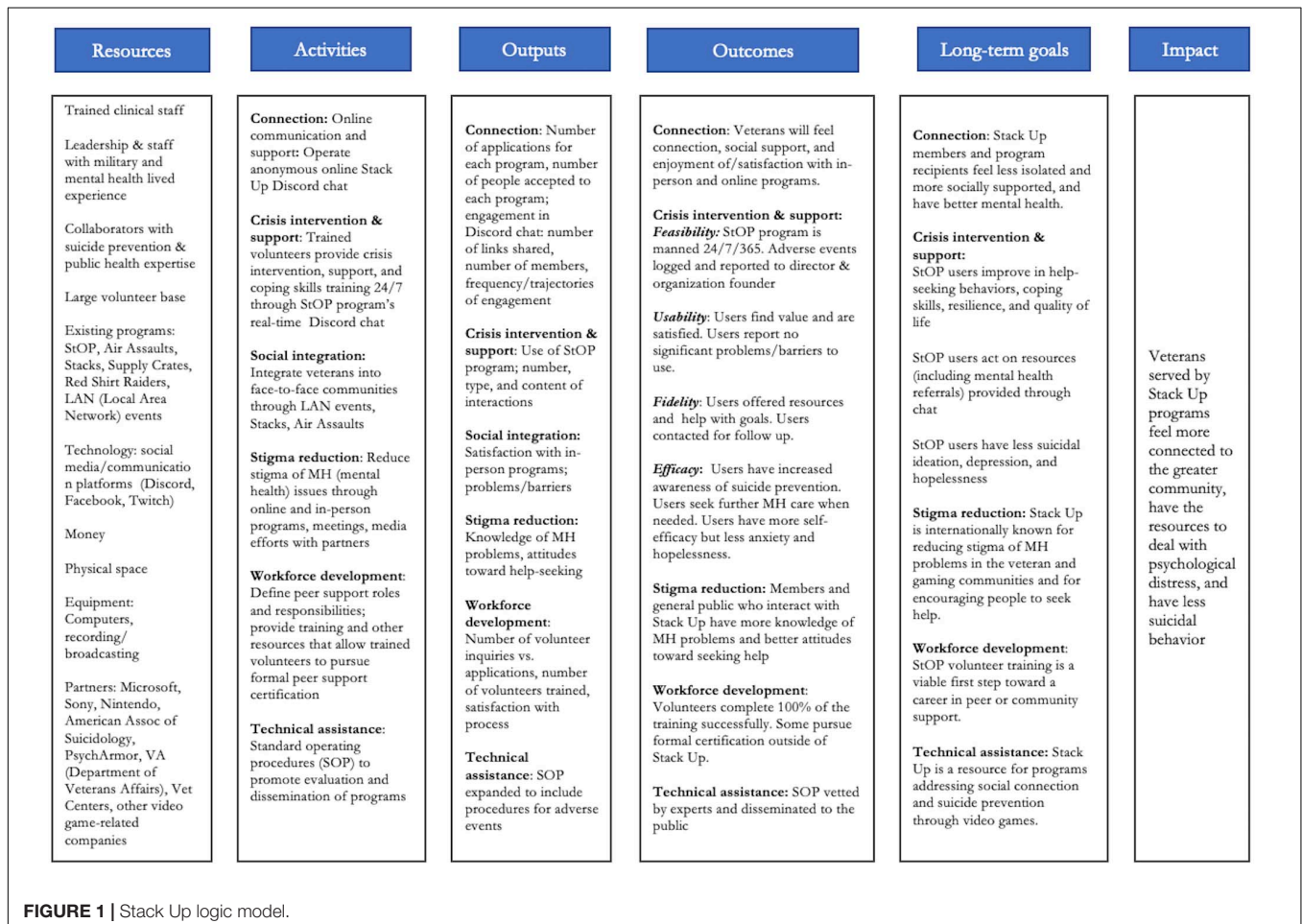
community support specialist. So far, one StOP team member has secured paid employment as an online community manager with a large game development company.

The team communicates and solves problems through discussion in the #StOP-team-room chat channel, where MB maintains a constant presence during waking hours. The team is also able to seek advice from a clinical advisory board, which is usually consulted only when staff identify a possible duty to warn situation (the need to send emergency services to intervene in an imminent suicide attempt).

Unlike many other suicide prevention programs, Stack Up does not refer out—all contacts are handled directly by StOP team members, unless the user wishes support that is more specific to their needs. For example, users in the LGBTQ (lesbian, gay, bisexual, transgender and queer or questioning) community who want support from an LGBTQ-specific service may be referred to the Trevor project, a charity that focuses on suicide prevention for LGBTQ youth. Other suicide prevention initiatives, such as the Veteran Crisis Line, use multiple call centers, which may have differing practices or organizational structure that may make oversight complicated (Veterans Health Administration [VHA], 2019). However, StOP is still new. As it grows, it may need to expand to multiple groups or channels, which could reduce its ability to meet the needs of users exclusively from within StOP.

Accessing the Service and Moving Between Channels

The Overwatch Program (StOP) has a public chatroom (#the-overwatch-program), private chatrooms devoted to training and team discussion, and public and private voice chats. Through these channels and chatrooms, it delivers crisis intervention and mental health support using trained volunteer peer supporters (StOP team members) to any member who

requests to use it. StOP team members also maintain a presence in the #general channel, which allows them the opportunity to offer StOP support to anyone whose chat may indicate that they could use it.

As shown in **Figure 2**, the service can be accessed through several different ways. Members can enter #the-overwatch-program channel directly and request help. If a member says something in the #general channel like "I'm really down; I just got fired and my VA benefits haven't kicked in. I'm feeling really depressed," another member or a StOP team member might suggest they post that in #the-overwatch-program. Users sometimes get referred from game streaming websites (e.g., Twitch) of Stack Up members or affiliates, and buttons and widgets on the Stack Up website link to #general and #the-overwatch-program. A feed from #the-overwatch-program is displayed on the website as a way to illustrate the nature of the chat, normalize help-seeking, and provide another anonymous way to get help. In June 2020, Stack Up began a unique partnership with wargaming.net's World of Warships to offer Operation Lifeboat, a direct link to StOP from within the World of Warships digital game (colloquially known as "The Button"). This innovative intervention appears to be the first industry-supported bridge to mental health support from within a commercial video game designed for entertainment.

Although members at times seem to enjoy hanging out in #the-overwatch-program to talk about their issues and provide peer support, the channel as currently designed functions as a monitored public lobby where members are introduced to the team and program and receive general support. More specific crisis intervention is provided privately. Once a user has interacted with #the-overwatch-program, they or the StOP team member may request a private voice or text chat. These private chats follow best practices for crisis intervention as described

FIGURE 2 | Stack Up Discord server chat and Stack Up Overwatch Program.
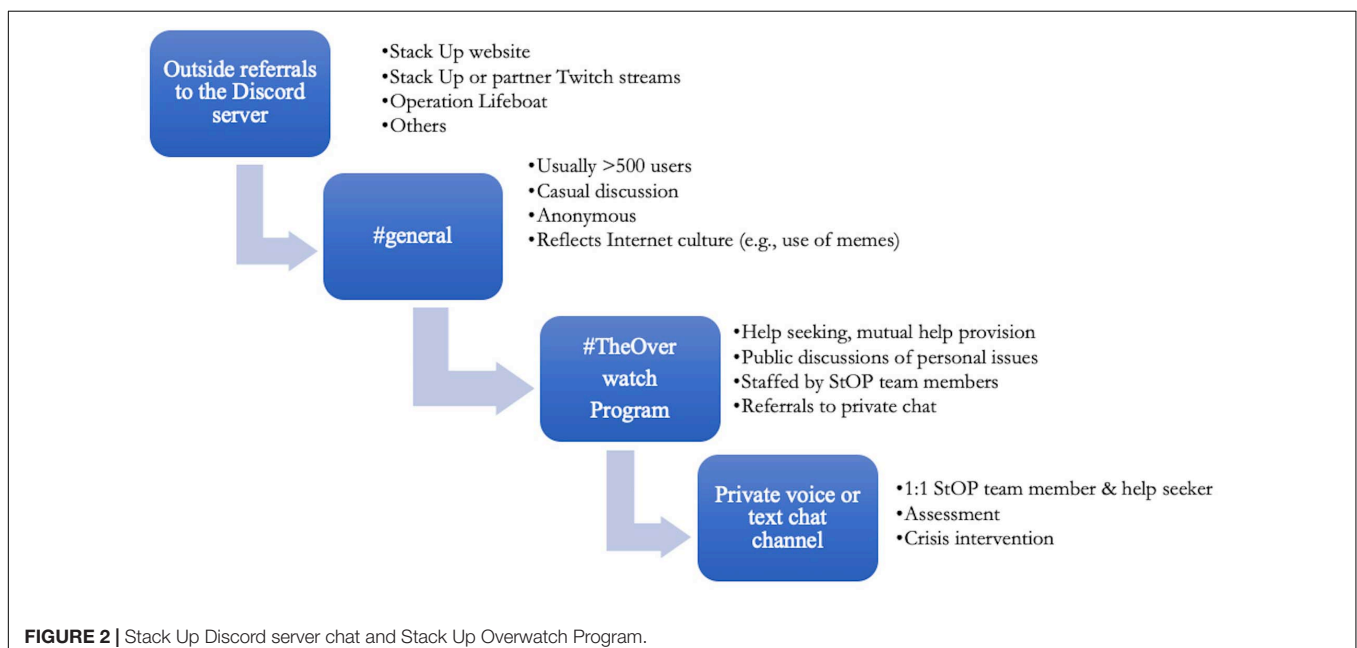
in section "Defining and Responding to Crisis." Members may request repeat private chats as needed, and StOP team members follow up with users in crisis.

Defining and Responding to Crisis

Crisis intervention encounters are based on best practices and guided by the same formal rubric used to evaluate a trainee's readiness to provide crisis intervention. Team members use a calm, welcoming, and non-judgmental approach, often using discussion of games to build rapport and explore issues. They are expected to have a broad knowledge of resources, many of which are contained in the StOP team member handbook or #training channel. In accordance with national standards for suicide risk assessment, StOP team members are encouraged to formally assess for suicidality by asking about current and recent suicidal ideation and then follow up with questions about suicidal plans, means, and past attempts if the user reports ideation (National Suicide Prevention Lifeline Standards, Training & Practices Subcommittee [NSPLSTPS], 2007). Other goals for the encounter are to discuss the life difficulties that brought the user to seek help, assess resiliency factors and support coping skills, offer resources (including referrals to mental health treatment), and co-develop an action plan. Team members collect information about the encounter and follow up within a few days of the contact. StOP emphasizes inclusivity and recently added specific training to help members meet the needs of the LGBTQ community.

One challenging standard for community-based crisis intervention services is the duty to warn situation. A duty to warn (also called duty to protect) situation occurs when a professional identifies a potential threat to life (the patient or someone else's) and must break confidentiality to implement an intervention (e.g., calling police, notifying the family of someone in danger). Standards for suicide prevention services require that "Any program, which purports to be involved with life-threatening behaviors, must be, at the very least, capable of initiating or actually accomplishing a rescue in cases of life threatening acts already set in motion" (American Association of Suicidology [AAS], 2019, p. 57). Stack Up follows this standard by seeking informed consent from its users, assessing risk to life, seeking identifying information, and conducting rescue operations by contacting local emergency services when imminent risk is determined.

DISCUSSION

The Overwatch Program, a grassroots effort started by passionate volunteers, has evolved into an emerging model for providing mental health support through a focus on games and online connection. Although the program has been implemented in a large virtual community, from an evaluation standpoint is still in the early phases: Stack Up was just awarded a second grant by the CDC Foundation to conduct a formal evaluation of StOP and how it could be useful for veteran mental health, especially during the coronavirus disease 2019 (COVID-19) pandemic.

The evaluation will use interviews, a survey, and captured data to assess organizational factors, user characteristics, feasibility,

usability, and efficacy (i.e., changes in processes or outcomes) of the program. We will also address critical questions related to the COVID-19 pandemic and mental health to get a picture of how this is impacting an online veteran community, such as the resources veteran members are able to access, including the VA care, and how lockdowns and other societal changes impact mental health and coping. The project uses a convergent/sequential design, mixed methods research approach to evaluate StOP and provide an initial scientific description of the Discord chat-based intervention. Our analysis is guided by the CDC Framework for Program Evaluation (Milstein and Wetterhall, 1999) as well as the World Health Organization guidance for evaluating digital health interventions (World Health Organization [WHO], 2016).

Although we have not yet collected enough data to inform an analysis, from previous data collection we know that 72 people used the StOP program last year, and so far this year, we have had 52 contacts. Interim data from the recently launched survey ($n = 27$ responses so far) show broad support for the program but also point to a few concerns. Some respondents appreciated knowing StOP was there if they needed it:

> I think it's appealing if someone is having a moment and need to vent especially dealing with PTSD [post-traumatic stress disorder] and depression.
>
> I think it's a great resource and just knowing it's there is a great comfort. I think if we could get this to bases all around the country on the same level as other military sources like Military One Source, it could do even more good.
>
> There are great people within it and I know that should I utilise the resource, I'd be speaking with those that actually care and can relate on some level.

One respondent pointed to the attributes of StOP team members as peers that they felt made the program valuable:

> Stack Up has mental health professionals on staff who are very up front with helping educate us and making sure that we are all doing ok. I think the biggest highlight of the StOP program is that all of the staff and volunteers do it because they care about and love every person that they help. Their interactions with the volunteers are on a very open and personal level, much more so than other professional services I've interacted with in the past.

That said, we did find that some users expressed concerns about the program. Two respondents felt that there was a lack of specialty knowledge about the LGBTQ community, whereas one felt that training could be better. Several respondents felt that information about it was hard to find or was inadequate. These represent possible areas for improvement that are currently being addressed.

While our preliminary data do not reflect systematic analysis, asking open-ended questions is an evaluation approach that allows organizations to immediately address issues and improve program quality.

Practical Implications

In the hopes that our description will be of use to other online communities, we provide here some lessons learned and practical implications for those who would like to translate this program

to other virtual settings or conduct further research on StOP or Stack Up's other programs.

Leverage the Skills and Passion of the Community

First, this program and its evaluation projects have required extensive time and commitment to launch, fund, and maintain. MB has been the passionate driver of the program for over 2 years, and his leadership has been invaluable for promoting the recognition of StOP in the suicide prevention community and securing funding for the program and its evaluation. MB brings his lived experience of being a veteran with PTSD to his professional leadership, informing and infusing the project with the values and preferences of those who have "been there." As shown in the logic model, one of Stack Up's major assets is the volunteers who are passionate about the Stack Up mission and the close-knit, grassroots community centered around video games and the military experience. Although StOP is based in a military gaming culture, it could easily translate to other online cultures. The tightknit nature seems critical to success, but communities can be built around other shared passions.

