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The relations between YouTube addiction, social anxiety and parasocial relationships with YouTubers: A moderated-mediation model based on a cognitive-behavioral framework

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ABSTRACT

YouTube is a popular video-sharing platform where viewers can watch videos made by media performers called YouTubers. YouTube is a social media site conducive to the development of parasocial relationships, which consists in asymmetrical relationships between media users and media performers. The aim of this study is to identify the determinants of YouTube addiction by examining the relationships between social anxiety, parasocial relationships with YouTubers and YouTube addiction based on a cognitive-behavioral theoretical framework. Data from 932 participants were collected through an online survey. Multiple regression analyses and structural equation modeling using a bootstrap procedure reveal that 1) social anxiety and 2) parasocial relationships with YouTubers are predictors of YouTube addiction, 3) social anxiety is a predictor of parasocial relationships, 4) social anxiety moderates the relation between parasocial relationships and YouTube addiction, 5) parasocial relationships mediate the relation between social anxiety and YouTube addiction and 6) social anxiety also moderates this mediated effect. The proposed moderated-mediation model of YouTube addiction fits well the data. The findings of this study contribute to the literature on the parasocial compensation hypothesis while providing useful information for prevention and intervention for YouTube addiction and social anxiety disorder.

1. Introduction

Launched in 2005, YouTube is a popular video-sharing platform with over one billion users and one billion hours of video viewed every day (YouTube, 2017). It is the second most visited website in the world after Google and ahead of Facebook (Alexa, 2019). YouTube is the most popular social media platform in the US with 73% of American adults using it (Pew Research Center, 2018). Social media sites can be characterized as internet applications that permit users to create and exchange content with others (Kaplan & Haenlein, 2010). They all have their unique architecture, norms and culture (Smith, Fischer, & Yongjian, 2012). Among them, social networking sites (SNS), and especially Facebook, are the most popular and the most studied (Kuss & Griffiths, 2017). SNS are characterized by the fact that users create personal profiles and use the platform to interact with real-life friends or to meet new people (Kaplan & Haenlein, 2010; Kuss & Griffiths, 2017).

YouTube does not possess all the social networking functionalities and is best categorized as a content community within the scope of social media sites (Kaplan & Haenlein, 2010; Kuss & Griffiths, 2017). Whereas SNS are more focused on relationships between users, YouTube is focusing on content viewing (Khan, 2017). As in the case of SNS, the success of YouTube comes along with the development of addictive behaviors toward the website (Balakrishnan & Griffiths, 2017; Klobas, McGill, Moghavvemi, & Paramanathan, 2018; Masters, 2015). Regarding SNS, social networking functions seem to act as reinforcement of online addictive behaviors through the enjoyment they bring to the users (Turel & Serenko, 2012). However, as YouTube architecture differs from SNS architecture, determinants of YouTube addiction may also differ from the determinants of SNS addiction.

Based on a cognitive-behavioral framework of online addiction (Davis, 2001), the aim of the present study is to identify the specific determinants of YouTube addiction. This constitutes the first step for designing effective prevention and intervention targeting YouTube

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addiction. From a database of 932 participants, a moderated-mediation model of YouTube addiction based on a cognitive-behavioral framework is proposed and empirically tested. In what follows we present the literature that theoretically supports the postulated model.

1.1. A cognitive-behavioral approach

Internet addiction can be defined as a non-chemical and behavioral addiction which involves human-machine interaction (Cerniglia et al., 2017; Griffiths, 2000). Different terms, such as Internet addiction or Internet pathological use are used within the scientific literature to describe Internet-related maladaptive behaviors. As done by other authors, the terms Internet addiction (Cerniglia et al., 2017; Chou, Condron, & Belland, 2005) and therefore YouTube addiction (Balakrishnan & Griffiths, 2017) are used in this article in reference to the global phenomenon, whereas the term of pathological use is used to discuss the specific work of Davis (2001).