Incorporate Lived Experience

In contrast to forums or chatrooms designed as communities for mental health support, StOP provides a mental health intervention in a supportive existing community that was not originally designed to help users find mental health or social support. This is a novel model: StOP is created and led by an organization whose members have the lived experience of mental health challenges (like combat-related PTSD) and is delivered by trained members of the community rather than professionals. Use of community health workers to deliver mental health interventions is nothing new; such interventions provide an important way to shift tasks from professionals to paraprofessional community members in resource-constrained settings (Barnett et al., 2018).

One of Stack Up's original goals for this program was to reduce veteran suicide by providing another avenue for veterans to seek mental health support and thus contribute to a suicide prevention mission, especially for veterans who are unable or unwilling to seek care from the VA. It also aims to provide an alternative to formal healthcare, as many veterans feel uncomfortable seeking help due to stigma or are unable to access it because resources are lacking (Castro, 2014; Kulesza et al., 2015). However, despite attending gaming conventions and suicide prevention conferences for years and being deeply embedded in the suicide prevention and "geek therapy" communities, we have seen no other examples of an online community—veteran oriented or not—that provides volunteer members with the combination of intensive training, supervision, and standards needed to deliver a suicide prevention intervention. This novel approach, combined with the potential for enormous reach, is what has brought StOP to the attention of the veteran suicide prevention community.

Disseminate New Knowledge and Practices

Social media monitoring and screening for suicide prevention is a hot topic for a research right now, and the Discord platform offers the opportunity for a new type of big data. The authors worked together to create a virtual suicide prevention conference (Operation HEAL: Suicide Prevention Conference-Home, 2018) to discuss how games and social media are used for suicide prevention[1] and have participated in multiple panels together including at academic conferences (Colder Carras et al., 2018a, 2020b) and gaming conventions (Colder Carras et al., 2020a). The Stack Up community has spread information about its program through partnerships with streamers, social media suicide prevention communities, and industry. MB and MCC have discussed and promoted mental health support and crisis prevention through regular streaming efforts, including some focused on the COVID-19 pandemic and mental health (Stack Up, 2020). The gaming community has been extremely receptive and welcoming and has repaid Stack Up in volunteer time and fundraising efforts; last year, streamers raised over $250,000 for Stack Up programs.

Prepare for Research and Evaluation Early

Research activities have proven a challenge given the timeline of Stack Up's fundraising efforts and travel, but the formative evaluation experience provided insight for organizational changes needed to sustain evaluation and research efforts. For a new or lean organization, time spent on evaluation may seem to compete with fundraising efforts. However, potential funders require data, so early investments in infrastructure pay off. It is vital to plan for resources, including staff time and support, to conduct program evaluation and research. Establish practices for evaluation and monitoring as you begin and start collecting data early to use in ongoing quality improvement.

New mental health support/crisis intervention programs should ensure not just that they are meeting the needs of community members, but that they do no harm. It is critical to have clear and intense training, testing, supervision, communication, and support for program volunteers. While all grassroots (i.e., community-developed) programs should have a thorough grounding in evidence-based practices, programs based in online communities also need to pay careful attention to privacy. Balancing confidentiality with ethical duty to intervene if suicide is imminent (American Association of Suicidology [AAS], 2019) is an imperative that new programs must be ready to address. This topic is developing in the research literature (see, e.g., Benton et al., 2017), but a greater review of these issues is beyond the scope of this paper.

Be Prepared for Change

Changes in technology or expansion to scale can have a powerful impact on programs. In support of the potential traffic from World of Warships' 1 million players driven by Operation Lifeboat and "The Button," StOP for the first time hired paid supervisory staff to cover the night shift. When communities transition from providing volunteer-based support to providing mixed volunteer and paid staff teams, this may affect how relationships are experienced and shift power dynamics within the team. Stack Up addressed this proactively for months

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[1] https://tinyurl.com/OpHealConf

as part of regular team meetings, but others wishing to use this model might consider having paid and volunteer staff from the outset so as to avoid the need for a cultural or attitudinal shift.

Stack Up also gained hundreds of new members within a week from this partnership, which pushed it from being a medium-sized to a large server on Discord. As a newly large server, the default ability to send push notifications for "at mentions[@name]" (e.g., "@Mat, I have a question") was removed. StOP team members frequently use at mentions in the team channel to discuss real-time questions, so this feature is sorely missed, and work-arounds are currently being tested.

Implications for Research and Policy

Creating mental health programs for and conducting mental health research within the gaming community are made much easier when these efforts are community- and peer-led. As members of mental health lived experience communities (i.e., people with the lived experience of mental health challenges) and gamers, MB and MCC bring in-depth, culturally informed perspectives to their joint projects that make planning easier and emphasize co-production of knowledge. Using professionals with lived experience to conduct research into mental health can be transformative for mental health systems and services (Jones et al., 2014), and transformation and innovation are needed for both suicide prevention and veteran mental healthcare (National Institute of Mental Health [NIMH], 2019). Lived experience research leadership streamlines the incorporation of multiple perspectives and can help ensure a focus on community values, preferences, and cultural considerations.

The setting of an online gaming community and a chat-based platform is extremely well-positioned to support program implementation and research. Text chat can be anonymous, allowing people with mental health needs to seek support privately, and the setting of a mental health promoting, stigma-busting community normalizes help seeking. Synchronous and asynchronous chats in the StOP team room foster connection between team members but also allow for rapid response and supervision/intervision (peer problem solving).

The combination of military and gaming communities also challenges existing approaches to social media data analysis. For example, use of vulgar language (swear words) has been considered a sign of negative sentiment in some approaches to social media data analysis, but could also reflect group identity or signal informal conversation (Cachola et al., 2018). For male veteran gamers, "trash talking" may be an integral part of the gaming experience (Colder Carras et al., 2018a). That said, natural language processing and other machine learning methods used in suicide prevention (e.g., Coppersmith et al., 2018) will be a great next step, especially as links between suicide and risk factors, such as alexithymia (difficulty identifying and describing emotions in oneself and others; De Berardis et al., 2017), are better understood.

We have been approached by several non-gaming organizations seeking to implement similar programs and can highly recommend that interested researchers or program

directors immerse themselves in the communities they seek to serve or work with. There is no substitute for being there, day after day, week after week, offering attention and appreciation while being mindful of the limits of one's own understanding.

Conceptual and Methodological Constraints

In describing StOP, we face several challenges and methodological constraints. Meetings with potential funders can be challenging as the authors must bridge many knowledge gaps related to online communications, the Discord platform and the privacy implications of public discussions of mental health and suicide. The Stack Up community is itself hard to describe—it is not limited to a specific game or to veterans, but made up of people who play multiple games (or do not game much) as well as veterans, military service members, and citizens.

Another challenge is understanding the meaning of peer-to-peer support in StOP. Stack Up uses that term to describe an intervention that uses community health workers, e.g., "interventionists without formal mental health training and who are members of the community they serve" (Barnett et al., 2018). This is in contrast to the way it is often seen in the VA and other mental health service settings in the United States, where the term "peer" in peer support implies having the lived experience of the mental or behavioral health condition one is supporting. Importantly, Stack Up does not require team members to have lived experience, but it does support and encourage people who are veterans or who have lived experience to apply.

One big challenge for understanding online Discord-based communities from a public health perspective is defining what it means to be a member of the population. In public health, we aim to define populations from which samples and study participants can be drawn. We think of the Stack Up server as having a population of over 2,700 members, but this fluctuates from month to month. The state of being a member is relatively absorbent—once you become a member, you stay a member, even if you no longer participate in the server. The only way to change this is to quit (or be banned, which is not uncommon in some online communities). Some online communities reflect the approaches used in marketing and online media, measuring activity and membership as active or not based on various online behaviors (posting, logging in, etc.). This poses a challenge to data collection and inference, because scientists will need to develop new ways to think about populations and who can be considered in the sample of those who may benefit (or be put at risk by) online activities and groups.

Evaluating mental health programs for gaming or other online communities requires not just a public mental health lens but also an informatics lens and ample researcher reflexivity. Grassroots organizations can have tremendous success at developing and implementing programs but be less prepared for the steps required for a rigorous evaluation. It is vital to have a clear understanding of what is needed to conduct proper evaluation research and ongoing monitoring to ensure that the community's mental health is supported and research participants' privacy is protected.

CONCLUSION

As far as we know, this is the first description of a formal, volunteer-driven crisis intervention program in an online gaming setting. By taking advantage of new computing approaches, using data from outside healthcare settings in health research, applying algorithms and data analytics to assess the value and efficacy of interventions, and describing an intervention designed to connect veterans with each other and the community at large, the current evaluation project addresses several strategies and goals of the NIMH Strategic Plan (National Institute of Mental Health [NIMH], 2020) as well as the Executive Order to End Veteran Suicide (EO13861). Using a public chatroom to deliver crisis intervention services is a potentially disruptive form of suicide prevention—while many interventions exist to identify potential suicidality in social media postings (e.g., Facebook's feature that allows users to report other users' posts), such interventions provoke the ethical dilemma of what to do when an online risk analysis identifies an individual at need of crisis intervention in real time (National Institute of Mental Health; Coppersmith et al., 2018). The intervention presents challenges in terms of understanding what it means to be a community member and how it fits within the models of peer- or community-based support, but by outlining these and the potential benefits, we are hopeful that other researchers and organizations can learn from this information and leverage the power and passion of gaming communities to promote mental health and prevent suicide.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because minimal preliminary data is presented here. The full dataset will be made available when the study is complete. Requests to access the datasets should be directed to MCC, mcarras@jhu.edu.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Institutional Review Board of the Johns Hopkins Bloomberg School of Public Health. Written informed consent for participation was not required for this study in accordance with national legislation and institutional requirements.

AUTHOR CONTRIBUTIONS

MCC and AL: conceptualization. MCC and MB: funding acquisition. MCC: investigation, project administration, and writing—original draft. MCC, MB, and AL: methodology, writing—review, and editing. All authors contributed to the article and approved the submitted version.

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The remaining author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Breathing Biofeedback for Police Officers in a Stressful Virtual Environment: Challenges and Opportunities

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As part of the Dutch national science program "Professional Games for Professional Skills" we developed a stress-exposure biofeedback training in virtual reality (VR) for the Dutch police. We aim to reduce the acute negative impact of stress on performance, as well as long-term consequences for mental health by facilitating physiological stress regulation during a demanding decision task. Conventional biofeedback applications mainly train physiological regulation at rest. This might limit the transfer of the regulation skills to stressful situations. In contrast, we provide the user with the opportunity to practice breathing regulation while they carry out a complex task in VR. This setting poses challenges from a technical – (real-time processing of noisy biosignals) as well as from a user-experience perspective (multi-tasking). We illustrate how we approach these challenges in our training and hope to contribute a useful reference for researchers and developers in academia or industry who are interested in using biosignals to control elements in a dynamic virtual environment.

Keywords: biofeedback, virtual reality, stress exposure, user experience, physiological computing

Acute physiological stress impairs performance by causing deficits in motor control, cognition, or perception (Nieuwenhuys et al., 2009; Nieuwenhuys and Oudejans, 2010; Andersen and Gustafsberg, 2016) and can negatively impact mental health in the long term (Maguen et al., 2009). By teaching acute stress regulation, biofeedback could help preserve performance in challenging situations, and lessen the detrimental impact of repeated stress responses (Andersen and Gustafsberg, 2016). Since police are frequently confronted with demanding situations that require quick, high-stakes decisions, police forces, including the Dutch police, recently started introducing biofeedback to their training curricula (van der Meulen et al., 2018). However, the physiological regulation skills are usually exclusively taught at rest which might limit their transfer to stressful situations (Bouchard et al., 2012).

To make physiological regulation skills more robust to degradation under stress, we developed a training that combines biofeedback with a demanding task in virtual reality (VR). VR is increasingly used for stress-exposure training since it offers the opportunity to create immersive and stressful, yet controlled environments (Pallavicini et al., 2016). However, to date, the majority of biofeedback trainings do not leverage the potential of VR (Jerčić and Sundstedt, 2019). While providing a more immersive environment than screen-based biofeedback applications, current VR biofeedback applications require the user to stay relatively motionless and to solely focus on the biofeedback (van Rooij et al., 2016; Rockstroh et al., 2019). In contrast, we provide police with the opportunity to recognize and regulate their physiological stress response *while* they carry out a demanding task in a stressful environment. Specifically, we provide an environment that requires the user to regulate their breathing while making fast decisions based on ambiguous, constantly changing information. We will refer to this kind of biofeedback as stress-exposure biofeedback. The promise of stress-exposure biofeedback has already been demonstrated in a military population, albeit in a non-VR setting (Bouchard et al., 2012).

Compared to conventional biofeedback applications, stress-exposure biofeedback introduces challenges from a technical and user-experience perspective. Here, we summarize and illustrate challenges in three critical areas: (1) the choice of a biofeedback parameter, (2) the implementation of the biofeedback processing, and (3) the biofeedback representation in the virtual environment. We hope to demonstrate the feasibility of stress-exposure biofeedback by illustrating each of these challenges with our implementation. Further, by sharing our experiences, decisions, and considerations we hope to contribute a useful reference for researchers and developers in academia or industry who are interested in using physiological signals to control elements in a dynamic virtual environment.

WHAT IS BIOFEEDBACK?

People are usually not conscious of their autonomic physiology, let alone able to regulate it (Price and Hooven, 2018). Biofeedback reveals internal physiological processes and provides guidance on how to change them, which can reduce anxiety and facilitate coping with stress (Yu et al., 2018; Tolin et al., 2020). In the following, we discuss how a conventional biofeedback application works and then show how it can be adapted for stress-exposure biofeedback.

Let's consider an example of a trainee who is taught to downregulate their heart rate (i.e., the biofeedback parameter, **Figure 1A**). Electrocardiogram electrodes measure the electrical activity of the heart, which is send to a processing unit (**Figure 1B**). The unit estimates the trainee's heart rate and applies a decision criterion that determines if the heart rate increased or decreased compared to the last measurement. The decision criterion is based on a biofeedback target, for example a decrease of 10%. Finally, the biofeedback representation reveals the outcome of the biofeedback processing (**Figure 1C**): for example, a green screen in case of a decrease, a red screen in
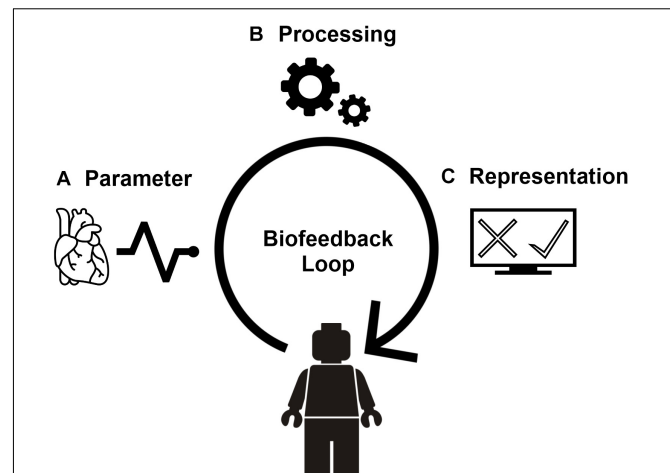
FIGURE 1 | The biofeedback loop. Biofeedback is a form of human-computer interaction which puts the user in a closed real-time loop. We divide this loop in three components that are discussed throughout the paper. First, a biofeedback parameter **(A)** is extracted from a physiological modality. For example, heart rate derived from an electrocardiogram. Second, in a series of processing steps **(B)** the current state of the parameter is evaluated relative to a target state. The processing results in a biofeedback score that expresses how well the parameter's current state matches the target state. The biofeedback score can be qualitative (match vs. no match) or quantitative (degree of matching). Finally, the biofeedback score is translated into a representation **(C)** consisting of (a combination of) visual, auditory, or tactile feedback which can be embedded in a variety of media, such as VR.

case of an increase, or a blue screen if no change occurred. By rewarding the downregulation of the heart rate, the biofeedback system guides the trainee to the target through operant learning (Weerdmeester et al., 2020).

In the calm environments of conventional biofeedback applications, the trainee can fully focus on regulating their physiology to meet the biofeedback target. However, in a more stressful, demanding context, this is no longer possible since the environment might distract the user from the physiological regulation. Additionally, stress-exposure biofeedback poses technical challenges since acquiring and processing physiological signals is more challenging in dynamic conditions compared to resting conditions. That is, stress-exposure biofeedback creates additional demands both for the user and the developer. We will discuss these demands based on our application, in the context of the three challenges mentioned before: (1) the choice of the biofeedback parameter, (2) the real-time processing of the biofeedback parameter (evaluating match with biofeedback target), and (3) the representation of the biofeedback in the training environment.

CHALLENGE 1: CHOICE OF THE BIOFEEDBACK PARAMETER

Prioritizing Controllability

To account for the trainee's divided attention during stress-exposure biofeedback, their control of the biofeedback parameter should be as easy and direct as possible. A variety of physiological

modalities are related to stress and can serve as a basis for a biofeedback parameter, such as electroencephalography, heart rate variability or breathing (Yu et al., 2018; Tolin et al., 2020). These modalities differ in terms of their controllability and one of the easiest-to-control physiological modalities is breathing (Nacke et al., 2011; Parnandi and Gutierrez-Osuna, 2019). This is why we chose breathing rate as our biofeedback parameter, with a biofeedback target of 4 to 12 breaths per minute (Russo et al., 2017), which is considerably lower than human breathing rates under cognitive or physical load (Nicolò et al., 2017; Hidalgo-Muñoz et al., 2019). Slow breathing affects the autonomic nervous system by increasing vagus nerve activity and evoking a shift toward parasympathetic dominance (Russo et al., 2017). This might help regulate physiological arousal in an emotionally or cognitively challenging situation. In summary, breathing seems to offer both controllability and the ability to regulate physiological arousal. We evaluated the controllability of the biofeedback parameter and the achievability of the biofeedback target in a sample of nine police trainers. Each of them completed 10 training sessions over the course of three weeks. Each session lasted about 15 min and was played with or without biofeedback. Sessions with and without biofeedback were alternated in order to get an impression of the transfer of the physiological regulation skill.

The pilot data suggest that the biofeedback parameter is controllable and that the biofeedback target is achievable in a stress-exposure context. We observed that mean breathing rates decrease over sessions (**Figure 2A**, upper panel) and are lower in biofeedback sessions compared to sessions without biofeedback (**Figure 3A**). Many of the mean breathing rates fall within the biofeedback target range of 4 to 12 breaths per minute (e.g., **Figure 3A**). Similarly, participants continuously improve their biofeedback scores over the training sessions (**Figure 2A**, lower panel) and their mean biofeedback scores are higher in biofeedback sessions compared to sessions without biofeedback (**Figure 3B**, see challenge 2 for details on the biofeedback score). Moreover, the decreasing trend in breathing rate and increasing trend in the biofeedback score shown in **Figure 2A** do not seem to merely reflect the participants' habituation to the stressful environment. This is evident by the biofeedback-induced session-by-session fluctuations on top of the decreasing- (**Figure 2A**, upper panel) or increasing trend (**Figure 2A**, lower panel). These fluctuations seem to be an indication that, following biofeedback sessions, participants transfer the physiological regulation skill to subsequent sessions without biofeedback. Finally, we found the session averages of breathing rates and biofeedback scores to be strongly related (**Figure 2B**). This indicates that the biofeedback score is a valid representation of the extent to which participants manage to achieve the biofeedback target.

The Costs of Controllability

However, there are downsides to choosing a biofeedback parameter that is easy to control. As illustrated earlier (**Figure 1**), biofeedback is a form of human-computer-interaction (HCI). The human in the HCI is used to *immediate* and *invariable* control over the computer (Limerick et al., 2014; Attig et al., 2017). If someone presses the "k" key on their keyboard

they expect the letter to appear on the screen instantaneously (immediacy). Also, they expect the letter to always be "k," not "o" occasionally (invariability). Immediacy or invariability cannot be guaranteed in a biofeedback system.

Variability Is More Noticeable

The non-deterministic nature of human physiology introduces variability to the biofeedback system. Consider the example of heart rate downregulation again: At some point the trainee may notice that they can decrease their heart rate by exhaling deeply. However, two identical outbreaths (in terms of duration and depth) don't necessarily produce the same decrease in heart rate. In general, a biofeedback parameter cannot be controlled in a deterministic manner. That is, even if a trainee consistently applies a specific regulation strategy, they will achieve variable outcomes in terms of the behavior of the biofeedback parameter. Variability is a greater challenge for biofeedback parameters that are under more direct control, because the trainee will have a clearer sense of their current physiological state. Consequently, they will more easily notice variability-induced discrepancies between their perceived physiological state and the biofeedback representation.

Delay Is More Noticeable

The biofeedback processing introduces a noticeable delay between the recording of the biosignal and the presentation of the feedback. To get a reliable and accurate estimate of a physiological state, it usually has to be integrated over longer time windows. For example, estimating instantaneous breathing rate requires at least a full breathing cycle and several breathing cycles have to be averaged to obtain a reliable and accurate estimate in the presence of measurement artifacts. Consequently, the biofeedback presented to the trainee will not pertain to their instantaneous physiological state. This can violate the trainee's expectation of immediacy, especially during abrupt shifts in the physiological state. For example, when someone shifts from slow, deep breathing to a markedly faster breathing rhythm or vice versa, the response of the biofeedback representation can appear sluggish.

In summary, stress-exposure biofeedback benefits from a biofeedback parameter that is relatively easy to control. However, controllability comes at the cost of more salient variability and delay. Nevertheless, we think that controllability outweighs these costs especially since both variability and delay can partly be alleviated during biofeedback processing (Challenge 2) and the careful design of the biofeedback representation (Challenge 3).

CHALLENGE 2: IMPLEMENTATION OF THE BIOFEEDBACK PROCESSING

The goal of biofeedback processing is to map the biofeedback parameter to the biofeedback representation. This involves two steps: First, the current state of the biofeedback parameter (e.g., breathing rate) has to be estimated. Second, the extent to which the current state of the biofeedback parameter approaches the biofeedback target has to be evaluated (e.g., breathing rate
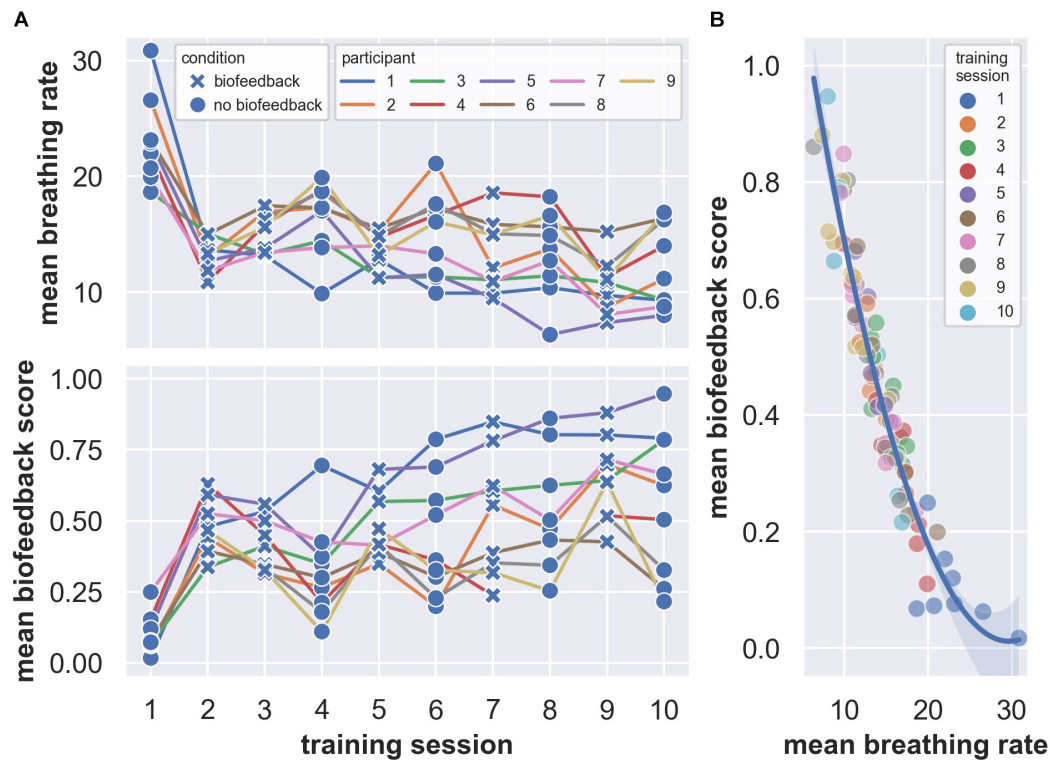
FIGURE 2 | Mean breathing rates **(A, upper panel)** and biofeedback scores **(A, lower panel)** over training sessions (alternating with and without biofeedback). **(B)** Quadratic fit characterizing the relationship of the session means of breathing rate and biofeedback score. The shaded region indicates a bootstrapped 95% confidence interval for the quadratic fit.

between 4 and 12 breaths per minute). Based on how closely the trainee matches the target, we then compute a biofeedback score that is ultimately reflected in the biofeedback representation (see Challenge 3). **Supplementary Material 1** contains details on the hardware and software used for the biofeedback processing.

Estimating the Current State of the Biofeedback Parameter

The first processing step is to estimate the current breathing rate from the raw data, which comes from a breathing belt around the trainee's lower abdomen. The raw data contains a phasic pattern with inhalation peaks and exhalation troughs, and conceptually, the instantaneous breathing rate is based on the temporal difference between moments of the same phase (e.g., inhalation peaks or exhalation troughs). **Supplementary Material 2** contains a detailed description of how we estimate breathing rate.

Unfortunately, the raw sensor data does not exclusively reflect the dynamics of the biofeedback parameter. Instead, it contains artifacts that can originate from the measurement environment or unrelated physiological activity. For example, our breathing belt tracks breathing by measuring changes in torso circumference. However, since the trainee is standing and moving their upper body, the data contains movement artifacts that are in the same frequency range as (fast) breathing and cannot easily be filtered out (**Supplementary Material 2** and **Supplementary**

Figure 4). Regardless of the physiological modality, artifacts tend to be more prevalent in stress-exposure biofeedback compared with biofeedback at rest and from a user-experience perspective they contribute to both the problem of variability and delay (see Challenge 1).

Artifacts increase variability, which can frustrate the trainee because it can make the biofeedback target seem unattainable. This problem can be alleviated by making the biofeedback target less specific. When the target range is narrow (e.g., breathing at 6 breaths per minute), the estimated breathing rate will more often be "off target" due to artifacts. In contrast, when the target range is broader, the influence of artifacts is less perceptible since the wider margin compensates for artifact-induced variability in the estimated breathing rate. However, if the target range is too broad the training goal can lose specificity from a user's perspective.

Additionally, artifacts can increase delay. The presence of artifacts makes estimating the breathing rate from a short segment of data unreliable due to a low signal-to-noise-ratio. To increase the signal-to-noise-ratio, longer segments need to be processed (Hassan and Anwar, 2010). However, this means that at each point in time, the current estimate of the breathing rate and corresponding biofeedback representation do not exclusively reflect the most recent physiological state. Therefore, there is a trade-off between delay and the reliability of the biofeedback: More reliable estimates of breathing rate from longer segments come at the cost of more delay. A good compromise between
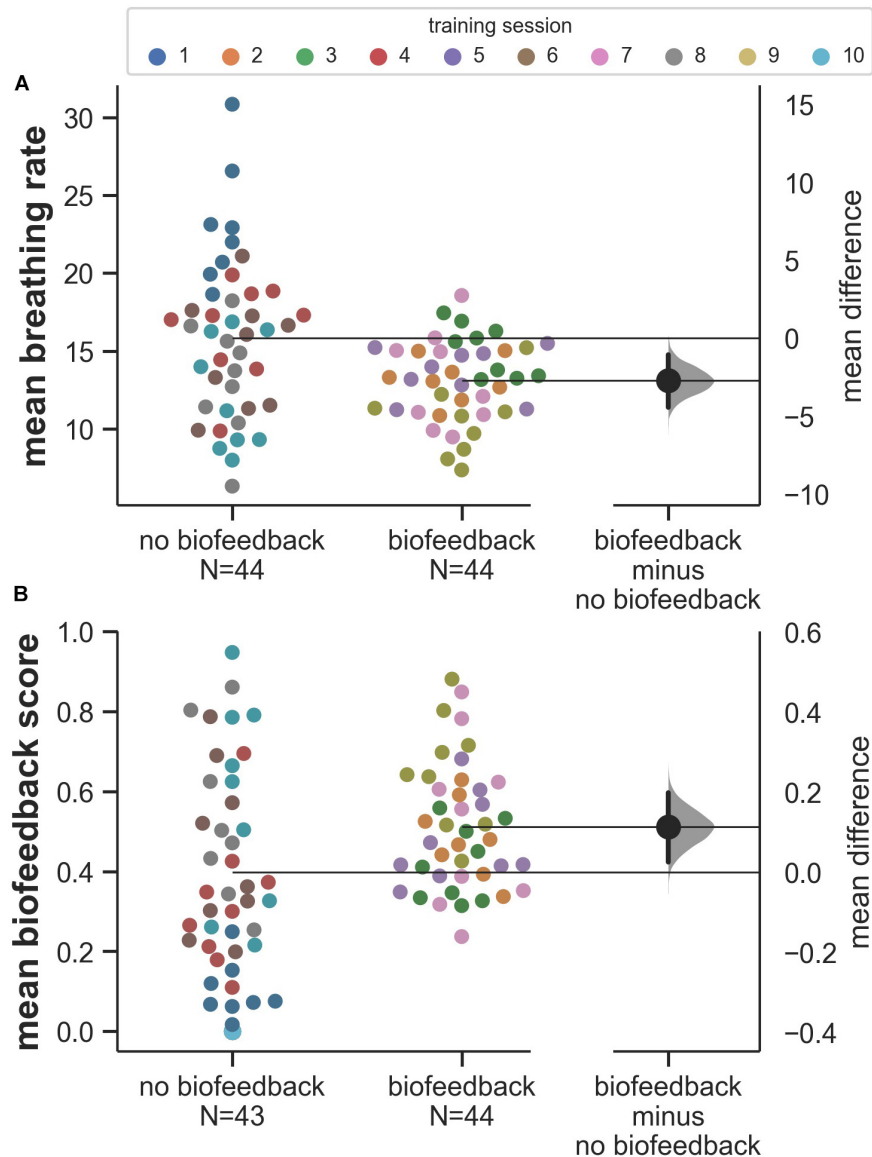
FIGURE 3 | Comparison of mean breathing rates **(A)** and biofeedback scores **(B)** in sessions with and without biofeedback. In sessions without biofeedback, the biofeedback score was computed and recorded but did not affect the game. The distributions on the right side of panels **(A,B)** display bootstrapped 95% confidence intervals for the mean differences between the conditions (Ho et al., 2019). Note that the condition differences are mainly driven by the first training session.

reliability and delay allows for a reliable estimation of the biofeedback parameter from a technical perspective, while still feeling relatively responsive to changes in the biofeedback parameter from a user's perspective.