Davis (2001) proposed a cognitive-behavioral model of pathological Internet use based on distal and proximal causes. Maladaptive cognitions are considered as proximal causes because they are sufficient to cause a problematic use of the Internet by themselves. On the other side, distal causes are supposed to generate maladaptive cognitions. Among distal causes, two main elements are identified. A preexisting psychopathology, such as social anxiety, constitutes a predisposed vulnerability to the development of a pathological use of the Internet. Combined to this predisposed vulnerability, the experience of technologies is assumed to be a catalyst for the development of a pathological Internet use. The experience that the user gets from the technology is then considered in the model as a behavioral reinforcement. When an individual uses the Internet, he or she is reinforced by the ensuing response which causes the maintenance of behavioral pathological Internet use symptoms. Moreover, it has been argued that individuals become specifically addicted to the activities they engage in on the Internet (Kuss & Griffiths, 2017), such as the use of YouTube. One of the products of the particular functioning of YouTube appears to be the development of specific relationships between the users who watch the videos, the viewers, and the users who create and upload them, the content creators.

1.2. The use of YouTube: YouTubers and viewers

One particularity of YouTube is that two types of users can be clearly distinguished: the viewers and the content creators. There is a great diversity among content creators on YouTube. They can be politicians, news organizations, education institutes, corporations or amateur content creators (Khan, 2017). However, YouTube is characterized by its original celebrity culture (Smith, 2014) and one type of content creator stands out as it embodies this specific culture of YouTube: the YouTubers. YouTubers are video bloggers who regularly upload videos on their personal YouTube channels (Jerslev, 2016). While YouTubers upload videos, viewers can comment, rate (like/dislike) or share them on other platforms. Viewers can also subscribe to specific channels to be kept informed of the latest videos uploaded by their favorite content creators. Most functionalities available on YouTube are indeed oriented to the specific interaction between viewers and YouTubers.

Compared to SNS active users, YouTubers can be described as publicly overexposed active users who share their personal information and personal interests through video content with the rest of the users, the viewers, who remain mostly anonymous. YouTubers engage in self-

presentation and, to a certain extent, in self-disclosure in order to build and maintain relationships with their viewers (Chen, 2016; Ferchaud, Grzeslo, Orme, & LaGroue, 2018). However, these relationships between viewers and YouTubers are not classical social relationships as they are not reciprocal. They can be compared to relationships with traditional television (TV) characters (Chen, 2016). These asymmetrical relationships are called parasocial relationships.

1.3. Parasocial relationships: a product of the particular functioning of YouTube

YouTube, with its own celebrity culture, seems indeed to be a favorable environment for the development of parasocial relationships (Ferchaud et al., 2018; Hartmann, 2016). A parasocial relationship is a relationship an individual forms with someone he does not actually know by consuming media about that person (Dibble, Hartmann, & Rosaen, 2016; Horton & Richard Wohl, 1956). Parasocial relationships can be formed with fictional characters but also with real people like celebrities or politicians. The concept of parasocial relationship is considered close to the concept of real-life relationship (Dibble et al., 2016). The human brain is even believed to have difficulties in distinguishing real friends from parasocial relationships (Kanazawa, 2002).

The parasocial compensation hypothesis posits that parasocial relationships could satisfy the need to belong of individuals by compensating their lack of real life relationships (Hartmann, 2016; Horton & Richard Wohl, 1956). More precisely, this hypothesis reflects the fact that individuals feeling lonely, socially isolated, or with social skills deficits such as social anxiety, may develop more intense parasocial relationships (Hartmann, 2016). However, results about the parasocial compensation hypothesis are mixed and it is difficult to identify precisely which variables are associated with parasocial relationships (Hartmann, 2016; Schiappa, Allen, & Gregg, 2007).