Comparing the Current State of the Biofeedback Parameter to the Biofeedback Target

In a second step, the biofeedback processing quantifies how much the current state of the biofeedback parameter matches the biofeedback target. This matching is then expressed quantitatively (e.g., percentage) or qualitatively (e.g., binary)

in the form of a biofeedback score. The computation of the biofeedback score can differ widely between biofeedback applications. However, regardless of the specific application, the computation of the biofeedback score presents the developer with seemingly small choices regarding algorithmic parameters that can profoundly influence the user experience. For example, related to our application, we already mentioned choosing the upper and lower bound of the biofeedback target range. We illustrate additional parameter choices related to the computation of the biofeedback score in **Supplementary Material 2**. Making these choices based on iterative user testing is crucial to ensure a satisfactory user experience (Scholten and Granic, 2019). User testing

is greatly facilitated by the ability to visualize the raw data and intermediate processing steps as well as the ability to adjust parameters in real-time. Therefore, we implemented a dashboard that allowed us to fine-tune the biofeedback processing in real-time to immediately experience the effects of different parameter settings (**Supplementary Material 2** and **Supplementary Figure 3**).

CHALLENGE 3: BIOFEEDBACK REPRESENTATION IN THE VIRTUAL ENVIRONMENT

Finally, the biofeedback score needs to be presented to the trainee in a meaningful and intuitive way. In our virtual environment, the trainee finds themselves at the center of a poorly lit parking garage where they are surrounded by zombies that can either be benign or hostile, which is indicated by their eye-color or body shape (**Supplementary Material 3** and **Supplementary Figure 5**). These indicators change several times throughout the training, which is announced via radio dispatch calls that mimic a suspect description. The trainee has to shoot the hostile zombies while leaving the benign zombies unharmed. In collaboration with our advisors at the Dutch police, we made an effort to steer clear of the "shoot 'em up" genre of video games (i.e., reflexive shooting at uniformly hostile adversaries) by designed the shooting task such that the player is primed to make, careful, deliberate shooting decisions. Additionally, the task engages behaviors that are universally relevant to police: The trainee has to rely on good situational awareness, be constantly vigilant to changes in information, and be able to override response biases by flexibly incorporating these changes in their decisions (Di Nota and Huhta, 2019). At the same time, by eliciting police-relevant behavior in an overtly fictional environment, we sidestep the necessity to simulate realistic police incidents and avoid overtraining the officers to idiosyncratic elements of a realistic simulation (Michela et al., 2019).

In this environment the biofeedback representation needs to be as salient and intuitive as possible, since regulating physiology becomes part of a multi-tasking exercise. The player has to allocate cognitive resources to both the decision task as well as the physiological regulation, which can worsen performance on both tasks (Wickens, 2002). Additionally, high task demands in a multitasking context can increase heart- and breathing rates (Fairclough et al., 2005). Together, these findings suggest that deliberate physiological regulation may be especially challenging in a multitasking context. Further, the multi-tasking bears the danger that the biofeedback is misattributed to behavior instead of the physiological regulation. For example, the trainee might attribute a poor biofeedback score to shooting a benign zombie rather than their fast breathing. This misattribution can be prevented by presenting the biofeedback such that it intuitively represents physiology in the task context. We use the analogy of tunnel vision which is relatable for Dutch police since they are introduced to this concept during their academy training (van der Meulen et al., 2018). **Figure 4** illustrates

how the trainee's peripheral vision widens as the breathing gets slower and deeper.

This is particularly salient since the decision task requires the trainee to monitor all 360° of their surroundings, which makes losing peripheral vision costly. The tunnel vision is amplified by modulating the brightness of environmental lights. In general, the biofeedback representation should intuitively fit into the context and training goals of the application to facilitate immersion and engagement. This can lead to fundamentally different representations of the same biofeedback parameter. For example, DEEP, another breathing biofeedback training in VR, teaches the user to leverage their exhalation to propel themselves forward and their inhalation to float upward in a virtual underwater environment (van Rooij et al., 2016).

Moreover, to ease multi-tasking, the biofeedback representation should only interfere with game play if this is intended (such as the tunnel vision), not for ergonomic reasons such as graphs that are placed inconveniently in the trainee's field of vision. In the same vein, we chose to not include a more explicit biofeedback representation such as the commonly used statistical graphs (Sun et al., 2017) to avoid burdening the trainee with monitoring yet another element in the environment.

Another crucial element of the biofeedback representation is its stepwise introduction. Before the trainee enters our multitasking environment, they are guided through a breathing tutorial that gradually introduces them to the regulation skill. The trainee starts with a breathing exercise that requires them to breathe along with a visual pacer (**Supplementary Material 3** and **Supplementary Figure 6A**). Once they feel comfortable with the breathing skill, we demonstrate the effects of the breathing regulation. This demonstration includes an explicit component (bar graph) providing clear feedback on the current physiological state as well as the more implicit environmental effects described earlier (tunnel vision and environmental lights) (**Supplementary Material 3** and **Supplementary Figure 6B**). Note that the latter are implicit only in terms of the concrete representation, not in terms of saliency. Once the trainee has a good understanding of how their breathing affects the environment, we remove the bar graph and they practice the regulation skill in a simplified version of the decision task (**Supplementary Material 3** and **Supplementary Figure 6C**) before entering the full-fledged training. The gradual introduction of the regulation skill in progressively more challenging contexts avoids overwhelming the trainee with the demands of multi-tasking and is believed to facilitate skill transfer (Driskell and Johnston, 1998; Driskell et al., 2001).

Lastly, in designing the biofeedback representation, it is helpful to know the behavior of the biofeedback parameter as early as possible. This includes being familiar with its temporal dynamics as well as extreme patterns. Regarding the latter, it is useful to account for the possibility that trainees "get stuck" in a physiological state and consequently struggle to meet the biofeedback target. In this scenario, it is important for the biofeedback representation to be designed such that the trainee can still function in the environment. For example, in our environment the trainee always retains a minimum of visibility even with the worst biofeedback score (see **Figure 4**).
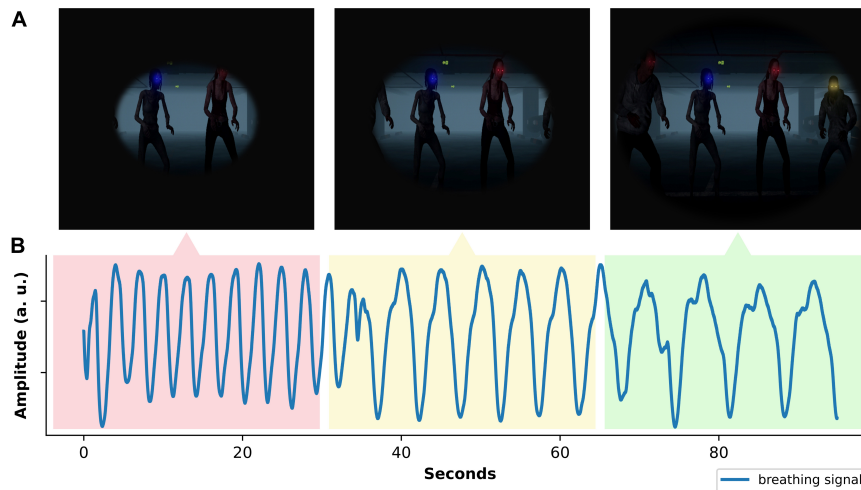
FIGURE 4 | Biofeedback representation and its relation to breathing. The peripheral vision in the VR headset **(A)** responds to the user's breathing rate. **(B)** Shows the raw breathing signal of a user who transitions from a fast breathing rate to a slower breathing rate that matches the biofeedback target more closely.

DISCUSSION

Designing and implementing a stress-exposure biofeedback training requires a re-thinking of conventional biofeedback training. This introduces challenges around (1) the choice of a biofeedback parameter, (2) the biofeedback processing, and (3) the representation of the biofeedback. We examined these challenges from both a technical as well as a user-experience perspective and illustrated the feasibility of stress-exposure biofeedback with examples from a breathing-based stress regulation training for police.

We highlighted the importance of controllability of the biofeedback parameter as well as the attainability of the biofeedback target. Additionally, we showed how seemingly small algorithmic decisions during the real-time computation of the biofeedback can have far-reaching consequences for the user experience, and emphasized the importance to arrive at these decisions during iterative user testing. Finally, we point out the relevance of a salient, intuitive biofeedback representation that is introduced gradually, and tailored to the task context and goals.

In demonstrating the feasibility of stress-exposure biofeedback, we hope to advance this biofeedback paradigm and to help pave the way for studies that explore its potential to diminish the short- and long-term consequences of repeated stress-exposure. Above all, we hope this paper and its **Supplementary Material** provide a useful reference for developers and researchers in academia or industry who are interested in using physiological signals to control elements in a dynamic virtual environment.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee Faculty of Social

Sciences, Radboud University, Nijmegen, Netherlands. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

AUTHOR CONTRIBUTIONS

JB wrote the manuscript, conceptualized and implemented the biofeedback, and analyzed the pilot data. RO conceptualized and implemented the IT infrastructure (software and hardware) for the biofeedback. RO and FK supervised the implementation of the biofeedback. JB, JP, MR, FK, AM, IG, KR, and WD conceptualized the VR environment and decision task. WD coordinated the pilot data collection. AM planned and conducted the pilot data collection. All authors reviewed and contributed to the manuscript.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg. 2021.586553/full#supplementary-material

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Game Transfer Phenomena and Problematic Interactive Media Use: Dispositional and Media Habit Factors

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The study of the effects of interactive media has mainly focused on dysregulated behaviors, the conceptualization of which is supported by the paradigms of addiction. Research into Game Transfer Phenomena (GTP) examines the interplay between video game features, events while playing, and the manipulation of hardware, which can lead to sensory-perceptual and cognitive intrusions (e.g., hallucinations and recurrent thoughts) and self-agency transient changes (e.g., automatic behaviors) related to video games. GTP can influence the interpretation of stimuli and everyday interactions and, in contrast to gaming disorder, are relatively common and not necessarily negative. However, some players have reported feeling distress due to their GTP. This study focuses on how dispositional and interactive media habit factors are related to GTP and two forms of problematic interactive media [problematic video game playing (PVG) and problematic social media use (PSMU)]. A sample of 343 university students who played video games completed an online survey (58.7% male, 19–25 years old). Not all who had experienced GTP were identified as exhibiting PVG or PSMU, but all of those in the PVG group had experienced GTP. Overall, the profiles of the groups, including GTP (91.4%), PVG (28.5%), and PSMU (24.8%), were in accordance with previous findings. Those in the GTP and the PVG groups were characterized by being male, being highly engaged in the game (either while playing or *via* game-related activities), and showed preferences for game-related activities. However, while those in the GTP group were significantly more likely to be fantasy-prone, those with PVG were the ones who played most per day. Those in the PSMU group were characterized by being female and/or extroverted, frequently using social/sharing platforms, and seldom playing video games. A hierarchical binary logistic regression revealed that males were more likely to experience GTP. Increases in PVG, fantasy proneness, and neuroticism increased the odds of GTP. Future work can benefit from considering the role of GTP in gaming disorder, since intrusive thoughts, cognitive biases, and poor impulse control are pivotal in the initiation and maintenance of dysfunctional playing behaviors.

Keywords: Game Transfer Phenomena, problematic video game playing, problematic social media use, gaming disorder, personality traits, fantasy proneness, gaming habits, game engagement

INTRODUCTION

Playing video games and using social media can provide benefits such as informal learning, enabling creativity and self-expression, and belonging (Collin et al., 2011; Hall et al., 2012; Griffiths et al., 2017); on the other hand, they also tend to be associated with problematic use (Andreassen, 2015; Buono et al., 2020). The unhealthy and pathological use of interactive media has mainly been investigated with a focus on dysregulated use as supported by paradigms of addiction (Kuss and Griffiths, 2012; Billieux et al., 2019; Montag et al., 2019). The emerging area of research into Game Transfer Phenomena (GTP) examines the interplay between video game features, in-game experiences, and the manipulation of hardware, which can lead to sensory-perceptual and cognitive intrusions (e.g., hallucinations and recurrent thoughts) and self-agency transient changes (e.g., automatic behaviors) in relation to video games (Ortiz de Gortari, 2019b). It is only recently that GTP has started to be contextualized into research on gaming disorder to explain thought intrusions related to game content, reactivity to game-related cues, dissociation, and players' distinctive relationships with their avatars (Ahn et al., 2015; Cudo et al., 2020; Stavropoulos et al., 2020). Gaming disorder (GD) only affects a small minority of individuals (Kardefelt-Winther et al., 2017; Przybylski et al., 2017). The worldwide prevalence of GD are 3.05% (Stevens et al., 2020) and can lead to clinically significant impairment or distress (Kuss and Griffiths, 2012; Montag et al., 2019). GTP is, in contrast to GD, relatively common and does not necessarily involve negative consequences, although distress and risks have been associated with GTP (Ortiz de Gortari et al., 2011, 2016; Ortiz de Gortari, 2019b). The prevalence rate of GTP (having experienced at least one instance of GTP) is estimated to range between 82 and 96% in studies conducted with international samples ($N > 6,000$, 15–60 years old) (Ortiz de Gortari, 2017; Dindar and Ortiz de Gortari, 2017; Ortiz de Gortari and Griffiths, 2016b).

This paper examined and compared GTP with two forms of problematic media use [i.e., problematic video game playing (PVG) and problematic social media use (PSMU)].

LITERATURE REVIEW

Game Transfer Phenomena

Game transfer phenomena is in the continuum between everyday involuntary phenomena (e.g., auditory or visual imagery) to unusual phenomena that are commonly linked with psychopathology (e.g., hallucinations, obsessive thoughts, dissociations) (Ortiz de Gortari, 2019a). Participants in studies on GTP have consisted of non-clinical samples (i.e., no clinical diagnosis or drug use) from the general population who have not been identified as having a gaming disorder. The existing studies have not been attached to specific video game genres, although research has been conducted on specific mobile augmented reality games (Sifonis, 2018; Ortiz de Gortari, 2019a).

Game transfer phenomena has mainly been reported in awake states after playing, but it has also been experienced when trying to fall asleep (Ortiz de Gortari and Griffiths, 2016b).

Experiments have shown that playing video games can lead to replays of the game manifesting as images or sounds during the onset of sleep (Wamsley et al., 2010; Kusse et al., 2012). Interestingly, hypnagogic images have even been reported by amnesic patients, suggesting that implicit memory (information acquired unconsciously) rather than explicit memory (conscious and intentional recollection) mediates these forms of GTP (Stickgold et al., 2000).

Game transfer phenomena has mainly been reported *after* playing, but in some circumstances and for certain games, players have reported experiencing GTP *while* playing (Ortiz de Gortari and Griffiths, 2016b). This is particularly true for augmented reality games that require switching between the virtual and the real world (Sifonis, 2018; Ortiz de Gortari, 2019a). However, GTP should not be confused with subjective phenomena that occur while playing, such as immersion, flow, and subjective presence in the virtual world, or losing track of time that some have conceptualized as game engagement (Brockmyer et al., 2009).

In most cases, GTP is not associated with negative consequences and tends to be appraised by players as pleasurable experiences (Ortiz de Gortari and Griffiths, 2016b). Positive and even therapeutic uses of GTP have been proposed (Ortiz de Gortari, 2018), including the potential to induce GTP to interfere with distressful thoughts or images due to traumatic events (Ortiz de Gortari and Griffiths, 2016a). However, a large number of those who have experienced GTP in several forms frequently reported distress and dysfunction (Ortiz de Gortari et al., 2016). GTP has also been reported to provoke confusion and sleep deprivation, and it has been associated with risk-taking behaviors (Ortiz de Gortari and Griffiths, 2013, 2014). It is not clearly understood when GTP can be hazardous. According to Ortiz de Gortari (2019b), the potential for GTP to become problematic depends on a number of different factors: (i) the individual's interpretation of their GTP experience (e.g., recognizing GTP as a consequence of playing rather than casting doubts about mental stability); (ii) the frequency and duration (e.g., many times per day, once per week, or for hours or seconds); (iii) the perceived location of the images and sounds, which can be either inner or outer phenomena (e.g., hearing sounds in the head as opposed to hearing sounds coming from somewhere else); (iv) the circumstances where GTP occurred (e.g., in compromised situations such as driving or while lying in bed); (vi) how the individual acts when experiencing GTP (e.g., getting distracted from the task at hand, acting out toward game-related stimuli, which, under certain circumstances such as driving, can be dangerous); and (vi) the content of the experience (e.g., seeing abstract video game shapes or realistic video game content or hearing an aversive or soothing sound).

Problematic Media Use

Problematic online behaviors and activities are usually examined from two different approaches (Davis, 2001; Montag et al., 2015). Problematic use of media not concerning any specific online activity is referred to as Generalized Problematic Internet Use or Generalized Problematic Media Use. The second approach focuses on specific online behaviors (Laconi et al., 2015), such

as online gambling, cybersex, and shopping, as well as playing online video games or using social networking sites that are examined in the current study.

Gambling addiction is the only non-substance addictive behavior recognized in the fifth revision of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013). "Internet Gaming Disorder" is included as a condition that requires further study. More recently, PVG, referred to as Gaming Disorder, received recognition by the World Health Organization (WHO) (2018) in the 11th Revision of the International Classification of Diseases (ICD-11). Therefore, caution is warranted to distinguish actual Gaming Disorder, which is characterized by a sum of symptoms endured for a sustained period of time that evolve into dysfunction from high engagement (e.g., frequent playing without presenting a problematic outcome), and to distinguish Gaming Disorder from transient or episodic periods of intense playing that can become problematic (Kardefelt-Winther et al., 2017; Billieux et al., 2019; Männikkö et al., 2020).

In terms of characteristics, playing video games and using social media differ substantially, even though some social media sites include video games, and many video games have a social component (e.g., Xbox live). For instance, playing video games requires focusing on earning rewards, mastering challenges, visual–motor coordination, involvement in fantasy, detachment from reality, and sometimes socializing (Ortiz de Gortari and Griffiths, 2017). In contrast, social media use involves communication; sharing thoughts, photos, and videos; consuming information; and sometimes playing social games.

The preference for different kinds of media and activities according to different individual profiles is thus expected. Differences have been established in terms of dispositional characteristics between video game players and avid social network users. Video game players tend to be males, although in recent years, more females have started to play video games (Lopez-Fernandez et al., 2019). Males usually have more problems with their video game playing, while females are usually more active social media users.

While video game players are usually considered tech-savvy, introverted, interested in sensation seeking, desiring to escape from reality, and fantasy-prone (Mehroof and Griffiths, 2010; Ballabio et al., 2017), social media users tend to be apprehensive about real life, be more involved in others' lives, and compare their own lives with others (Lopez-Fernandez, 2018).

Problematic playing and gaming disorder have been connected with a variety of personality traits, including neuroticism, high impulsivity, and high aggressiveness (Gervasi et al., 2017) while also being negatively associated with extroversion, openness to experience, agreeableness, and conscientiousness (Montag et al., 2011). PSMU has been shown to be positively correlated with neuroticism and extroversion (Andreassen et al., 2012).

Aim and Study Justification

To date, little is known about the dispositional factors involved in experiencing GTP and their relationship with the problematic use of other interactive media. Therefore, for the first time, this study explores the interrelationship and areas of overlap between GTP and two forms of problematic media use, herein referred to as PVG and PSMU. This study mainly focuses on examining those personality traits that reflect attitudes, behaviors, feelings, and thoughts that have been found to increase one's vulnerability to problematic media use (Montag et al., 2011; Collins et al., 2012). A further objective is the examination of the habits that are intrinsic to the use of interactive media, such as consumption patterns (e.g., time spent playing and frequency of playing), engagement during playing, and preferences for game-related activities. The following specific research questions are addressed:

(1) Is GTP associated with PVG and PSMU, and what is their prevalence in the sample? Evidence suggests that there is a relationship between GTP and PVG (Ortiz de Gortari et al., 2016), but the relationship between PSMU and GTP has not previously been investigated.

(2) Which video game and social media habits can be observed among those who have experienced GTP and have PVG or PSMU? Spending excessive time playing video games and using social media are core characteristics of PVG and PSMU, respectively. However, excessive playing time appears not to be needed to experience GTP (Ortiz de Gortari, 2019a).

(3) Does engagement in a game differ for those who have experienced GTP as opposed to those who have PVG or PSMU? Game engagement has been conceptualized in different ways. Some consider it to be the subjective experience that involves flow, absorption, immersion, and presence (Brockmyer et al., 2009); this is best understood as engagement while playing. Others understand game engagement as a person's commitment to his or her gaming activities beyond the gameplay itself (e.g., reading about video games, talking with friends about games, or preferring playing over other activities) (Becerra, 2012). To be engaged in a game also defines those players who only exhibit the primary peripheral criteria of a gaming disorder, such as salience, tolerance, and mood modification rather than conflict, withdrawal, relapse, and other problems due to playing (Charlton and Danforth, 2007; Krossbakken et al., 2018).

(4) Is gender associated with GTP, PVG, or PSMU, and if so, which gender is predominant among those who have experienced GTP compared to those who have PVG or PSMU? Most studies have found no association between gender and GTP (Ortiz de Gortari and Griffiths, 2016b; Dindar and Ortiz de Gortari, 2017; Ortiz de Gortari, 2017). However, one study conducted on a mobile phone augmented reality game showed that females were more likely to experience GTP (Sifonis, 2018). Furthermore, males have been found to be more vulnerable to PVG (e.g., Kuss and Griffiths, 2012), while females are more likely to be at risk of PSMU (e.g., Andreassen et al., 2016).

(5) Which personality traits characterize those who have experienced GTP or have PVG or PSMU? Certain personality traits, such as openness to experiences and fantasy proneness, have been suggested to be relevant for GTP (Ortiz de Gortari et al., 2016). Problematic playing has been associated with different personality traits than

PSMU (Montag et al., 2011; Andreassen et al., 2012; Gervasi et al., 2017).

Problematic media use is examined in this paper considering patterns of behaviors that involve conflict and dysregulated use of media, but which do not necessarily connote a severity of clinical relevance. The findings should be interpreted as pointing to *a risk* of developing PVG and PSMU; thus, this study avoids erroneous inflation of problems associated with interactive technologies.

MATERIALS AND METHODS

Participants

A total of 481 participants completed an online survey on playing video games and social media use. Participants who did not play video games were excluded. The final sample consisted of 343 respondents. Of these, 58.7% were male and 41.3% were female. Most participants were 19 years old or younger (49%), with the next largest group being those 20–25 years old (46.6%). Most stated that they were single (73%). All participants were students at a western Canadian university who received course credit for their participation.

Procedure

After informed consent was obtained, which was developed in accordance with the requirements of the ethics committee of the university, respondents were asked to provide three demographic pieces of information: gender, age, and marital status. Questions and scales about media consumption, video game engagement, individual characteristics, and dream-related information were included in the main part of the survey. The online survey was available for student participation over the entire academic year 2017–2018. The measures used to answer the research questions of the study are described below.

Materials

The Game Transfer Phenomena Scale (GTPS) is a 20-item Likert-type scale of frequency with responses ranging from 1 ("never") to 5 ("all the time") (Ortiz de Gortari et al., 2015). The subscales included Altered Perceptions Modality, which is subdivided into visual, auditory, and body sensory perceptions (e.g., "I have visualized or seen video game images with closed eyes" or "I have heard sounds, music, or voices from the game"); the Automatic Mental Processes Modality (e.g., "I have thought about using something from a video game in real life"); and the Actions and Behavior Modality (e.g., "I have sung, shouted, or said something from a video game in real life without intending to do so"). Based on previous studies (Ortiz de Gortari and Griffiths, 2016b; Dindar and Ortiz de Gortari, 2017), a composite score was calculated as the sum of the GTP items. Reporting at least one GTP item was considered having experienced GTP. The overall Cronbach's alpha for the 20-item scale in the present study was 0.938, and the McDonald's omega was 0.939.

The Problem Video Game Playing Questionnaire (PVGQ) is a nine-item scale scored with "yes" or "no" responses that was developed to assess PVG (Tejeiro Salguero and Morán, 2002)

based on criteria borrowed from pathological gambling and substance dependence in the DSM-IV (APA, 2000). This was one of the first validated scales to measure PVG that was initially developed for adolescents but then used with the general adult population. The items measure various components of addiction, such as preoccupation, tolerance, loss of control, withdrawal, escape, lies and deception, disregard of physical or psychological consequences, and family/school/work disruption. Certain items are explicitly related to conflicts due to playing, such as the following: "In order to play video games, I have skipped classes or work, lied, stolen, or had an argument or a fight with someone." Other items assess what has been considered as losing control: "I have tried to control, cut back or stop playing, or I usually play with the video games over a longer period than I intended" or "I spend an increasing amount of time playing video games." Tejeiro Salguero et al. (2012) recommended a cutoff point of 4 to be considered having PVG. However, some authors have argued a cutoff point of 4 to be inadequate. Hart et al. (2009) did not find evidence of problematic playing when using 4 as cutoff point. Moreover, some authors have argued that half or more of the diagnostic criteria should be met to be classified with problematic playing (Lemmens et al., 2009). In this study, a cutoff point of 5 was used to determine PVG, as suggested by Lopez-Fernandez et al. (2014). The Cronbach's alpha of this measure for this study was 0.713; the McDonald's omega was 0.721.

The Questionnaire on Video Game Consumption Habits (VGCH) consists of a 24-item questionnaire to measure video game consumption habits and general preferences for video games (Becerra, 2012), including degrees of attraction to video games, concerns about video games, and academic and non-academic interferences. The questionnaire includes single categorical items about video game consumption such as the experience of playing video games, the frequency of playing, and daily playing time. The questions about the number of video games played and name of the favorite game were excluded in the current study. The questionnaire also includes 19 items measured with a 5-point Likert-type scale of agreement. Examples of the items included "Video games seem fun," "I go to bed late, and I get up early to keep playing," "I save money to spend on video games," or "I talk to my friends about video games." Other items determine a participant's preferences for playing over other activities, with some items overlapping with those in the PVG measure to a certain degree, such as the following: "I dedicate more time to video games than to doing homework" and "I dedicate more time to video games than to being with my family." Moreover, some items measure flow and immersion (e.g., "When I play video games, time flies"). Cronbach's alpha of the 19 items for this study was 0.954; the McDonald's omega was 0.933.

The Bergen Social Media Addiction Scale (BSMAS) takes portions of a previous scale, the Bergen Facebook Addiction Scale (BFAS) (Andreassen et al., 2016), as, over the years, social networking has had a drastic increase in different media. No longer is social networking equated with Facebook, since there are now other popular media platforms, including Twitter, Instagram, and Pinterest. The six-item scale reflects six "addiction elements" (salience, mood modification, tolerance, withdrawal, conflict, and relapse) reported by the participant regarding social

media usage in the previous year. Participants answer on a 5-point scale, with responses ranging from 1 ("very rarely") to 5 ("very often"). The items include questions such as the following: "How often during the last year have you used social media to forget about personal problems?" A score over 19 was considered the cutoff point for being classified with PSMU based on Bányai et al. (2017). The Cronbach's alpha for this study was 0.811; the McDonald's omega was 0.815.

Additionally, a total of nine different types of applications were included in the questionnaire, although only eight applications received enough participant data to be part of the analyses of frequent use of social media and sharing platforms such as Facebook, YouTube, and Instagram (MUF) (Gackenbach et al., 2016).