Extreme forms of parasocial relationships, called celebrity worshiping, have also been associated with maladaptive social behavior and with negative effects on the well-being of an individual (Maltby et al., 2004; Maltby, McCutcheon, Ashe, & Houran, 2001; McCutcheon, Lange, & Houran, 2002). More specifically, the intensity of parasocial phenomenon on SNS appears to be linked to higher degree of addiction to these websites (Baek, Bae, & Jang, 2013; Baek, Cho, & Kim, 2014). Similarly, parasocial relationships with YouTubers may also play a role on the development of YouTube addiction.

The establishment of parasocial relationships with YouTubers is a product YouTube viewers get from their experience of the media. The product of the structural characteristics of particular software, can be considered as reinforcements of an addictive behavior (Griffiths, 1997; Turel & Serenko, 2012). Doing so, parasocial relationships may be a reinforcement of YouTube addiction alongside other distal causes. Nevertheless, the relation between parasocial relationships and YouTube addiction seems more complex than a mere direct association. Indeed, both variables may be affected by social anxiety.

1.4. Social anxiety, parasocial relationships and YouTube addiction: a complex relation

Social anxiety is defined as an excessive and persistent fear in social or performance situations that are either avoided or painfully and reluctantly endured (American Psychiatric Association, 2013). The persistent fear and discomfort that socially anxious individuals feel in social situations make it more difficult for them to establish positive

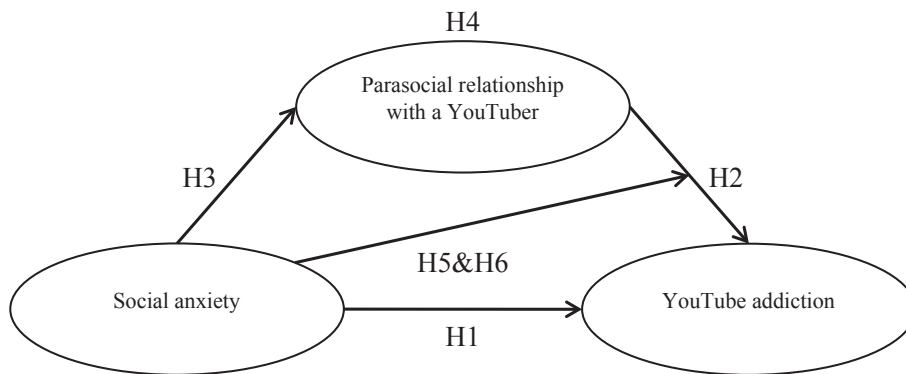


Fig. 1. Conceptual moderated-mediation model examining the relationships between social anxiety, the intensity of the parasocial relationship with a favorite YouTuber and YouTube addiction. Note: ovals represent latent constructs. For clarity of presentation, control variables, observed indicators and error terms are not shown.

relationships (Davila & Beck, 2002; High & Caplan, 2009; La Greca & Lopez, 1998; Sparrevoth & Rapee, 2009). Internet provides opportunities for less stressful interactions and is therefore perceived as a more comfortable medium for interaction by individuals with elevated social anxiety (Caplan, 2003, 2006; Lee & Stapinski, 2012; Pierce, 2009; Prizant-Passal, Shechner, & Aderka, 2016; Valkenburg & Peter, 2007). As a result, social anxiety is closely related to the development of online addiction (Caplan, 2006; Davis, 2001; Frost & Rickwood, 2017; Ko et al., 2014; Prizant-Passal et al., 2016).

Then, social anxiety could also constitute a predisposed vulnerability to YouTube addiction. The more socially anxious an individual is, the more he might develop an addiction to YouTube. Then, the following hypothesis is proposed:

H1: Social anxiety will be positively associated with YouTube addiction.

Additionally, as the product of the particular functioning of YouTube, the more intense parasocial relationships with YouTubers are, the more the viewers might be encouraged to use YouTube, leading to more addictive behaviors toward the platform. As such, this hypothesis is formulated:

H2: The strength of the parasocial relationship with a favorite YouTuber will be positively associated with YouTube addiction.