The Game Engagement Questionnaire (GEQ) is a 19-item scale (Brockmyer et al., 2009) that was developed to indicate how the participant perceives the reality around them while they are playing video games. The scale can be used with any video game genre, but it focuses explicitly on measuring absorption in the video game and dissociation from reality. Responses are provided in the form of "yes" or "no" answers to questions like "I lose track of time [while playing video games]" or "I don't answer when someone talks to me [while playing video games]." Total scores were computed by summing up the response scores. The Cronbach's alpha for this study was registered at 0.855; the McDonald's omega was 0.857.

The Big Five Inventory (BFI) is a scale with 44 items that are used to determine which traits a participant has that ultimately determine the extent the Big Five Factors play a part in their personality (John and Srivastava, 1999). On a scale from 1 ("strongly disagree") to 5 ("strongly agree"), participants are to respond to various statements about what they can observe about themselves in certain situations. The following are examples of these statements: "I am someone who does a thorough job" or "I am someone who starts quarrels with others." Total scores were computed by summing up the response scores per personality trait. Cronbach's alpha for this study was 0.702; the McDonald's omega was 0.703.

The Creative Experiences Questionnaire (CEQ) was developed as a 25-item questionnaire scored with "yes" or "no" responses to determine fantasy proneness (Merckelbach et al., 2001). Sample questions include the following: "Many of my fantasies have a realistic intensity" and "When I think of something cold, I actually get cold." The researcher can determine the participant's fantasy proneness based on his or her responses. Some items of the questionnaire deal with "intense elaboration of and profound involvement in fantasy and daydreaming," while others address the "consequences of fantasizing." A composite score was computed based on the sum of the items. Cronbach's alpha for this study was 0.720; the McDonald's omega was 0.712.

Statistical Analysis

The statistical analysis was performed using the SPSS package (SPSS 26 for Windows; SPSS Inc., Chicago, IL, United States). Bivariate and multivariate statistics using non-parametric and parametric tests were performed. Multiple imputations were

TABLE 1 | Chi-square of GTP, PVG, and PSMU on demographics.

	GTP %	No GTP %	χ^2	df	Effect size [b]	PVG %	No PVG %	χ^2	df	Effect size [b]	PSMU %	No PSMU %	χ^2	df	Effect size [b]
Gender	n = 296	n = 28	7.792**	1	0.16	n = 94	n = 237	19.062***	1	0.11	n = 82	n = 251	5.119*	1	0.10
Male	59.5	32.1				77.7	51.5				47.6	61.8			
SR[a]	(0.5)	(−1.7)				(2.4)	(−1.5)				(−1.3)	(0.7)			
Female	40.5	67.9				22.3	48.5				52.4	38.2			
SR	(−0.6)	(2.0)				(−2.8)	(1.8)				(1.5)	(−0.9)			
Age	n = 298	n = 28	2.560	2		n = 95	n = 238	3.701	2		n = 83	n = 252	3.025	2	
19 years or younger	50.3	35.7				48.4	50.0				53.0	47.6			
SR	(0.3)	(−1.0)				(−0.2)	(0.1)				(−0.5)	(−0.3)			
20–25 years	46.0	57.1				50.5	44.5				45.8	46.8			
SR	(−0.2)	(0.8)				(0.6)	(−0.4)				(−0.1)	(0.1)			
26 years or older	3.7	7.2				1.1	5.5				1.2	5.6			
SR	(−0.3)	(0.8)				(−1.5)	(0.9)				(−1.4)	(0.8)			

*p < 0.05, **p < 0.01, ***p < 0.001.
[a]Standarized Residual.
[b]Effect size = Cramer's V.
GTP, Game Transfer Phenomena; PSMU, problematic social media use; PVG, problematic video game playing.

computed to analyze the patterns of the missing data. The missing data were completely random and below 2%. The missing cases were not imputed since a rate of 5% or less had been found to be inconsequential, and statistical analyses are considered to be biased with 10% missing data (Dong and Peng, 2013). Preliminary analyses ensured that there was no violation of the assumptions in each of the tests performed. In order to compare each pair of the groups, including GTP/No GTP, PVG/No PVG, and PSMU/No PSMU, dichotomous variables were created for GTP based on having experienced GTP at least once (Ortiz de Gortari and Griffiths, 2016b) and at the recommended cutoff points for classifying participants as having PVG and PSMU, respectively (Tejeiro Salguero et al., 2012; Bányai et al., 2017). Spearman rank-order correlations and Mann–Whitney U tests were used with non-normal distributed continuous variables, and chi-square (χ^2) tests were used for categorical variables. The last step consisted of performing a hierarchical binary logistic regression for GTP. All statistics were two-tailed with a 0.05 level of significance, and the effect sizes were computed. A Bonferroni correction was applied to obtain an adjusted p-value. The original alpha level (0.05) was divided by the number of tests performed in each t-test, and the categories in the chi-square test. Bonferroni correction has been recommended when a large number of tests are conducted without preplanned hypotheses previously collected for the data and for protection against Type I error (Armstrong, 2014).

RESULTS

Prevalence and Interplay Between Game Transfer Phenomena, Problematic Video Game Playing, and Problematic Social Media Use

Most participants had experienced at least one instance of GTP (91.3%, n = 298); 86% had experienced more than one type of GTP, and 71.1% had experienced five or more different types of GTP (based on the 20 items of the GTP). The types of GTP reported by at least half of the sample were hearing music from a video game (69.4%), seeing or visualizing images (74.3%), thinking about using something from a video game in real life (61.4%), misinterpreting sounds (59.7%), wanting or feeling the urge to do something in real life after seeing something that reminds one of the video game (55.6%), and hearing sounds from a video game (55.1%). The least common type of GTP was mixing up video game events with actual real-life events (21.4%).

Correlation coefficients showed only a strong positive correlation between GTP and PVG [rs(318) = 0.51, p < 0.001]. No correlation was found between GTP and PSMU or between PVG and PSMU. Almost one third were classified with PVG (28.5%, n = 95) and one in four with PSMU (24.8%, n = 136) (see the "Measures" section for the cutoff points used). Moreover, the chi-square tests showed that 31.0% of those who had experienced GTP had PVG, and 24.1% had PSMU. A significant association was only found

TABLE 2 | Spearman correlation matrix.

	1	2	3	4	5	6	7	8	9	10	11	12
(1) GTP	1.000	0.526**	0.060	0.525**	0.473**	0.383**	0.038	-0.090	-0.028	0.080	0.150**	-0.069
(2) PVG		1.000	-0.038	0.547**	0.726**	0.137*	-0.082	-0.053	-0.076	0.099	-0.020	-0.080
(3) PSMU			1.000	0.154**	-0.208**	0.192**	0.118*	0.067	-0.060	0.123*	-0.054	0.508**
(4) GEQ				1.000	0.463**	0.349**	-0.045	-0.063	-0.037	0.187**	0.071	0.020
(5) VGCH					1.000	0.086	-0.129*	-0.057	-0.034	0.089	0.060	-0.185**
(6) CEQ						1.000	0.141*	0.025	-0.013	0.241**	0.377**	0.098
(7) Extroversion							1.000	-0.002	0.212**	0.004	0.310**	0.085
(8) Agreeableness								1.000	0.096	-0.070	0.118*	0.069
(9) Conscientiousness									1.000	0.116*	0.177**	-0.080
(10) Neuroticism										1.000	0.153**	0.066
(11) Openness											1.000	-0.122*
(12) MUF												1.000

**Correlation is significant at the 0.01 level (two-tailed).
*Correlation is significant at the 0.05 level (two-tailed).
GTP, Game Transfer Phenomena; PSMU, problematic social media use; PVG, problematic video game playing; GEQ, Game Engagement Questionnaire; VGCH, Questionnaire on Video Game Consumption Habits; CEQ, Creative Experiences Questionnaire; MUF, Media Use Frequency.

between GTP and PVG [$\chi^2(1) = 12.120$, $p < 0.001$], although the effect size was small. Those who did not have PVG were significantly less likely to have experienced GTP. Every participant considered as having PVG had also experienced GTP.

Demographics

The chi-square tests showed significant differences in terms of gender for GTP, PVG, and PSMU, but not in terms of age. There were more males in the GTP group, and females were significantly more likely to not have experienced GTP [$\chi^2(1) = 7.792$, $p < 0.01$]. There were also more males in the PVG group, and in this case, males were significantly more likely to be in the PVG group, while females were significantly less likely to be in the PVG group [$\chi^2(1) = 19.062$, $p < 0.001$]. There were more females in the PSMU group, and females were significantly more likely to be in the PSMU group, while males were significantly less likely to be in the PSMU group [$\chi^2(1) = 5.119$, $p < 0.05$]. Overall, the effect sizes were small (see **Table 1** for the full results).

Personality Traits

According to the Spearman rank-order correlations, there were positive correlations between GTP, openness, and fantasy proneness as measured by the CEQ. Also,

TABLE 3 | Mann–Whitney U test of GTP, PVG, and PSMU on personality traits.

Variables	Groups	*n*	*M*	*SD*	Median	Mean rank	*U*	*Z*	*p*	Effect size[a]
Extroversion	GTP	294	25.58	5.06	26.00	161.05	3,984.0	−0.281	0.779	
	No GTP	28	25.86	5.89	26.00	166.21				
	PVG	95	24.77	5.64	25.00	149.10	9,604.5	−1.828	0.068	
	No PVG	232	26.09	4.81	26.00	170.10				
	PSMU	80	27.05	4.75	27.00	190.94	7,884.5	−2.811	0.005*	0.16
	No PSMU	249	25.27	5.13	25.00	156.66				
Agreeableness	GTP	290	31.91	4.44	31.50	156.07	3,066.0	−1.581	0.114	
	No GTP	26	33.73	5.74	34.50	185.58				
	PVG	93	31.81	4.52	31.00	156.79	10,210.5	−0.580	0.562	
	No PVG	229	32.08	4.56	32.00	163.41				
	PSMU	79	32.78	4.26	32.00	179.65	8,323.0	−1.876	0.061	
	No PSMU	245	31.69	4.67	31.00	156.97				
Conscientious	GTP	294	31.00	4.23	31.00	157.90	3,059.0	−1.977	0.048	
	No GTP	27	32.81	5.21	33.00	194.70				
	PVG	95	30.49	4.61	31.00	153.60	10,032.0	−1.333	0.183	
	No PVG	233	31.38	4.28	32.00	168.94				
	PSMU	82	30.94	4.11	30.50	159.30	9,660.0	−0.680	0.496	
	No PSMU	248	31.12	4.51	31.00	167.55				
Neuroticism	GTP	293	25.86	4.91	26.00	164.92	2,953.0	−2.455	0.014	
	No GTP	28	23.43	4.77	24.00	119.96				
	PVG	95	26.22	4.85	26.00	172.79	10,374.5	−0.949	0.342	
	No PVG	234	25.58	4.90	26.00	161.84				
	PSMU	81	26.23	4.91	26.00	176.59	9,186.0	−1.207	0.227	
	No PSMU	249	25.44	4.97	26.00	161.89				
Openness	GTP	292	35.68	5.60	36.00	164.06	3,048.5	−2.226	0.026	
	No GTP	28	33.43	5.32	33.00	123.38				
	PVG	95	35.56	5.21	36.00	163.24	10,947.5	−0.094	0.925	
	No PVG	232	35.53	5.70	36.00	164.31				
	PSMU	81	35.57	5.07	36.00	166.84	9,895.0	−0.201	0.841	
	No PSMU	248	35.52	5.69	36.00	164.40				
CEQ	GTP	275	10.02	3.94	10.00	158.31	1,565.5	−4.751	0.000***	0.27
	No GTP	26	6.04	3.34	5.50	73.71				
	PVG	89	10.47	4.14	11.00	170.90	8,196.5	−2.138	0.032	
	No PVG	218	9.32	3.94	9.00	147.10				
	PSMU	75	10.37	4.33	10.00	168.96	7,578.0	−1.684	0.092	
	No PSMU	232	9.50	4.01	9.50	149.16				

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.
M, arithmetic; mean; SD, standard deviation; Me, median.
[a]Effect size = Cohen's.
GTP, Game Transfer Phenomena; PSMU, problematic social media use; PVG, problematic video game playing; CEQ, Creative Experiences Questionnaire.

TABLE 4 | Chi-square of GTP, PVG, and PSMU on media use habits.

	GTP %	No GTP %	χ^2	df	Effect size[a]	PVG %	No PVG %	χ^2	df	Effect size[a]	PSMU %	No PSMU %	χ^2	df	Effect size[a]
Daily playing time	n = 265	n = 15	9.151[1]	3		n = 92	n = 195	63.329***	3	0.81	n = 63	n = 226	2.517	3	
Less than 1 h/day	30.9	73.3				5.4	45.6				39.7	31.9			
SR	(−0.6)	(2.7)				(−4.6)	(3.1)				(0.8)	(−0.4)			
1–2 h/day	29.9	13.3				26.1	29.2				30.2	27.8			
SR	(0.3)	(−1.1)				(−0.4)	(0.3)				(0.3)	(−0.1)			
2–3 h/day	19.2	6.7				31.5	14.9				17.5	20.8			
SR	(0.3)	(−1.1)				(2.4)	(−1.7)				(−0.5)	(0.2)			
More than 3 h/day	20.0	6.7				37.0	10.3				12.7	19.5			
SR	(0.3)	(−1.1)				(4.0)	(−2.8)				(−1.0)	(0.5)			
Experience playing	n = 296	n = 25	7.976[1]	3		n = 95	n = 231	17.551***[1]	3	0.43	n = 83	n = 245	4.966[1]	3	
Months	9.1	24.0				1.1	13.9				13.3	9.0			
SR	(−0.6)	(2.1)				(−2.8)	(1.8)				(0.9)	(−0.5)			
A year	0.7	4.0				0.0	1.3				1.2	0.4			
SR	(−0.5)	(1.6)				(−0.9)	(0.6)				(0.7)	(−0.4)			
2–3 years	8.1	4.0				5.2	8.2				10.8	6.1			
SR	(0.2)	(−0.7)				(−0.8)	(0.5)				(1.2)	(−0.7)			
More than 4 years	82.1	68.0				93.7	76.6				74.7	84.5			
SR	(0.2)	(−0.7)				(1.3)	(−0.8)				(−0.7)	(0.4)			
Frequency of playing	n = 298	n = 28	26.216***	3	0.49	n = 95	n = 238	93.037***	3	0.92	n = 83	n = 252	11.328*	3	0.32
Once a month	24.8	67.9				6.3	35.3				39.8	22.6			
SR	(−1.2)	(3.9)				(−3.9)	(2.5)				(2.3)	(−1.3)			
Weekends	21.5	21.4				4.2	28.2				21.7	22.1			
SR	(0.0)	(0.0)				(−3.6)	(2.3)				(−0.1)	(0.0)			
3–4 days per week	23.2	7.1				26.3	21.0				20.5	23.0			
SR	(0.5)	(−1.7)				(0.8)	(−0.5)				(−0.4)	(0.2)			
Every day	30.5	3.6				63.2	15.5				18.1	32.1			
SR	(0.8)	(−2.5)				(6.1)	(−3.9)				(−1.8)	(1.0)			

*p < 0.05, **p < 0.01, ***p < 0.001.
[1]Fisher exact test was computed when more than 20% of expected counts were less than 5.
SR, standardized residual.
[a]Effect size = Cramer's V.
GTP, Game Transfer Phenomena; PSMU, problematic social media use; PVG, problematic video game playing.

positive correlations were found between PVG and CEQ. Positive correlations were also found between PSMU and neuroticism, extroversion, and the CEQ scores (**Table 2**).

According to the Mann–Whitney U test, comparing the GTP with the No GTP group showed that CEQ scores were significantly higher in the GTP group. There were no significant differences when comparing the PVG with the No PVG group. Comparing the PSMU with the No PSMU group showed that extroversion scores were significantly higher in the PSMU group. All the effect sizes were small (see **Table 3** for the full results).

Media Consumption

The majority of the participants had been playing video games for more than 4 years (81.8%). Most played either every day (29.2%) or once a month (27.1%), either for less than 1 h per day (33.1%) or 1–2 h per day (28.4%). The favorite game titles listed among the participants were *League of Legends*, *Halo*, *Overwatch*, *Sims*, *Fortnite*, *Call of Duty*, *Mario Kart*, *NHL*, *Skyrim*, and *The Last of Us*. The most popular platforms used (i.e., checking once per hour or more often) by the full sample were Instagram (35.4%), YouTube (21.3%), and Facebook (16.8%).

Gaming Habits

Chi-square tests were conducted to examine experience playing, frequency of playing, and daily playing time. All the effect sizes were large (see **Table 4** for the full results).

Game transfer phenomena and playing habits

Comparing the GTP vs. the No GTP group showed no differences in terms of experience playing or daily playing time. Only significant differences were found for the frequency of playing. However, *post hoc* test showed that only playing once a month in comparison to playing more frequently (i.e., weekends, three to four times per week, every day) was significantly associated (SR = 3.9) with the No GTP group [$\chi^2(3) = 26.216$, $p < 0.001$].

Problematic video game playing and playing habits

Comparing the PVG vs. the No PVG group showed significant differences in terms of experience playing [$\chi^2(3) = 17.551$, $p < 0.001$], daily playing time [$\chi^2(3) = 63.329$, $p < 0.001$], and frequency of playing [$\chi^2(3) = 93.037$, $p < 0.001$]. According to *post hoc* tests, only those who had been playing video games for months were significantly less likely (SR = -2.8) to be in the PVG group. Moreover, according to the *post hoc* test performed with the frequency of playing, only playing every day was significantly more likely (SR = 6.1) to be associated with the PVG group. Lastly, *post hoc* test showed that playing 2–3 h a day (SR = 2.4) or playing more than 3 h a day (SR = 4.0) was significantly more likely to be associated with the PVG group.

Problematic social media use and playing habits

Comparing the PSMU vs. the No PSMU group in terms of playing habits showed only significant differences in frequency of playing [$\chi^2(3) = 11.328$, $p < 0.001$]. The *post hoc* test showed that only

TABLE 5 | Mann–Whitney test of GTP, PVG, and PSMU on video game engagement and social media.

Variables	Groups	n	M	SD	Me	Mean rank	U	Z	p	Effect size[a]
GEQ[1]	GTP	281	37.56	6.93	38.00	161.99	1,128.0	−5.630	0.000***	−0.33
	No GTP	25	26.88	7.50	23.00	58.12				
	PVG	90	40.99	6.93	41.00	209.30	5,328.0	−6.502	0.000***	−0.36
	No PVG	223	34.89	7.11	35.00	135.89				
	PSMU	77	37.69	7.50	38.00	170.05	8,158.0	−1.397	0.162	
	No PSMU	237	36.28	7.49	36.00	153.42				
VGCH[2]	GTP	269	62.06	14.64	63.00	156.43	960.0	−5.910	0.000***	−0.34
	No GTP	25	39.60	14.65	36.00	51.40				
	PVG	87	74.78	9.35	77.00	233.59	2,211.0	−10.394	0.000***	−0.59
	No PVG	215	54.70	14.13	56.00	118.28				
	PSMU	78	56.41	15.38	56.50	128.56	6,947.0	−2.694	0.007*	−0.15
	No PSMU	224	61.53	15.67	63.00	159.49				
MUF[3]	GTP	271	26.03	7.33	25.00	147.88	3,220.0	−1.028	0.304	
	No GTP	27	26.59	3.74	27.00	165.74				
	PVG	89	25.40	7.03	24.00	144.79	8,881.0	−0.926	0.355	
	No PVG	214	26.20	7.04	25.00	155.00				
	PSMU	80	30.30	7.57	30.00	204.18	4,905.5	−6.052	0.000***	−0.35
	No PSMU	225	24.59	6.36	24.00	134.80				

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

M, mean; SD, standard deviation; Me, median.

[1]Game engagement while playing, e.g., flow, losing track of time.

[2]Engagement in game-related activities and preference for playing.

[3]Media use questionnaire on frequency of use of social media platforms.

[a]Effect size = Cohen's.

GTP, Game Transfer Phenomena; PSMU, problematic social media use; PVG, problematic video game playing; VGCH, Questionnaire on Video Game Consumption Habits; GEQ, Game Engagement Questionnaire; VGCH, Questionnaire on Video Game Consumption Habits; MUF, Media Use Frequency.

TABLE 6 | Mann–Whitney test of GTP, PVG, and PSMU on social media platforms.

Variables	Groups	*n*	*M*	*SD*	Me	Mean rank	*U*	*Z*	*p*	Effect size[a]
Facebook	GTP	295	4.54	2.381	5.00	162.16	3,788.0	−0.426	0.670	
	No GTP	27	4.37	2.420	5.00	154.30				
	PVG	95	4.40	2.410	5.00	163.14	10,938.5	−0.290	0.772	
	No PVG	235	4.62	2.341	5.00	166.45				
	PSMU	83	5.22	2.317	6.00	194.83	7,982.0	−3.150	0.002*	−0.17
	No PSMU	249	4.28	2.326	5.00	157.06				
LinkedIn	GTP	285	1.20	0.695	1.00	158.09	3,678.5	−1.263	0.207	
	No GTP	28	1.07	0.378	1.00	145.88				
	PVG	92	1.22	0.783	1.00	156.78	10,145.5	−0.773	0.439	
	No PVG	227	1.12	0.467	1.00	161.31				
	PSMU	83	1.11	0.350	1.00	158.41	9,662.0	−0.447	0.655	
	No PSMU	237	1.23	0.786	1.00	161.23				
Twitter	GTP	287	2.81	2.467	1.00	157.55	3,890.0	−0.301	0.764	
	No GTP	28	3.04	2.728	1.50	162.57				
	PVG	93	2.76	2.439	1.00	151.85	9,751.0	−1.219	0.223	
	No PVG	228	2.96	2.531	1.50	164.73				
	PSMU	83	3.45	2.773	2.00	181.69	8,242.5	−2.480	0.013	
	No PSMU	239	2.69	2.385	1.00	154.49				
Tumblr	GTP	287	1.75	1.581	1.00	159.17	3,682.0	−0.917	0.359	
	No GTP	28	1.46	1.071	1.00	146.00				
	PVG	93	1.67	1.510	1.00	160.11	10,519.0	−0.141	0.888	
	No PVG	228	1.76	1.603	1.00	161.36				
	PSMU	83	2.01	1.851	1.00	175.07	8,792.5	−1.965	0.049	
	No PSMU	239	1.63	1.443	1.00	156.79				
Instagram	GTP	294	2.66	5.23	6.00	158.86	3,339.5	−1.673	0.094	
	No GTP	28	6.11	2.378	6.00	189.23				
	PVG	95	4.94	2.710	6.00	148.00	9,500.0	−2.149	0.032	
	No PVG	235	5.72	2.572	6.00	172.57				
	PSMU	83	7.04	2.069	8.00	227.66	5,174.0	−6.877	0.000***	−0.38
	No PSMU	248	4.85	2.614	6.00	145.36				
YouTube	GTP	293	5.58	1.858	6.00	165.32	2,836.5	−2.783	0.005*	−0.16
	No GTP	28	4.61	2.006	5.00	115.80				
	PVG	94	5.94	1.771	6.00	194.86	8,144.5	−3.783	0.000***	−0.21
	No PVG	234	5.19	1.924	5.00	152.31				
	PSMU	82	5.45	2.240	6.00	164.46	10,083.0	−0.117	0.907	
	No PSMU	248	5.46	1.730	6.00	165.84				
Google Plus	GTP	288	2.23	2.059	1.00	156.11	3,344.0	−1.402	0.161	
	No GTP	27	3.00	2.557	1.00	178.15				
	PVG	94	2.04	1.894	1.00	150.20	9,654.0	−1.569	0.117	
	No PVG	227	2.49	2.234	1.00	165.47				
	PSMU	81	2.91	2.456	1.00	180.26	8,322.0	−2.353	0.019	
	No PSMU	242	2.18	1.981	1.00	155.89				
Pinterest	GTP	285	1.60	1.298	1.00	155.10	3,449.0	−1.497	0.134	
	No GTP	28	1.89	1.315	1.00	176.32				
	PVG	91	1.40	1.131	1.00	142.53	8,784.5	−2.681	0.007	
	No PVG	227	1.72	1.335	1.00	166.30				
	PSMU	83	1.87	1.606	1.00	173.40	8,682.0	−1.943	0.052	
	No PSMU	236	1.53	1.157	1.00	155.29				

*p < 0.05, **p < 0.01, ***p < 0.001.
M, arithmetic mean; SD, standard deviation; Me, median.
[a]Effect size = Cohen's.
GTP, Game Transfer Phenomena; PSMU, problematic social media use; PVG, problematic video game playing.

playing once a month (SR = 2.3) was significantly more likely to be associated with PSMU.

Video Game Engagement

The Spearman rank-order correlations showed that GTP and PVG were positively correlated with GE and VGCH scores. PSMU was positively correlated with GE scores and negatively correlated with VGCH (**Table 2**).

Further analyses conducted with the Mann–Whitney U test showed that when comparing the GTP vs. the No GTP group, engagement while playing (GE score) and engagement in game-related activities and preference for playing (VGCH score) were statistically significantly higher in the GTP group. Both effect sizes were of medium size. Comparing the PVG vs. the No PVG group showed that GE and VGCH scores were statistically significantly higher in the PVG group. The effect size for GE scores was medium, while it was large for VGCH scores. Comparing the PSMU vs. the No PSMU group showed that only the VGCH scores were statistically significantly lower in the PSMU group, and this effect size was small (see **Table 5** for the full results).

Frequent Social Media Use

The Spearman rank-order correlations showed that only PSMU was positively correlated with MUF (**Table 2**).

Analyses conducted with the Mann–Whitney U test showed that when comparing the GTP vs. the No GTP group, the use of YouTube was statistically higher in the GTP group than in the No GTP group. Comparing the PVG groups showed that YouTube use was statistically higher in the PVG group than in the No PVG group. Comparing the PSMU groups showed that Facebook and Instagram use was statistically significantly higher in the PSMU group than in the No PSMU group. All the effect sizes were small, except for the medium effect size for the comparison in the PSMU group for Instagram use (see **Table 6** for the full results).

Predictors of Game Transfer Phenomena

In order to understand the interplay of personality traits, PVG and key gaming factors in those who experienced GTP, GTP as a binary outcome (i.e., GTP vs. no GTP), and the significant predictors for GTP were entered block-wise into a logistic regression using the Enter model. A parsimonious approach was taken for constructing the model that included a minimum number of predictor variables to understand if PVG, personality traits, and engagement increased the predictability of GTP. Those variables that were significantly correlated with GTP after the Bonferroni correction were entered into the model. Since this study has a particular interest to understand personality traits, personality traits that were higher for GTP than No GTP were also examined in the model.

The data were inspected for assumptions. The linearity of the continuous variables with respect to the logit of the dependent variable was assessed *via* the Box and Tidwell (1962) procedure. Only GE failed the assumption of linearity. Both VGCH and GE were excluded from the analyses. This decision was made for various reasons. Collinearity concerns were raised due to the large correlation between PSMU and VGCH (<7) and GE (<5) scores (see **Table 2** for the correlation matrix), but the inflation

rate in any case was not above 5. However, there were conceptual issues, as some items of the VGCH overlapped in conflicts derived from playing. Moreover, some of the items of GE overlap with losing control over playing, which is core to PVG. Therefore, no transformation was conducted trying to linearize the non-linear relationship of GE. None of the remaining variables had variance inflation rates (VIF) over 2, and the average VIF was 1.12, which indicates that the VIF was moderately correlated (Hilbe, 2016).

The predictors were entered into three blocks. Block 1 contained the personality traits according to the five-factor model that were higher in the GTP group and gender. This first block explained the 17% of variance of GTP (Nagelkerke's $R^2 = 0.166$); Model [$\chi^2(3) = 22.423$, $p < 0.001$]. Males were 5.2 times more likely than females to experience GTP. Every unit increase in neuroticism significantly increased the odds of GTP by 1.129 (12.9%). Openness was not a significant predictor of GTP.

In Block 2, fantasy proneness was additionally added, which increased the predicted power of the model when the BFI personality traits and gender were held constant. This block that contained all the variables in the model explained the 36% of the variance of GTP (Nagelkerke's $R^2 = 0.361$); Model [$\chi^2(4) = 51.381$, $p < 0.001$]. Males were then 13 times more likely than females to experience GTP, and every unit increase in fantasy proneness increased the odds of GTP by 1.489 (48.9%).

In Block 3, PVG was added while all the previous variables were held constant. The predicted power of the model increased

TABLE 7 | Hierarchical binary logistic regression for GTP on dispositional factors.

	B	(SE)	Wald	df	Exp(B)
Gender (male)	1.654**	(0.481)	11.806	1	5.230
Openness	0.068	(0.037)	3.451	1	1.070
Neuroticism	0.122*	(0.043)	7.968	1	1.129
Constant	−3.779	(1.712)	4.873	1	0.023

$R^2 = 0.076$ (Cox and Snell), 0.166 (Nagelkerke). Model [$\chi^2(3) = 22.423$, $p < 0.001$]

	B	(SE)	Wald	df	Exp(B)
Gender (male)	2.556***	(0.584)	19.183	1	12.883
Openness	−0.042	(0.049)	0.744	1	0.959
Neuroticism	0.093	(0.047)	3.994	1	1.097
CEQ	0.398***	(0.087)	21.137	1	1.489
Constant	−2.775	(1.870)	2.202	1	0.062

$R^2 = 0.165$ (Cox and Snell), 0.361 (Nagelkerke). Model [$\chi^2(4) = 51.381$, $p < 0.001$]

	B	(SE)	Wald	df	Exp(B)
Gender (male)	1.451*	(0.625)	5.399	1	4.269
Openness	0.007	(0.055)	0.017	1	1.007
Neuroticism	0.072	(0.055)	1.675	1	1.074
CEQ	0.263*	(0.088)	8.916	1	1.300
PVG	0.872**	(0.236)	13.580	1	2.391
Constant	−4.858	(2.231)	4.741	1	0.008

$R^2 = 0.227$ (Cox and Snell), 0.496 (Nagelkerke). Model [$\chi^2(5) = 73.159$, $p < 0.001$]

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.*

The predictors that were significantly associated with GTP (Game Transfer Phenomena) and personality traits that were higher in the GTP group than the No GTP group were entered into the logistic regression using the Enter method in a block-wise manner, beginning with the core personality traits of the Big Five personality traits and gender, followed by CEQ (Creative Experiences Questionnaire), as a measure of fantasy proneness, and finally PVG (problematic video game playing).

even more and explained the 50% of the variance for GTP (Nagelkerke's R^2 = 0.496); Model [χ^2(5) = 73.159, p < 0.001]. PVG emerged as the strongest predictor of GTP. Every unit increase in PVG significantly increased the odds of GTP by 2.391 (139.1%). Every unit increased in fantasy proneness significantly increased the odds of GTP by 1.300 (30.0%). Males were 4.3 times more likely than females to experience GTP. Neuroticism was no longer a predictor of GTP (see **Table 7**).

DISCUSSION

This study investigated the interrelationship and overlap between GTP with PVG and PSMU in a sample of video game players by focusing on dispositional factors and interactive media habits. The sample was relatively equally divided in terms of gender, and most participants were 25 years old or younger. Most played every day, and more than half played up to 2 h per day.

The Prevalence and Relationship Between Game Transfer Phenomena, Problematic Video Game Playing, and Problematic Social Media Use

Similar to previous studies, the prevalence of GTP (having experienced at least one instance of GTP) was high (91.3%) (Ortiz de Gortari and Griffiths, 2016b; Dindar and Ortiz de Gortari, 2017). Most participants had experienced five or more different types of GTP. The most prevalent types of GTP were those that are also common among the general population (Ortiz de Gortari et al., 2016) such as earworms, visualizing or seeing images in the back of the eyelids as a sort of afterimage, and thinking about using video game elements in real-life contexts.

Previous research has shown inconsistencies in the prevalence of PVG and PSMU, the measurement of which substantially depends on the scales and thresholds used to confirm the conditions. Prior studies conducted with the scales that were chosen in the present study have reported a high prevalence of PVG (e.g., 8–23%) and PSMU (e.g., 12–22%) (Kuss et al., 2012; Lopez-Fernandez et al., 2014; Lin et al., 2017). Surprisingly, a remarkably high prevalence of PVG (28.5%) and PSMU (24.8%) was found in the present study even though conservative cutoff points were adopted. Hence, the findings should be interpreted with caution to avoid overestimation of problems associated with interactive technologies.

In line with a previous study (Ortiz de Gortari et al., 2016), PVG emerged as a predictor of GTP when taking into account personality traits. However, no associations were found with PSMU nor was PSMU associated with PVG. More specifically, not all who had experienced GTP were identified as having PVG or PSMU, but all of those in the PVG group had experienced GTP.

Video Game and Social Media Habits

No significant associations were found in daily playing time, playing experience, and GTP, similar to a previous study (Dindar and Ortiz de Gortari, 2017). Interestingly, those who played 2–3 h or more per day and those who played every day were

significantly more likely to have PVG. Playing less frequently, e.g., once a month, was more likely to be associated with PSMU.

That no significant association between gaming habits and GTP was found might suggest that individual factors (e.g., personality traits and cognitive profile) are even more relevant for GTP. However, one should be aware that the frequency of playing and session length have been found to predict severe levels of GTP (i.e., many types of GTP and a high frequency of occurrence) compared to low and moderate levels of GTP. Particularly, playing in a gaming session of 6 h or more was significantly associated with severe levels of GTP (Ortiz de Gortari et al., 2016).

In terms of social media use, Instagram, YouTube, and Facebook were the most frequently checked social/sharing media. The frequent use of social media was only significantly higher in those classified with PSMU. When taking a closer look at the platforms used by the sample, both those who experienced GTP and those with PVG had significantly higher scores on YouTube use compared to those with PSMU. This can be explained by the fact that YouTube is a popular outlet that is frequently used by players for watching and sharing videos on gameplay and news of upcoming games. High Facebook and Instagram scores were significantly associated with PSMU, which is understandable insofar as these platforms facilitate the interchange of text, images, and videos usually for socializing purposes.

Video Game Engagement

Engagement, as a subjective experience while playing and engagement in game-related activities, and preference for playing were other factors investigated in the present study. Both types of engagement were significantly high for those who had experienced GTP and those who had PVG. However, engagement in game-related activities and preference for playing over other activities were significantly low in those with PSMU. High engagement in game-related activities and preference for playing over other activities by those who experienced GTP and those with PVG are not surprising.

Moreover, engagement, as measured along a unidimensional continuum gauging subjective phenomena such as flow, absorption, immersion, and presence, may make the game more gratifying and therefore more appealing to continue playing (Boyle et al., 2012). The detachment from reality and suspension of disbelief that occur with deep engagement while playing may make the individual more receptive to video game content and in-game experiences facilitating lingering effects such as those observed as GTP. For instance, playing for immersion (Ortiz de Gortari and Griffiths, 2015), immersion as a composed factor that includes losing track of time, forgetting what is happening around oneself, and mix-ups like looking outside the device screen to search for game elements have previously been found to be associated with GTP (Ortiz de Gortari, 2017).

Gender and Personality Traits

The last research question in this study was concerned with dispositional factors that were assessed *via* demographics and personality traits. The only dispositional factors that have been investigated previously in the context of GTP are age and gender,

and the majority of previous studies have found no association between gender and GTP (Ortiz de Gortari and Griffiths, 2016b; Dindar and Ortiz de Gortari, 2017; Ortiz de Gortari, 2017). However, in the present study, females were significantly less likely to experience GTP, which contradicts the findings of another study on a specific augmented reality game that showed that females were higher in most modalities of GTP (automatic mental processes, actions, and behaviors and visual and auditory sensory perceptions) (Sifonis, 2018). Further, in the present study, PVG was found to be prevalent among males, and PSMU was prevalent among females, which is consistent with previous studies (Andreassen, 2015; Andreassen et al., 2012, 2016, 2017).

Scores indicating being fantasy-prone were significantly higher for those who had experienced GTP. Fantasy-prone individuals are usually referred to as fantasizers, and they tend to spend a considerable amount of time fantasizing, recalling vivid childhood memories, and being susceptible to hallucinatory, out-of-body, paranormal, and intense religious experiences and hypnosis (Wilson and Barber, 1983). Furthermore, fantasy proneness has been associated with everyday slips and cognitive lapses (e.g., lapses in attention) (Merckelbach et al., 1991), and cognitive and sensory intrusions as those observed in GTP appear to be explained by failures in cognitive control (Ortiz de Gortari and Griffiths, 2019).

Finally, the logistic regression model for GTP revealed a deeper picture than the bivariate analyses in terms of the association between GTP, PVG, gender, and personality traits. The results of the model showed the relevance of dispositional factors (i.e., gender and personality traits) on GTP. When neuroticism and openness as part of the five core personality traits were examined, neuroticism emerged as a predictor of GTP, and males were more likely than females to experience GTP. Neuroticism has been associated with reports of vivid daydreaming and proneness to hallucinations (Larøi et al., 2005), which appear to be particularly relevant for GTP. Interestingly, when fantasy proneness came into the picture, it also emerged as a predictor of GTP, while being male was still a predictor, but this was not the case for neuroticism. Openness remained as not being a predictor of GTP.

Moreover, when PVG was included in the model, males remained more likely to experience GTP and only fantasy proneness was a predictor of GTP among the personality traits, and PVG became the strongest predictor of GTP. This may suggest that those with PVG who are fantasy-prone are the ones more susceptible to experience GTP. These results contrast the bivariate results that showed no significant association between PVG and fantasy proneness.

In summary, those who have experienced GTP and those with PVG were characterized by being male, having played video games for several years, and playing frequently. They were highly engaged in the game while playing (e.g., losing track of time), valued playing video games, and preferred playing video games over other activities. The differences between the GTP and the PVG groups were that while those in the GTP group were more likely to be fantasy-prone, those with PVG played 2–3 or more hours per day. The profiles of those experiencing GTP and PVG differed from those with PSMU, the latter of whom tended to be females and extroverts who seldom played video games, showed less preference for playing games, and frequently used social or sharing platform sites instead, such as Facebook and Instagram.

LIMITATIONS

The empirical results reported herein should be considered in light of some limitations. First, regarding the sample selection, the generalizability of the study's findings is limited, since the study used a convenience sample of university students whose participation was rewarded with course credits. This raises issues such as the potential for self-selection and social desirability biases. Furthermore, since the study focuses on video games, the analyses of PSMU are restricted to those participants who have PSMU and play games. This may limit comparisons with other studies where these criteria are not applied to those with PSMU. However, it is important to note that even in the segment of those with PSMU, the results in the current study are reported according to previous studies on PSMU.

Second, even though the scales for assessing PVG and PSMU have been widely used (e.g., Collins et al., 2012; Kuss et al., 2012; Tejeiro Salguero et al., 2012; Lopez-Fernandez et al., 2014; Andreassen et al., 2017; Bányai et al., 2017; Tejeiro Salguero and Vallecillo Gomez, 2020), there are limitations on the instruments chosen. For instance, the PVG was the first validated scale for assessing PVG and, therefore, has been influential in the research area. However, the scale is not entirely in line with the most recent debates and recommendations for tools that assess gaming disorder suggested by the DSM-5 and WHO. Although the PVG scale covers the core symptoms of gaming disorder delineated by WHO, such as having lower control over gaming and a priority for gaming despite the occurrence of negative consequences (World Health Organization (WHO), 2018), it also includes items not considered in the frame of addiction to assess the loss of control (e.g., "When I lose in a game, or I have not obtained the desired results, I need to play again to achieve my target"). This might explain the large number of participants classified with problematic interactive media consumption (i.e., either PVG or PSMU). Hence, the findings should be interpreted with caution and replicated using other scales to assess PVG.

Third, the criterion of having experienced at least one GTP was used to classify participants with GTP rather than considering the severity of GTP (e.g., several types of GTP and experiencing GTP very frequently), the latter of which might be more consistent with the extreme behaviors exhibited in problematic playing and gaming disorder. This decision probably contributes to the extensive overlap between GTP and PVG because all of those with PVG had experienced GTP. However, this decision was made for the following reasons: (i) it facilitated comparisons with previous studies at this early stage of the investigation of GTP, and (ii) only a few individuals tend to present severe levels of GTP (Ortiz de Gortari et al., 2016), and we did not have a large enough sample to represent this group in this study. In any case, it is important to notice that in the present study, more than half of the sample reported experiencing five or more types of GTP. Nevertheless, future studies should compare PVG with GTP in terms of varying degrees of severity.

Finally, the effect sizes of several comparisons suggest that the differences between the samples were small. The use of severity criteria for GTP and a scale with core factors for gaming disorder may yield larger effect sizes. Furthermore, to reduce the familywise error rate due to multiple comparisons, Bonferroni correction was applied. However, it is recommended that future studies examine all the significant variables and their relationship with personality traits, since this is the first time that these have been examined in the context of GTP. Examining the different modalities of GTP (sensory perceptions, cognitions, and behaviors) and personality would lead to an improved understanding of GTP, since the different forms of GTP may have different underpinnings.

CONCLUSION

Despite the potential limitations considered above, it is notable that the results, to a large extent, are supported by findings in previous research into GTP and problematic interactive media use.

In terms of dispositional factors, this study showed that males are more likely to experience GTP, although this association between gender and GTP should be investigated even further, since different studies have shown inconsistent results.

Furthermore, the expected emergence of fantasy proneness as a predictor of GTP but the absence of openness should be investigated. Evidence has suggested that fantasizers tend to be open to the experiences (Merckelbach et al., 2001). However, some evidence has shown that fantasy proneness in adolescents is mainly related to neuroticism rather than openness (Sánchez-Bernardos and Avia, 2004). Future studies should also take a closer look at the five-factor model of personality, paying particular attention to neuroticism and openness and considering the different modalities of GTP (i.e., sensorial, automatic mental process and behaviors). Understanding the role of neuroticism in GTP is very important, since neuroticism denotes tendencies to respond with negative emotions to threat, frustration, or loss (Lahey, 2009), suggesting that individuals high in neuroticism traits may be more likely to experience GTP as aversive.

Overall, gender, personality traits, and PVG appear to predict the likelihood of experiencing GTP.

Beyond the contributions to the understanding of GTP, this study supports previous findings regarding personality factors, gender differences, and patterns of media use in individuals who play video games and those who have a preference for social networking. One of the most interesting findings was that those who play most per day were significantly more likely to have PVG, but not GTP.

This study can be viewed as an early step in differentiating GTP from problematic media use, in this case, PVG and PSMU. It showed the interplay between PVG and GTP, and that there is no relationship or similarity between PSMU and GTP, as denoted by the differences in personality traits, preference in media, and patterns of media use. Nevertheless, to better understand the relationship between GTP, problematic playing, and gaming disorder, the results should be tested again using a scale that is up-to-date and developed in accordance with the diagnostic criteria recommended for assessing gaming disorder. Moreover, different criteria for classifying GTP should be considered when comparing GTP and PVG groups. The severity levels of GTP should also be considered, which may facilitate the differentiation between GTP and PVG but most importantly because severe levels of GTP have been associated with distress and dysfunction and playing for sessions of 6 h or more.

As has been shown in this study, different factors influence GTP and PSMU. Thus, further research attempting to identify idiosyncratic characteristics influencing the occurrence of GTP could contribute to the theoretical differentiation between PSMU and problematic gaming.

Finally, future work can benefit from considering the role of GTP in gaming disorder, since intrusive thoughts, cognitive biases, and poor impulse control are pivotal in the initiation and maintenance of dysfunctional playing behaviors.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation, to any qualified researcher.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee of MacEwan University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

JG designed the study, obtained ethical approval, and supervised two students in mounting the survey online, cleaning the data, calculating subscale scores, and coding self-reports of dreams. Only parts of this study were used herein. AO conceptualized the background for the write-up, performed the statistical analysis, and wrote most of the article. Both authors contributed to the article and approved the submitted version.

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