According to the parasocial compensation hypothesis, social anxiety encourages the establishment of parasocial relationships to satisfy the need to belong. Thus, the more socially anxious an individual is, the more he might develop intense parasocial relationships with YouTubers. Hence, the following is hypothesized:

H3: Social anxiety will be positively associated with the parasocial relationship with a favorite YouTuber.

Moreover, through parasocial relationships with YouTubers, YouTube may offer to individuals with elevated social anxiety the opportunity to experiment less stressful relationships than real-life ones, promoting the development of YouTube addiction. Therefore, parasocial relationships with YouTubers might partially mediate the relation between social anxiety and YouTube addiction. Thus, the following hypothesis is proposed:

H4: The parasocial relationship with a favorite YouTuber will mediate the association between social anxiety and YouTube addiction such that social anxiety has both a direct effect and an indirect effect, through parasocial relationships, on YouTube addiction.

Furthermore, still according to the parasocial compensation hypothesis, socially anxious individuals have difficulties to satisfy their need to belong through real life social relationships. For that reason, it

seems reasonable to argue that the more socially anxious individuals are, the more they depend on alternatives, such as parasocial relationships, to satisfy their need to belong. However, when activities participate to fulfill user's need, it may actually facilitate an excessive use (Griffiths, 1997). Parasocial relationships with YouTubers could then have more impact on YouTube addiction among high socially anxious individuals compared to low socially anxious ones. Social anxiety might play a role of moderator between parasocial relationships with YouTubers and YouTube addiction. Thus, this hypothesis is then predicted:

H5: Social anxiety will moderate the association between parasocial relationships and YouTube addiction in such way that among high socially anxious individuals the relation between parasocial relationships and YouTube addiction will be higher than among low socially anxious individuals.

As a mediation effect and a moderation effect are expected, a moderated-mediation effect can reasonably be assumed. A moderated-mediation effect corresponds to the case where the mediated effect varies across different levels of a moderator variable. Then, in line with the previous hypotheses, hypothesis 6 is proposed:

H6: The degree to which parasocial relationships mediate the relation between social anxiety and YouTube addiction will depend on the value of social anxiety such that the indirect effect of social anxiety on YouTube addiction through parasocial relationships will be stronger under high social anxiety.

Based on the previous hypotheses and on the theoretical framework presented, a moderated-mediation model of YouTube addiction is tested in the current study (see Fig. 1).

1.5. Relations between social anxiety, parasocial relationships and YouTube addiction with other variables

Besides social anxiety, other variables might be associated with parasocial relationships. Previous studies found associations between parasocial variables and loneliness variables (Baek et al., 2013; Greenwood & Long, 2009; Schiappa et al., 2007), social support variables (Derrick, Gabriel, & Hugenberg, 2009; Lakey, Cooper, Cronin, & Whitaker, 2014) and anxious attachment style (Cohen, 2004; Cole & Leets, 1999; Greenwood, 2008; Greenwood & Long, 2011; Theran, Newberg, & Gleason, 2010). Moreover, YouTube addiction might be associated with various variables besides social anxiety and parasocial relationships. Social isolation and lack of social support are believed to result in problematic Internet use (Davis, 2001). Attachment styles

Table 1
Characteristics of the Facebook groups (n = 163) and of the participants (n = 932) who accepted to participate to the current study.

	Frequency	Proportion
<i>Characteristics of the Facebook students' groups (n = 163)</i>		
International students' groups	57	35%
Psychology students' groups	56	34%
Other social sciences students' groups	28	17%
Other students' groups (law, art, sport, science ...)	22	14%
<i>Socio-demographic characteristics of the participants (n = 932)</i>		
<i>Sex (n = 932)</i>		
Male	253	27%
Female	679	73%
<i>Nationality (n = 932)</i>		
French	558	60%
Other nationalities	374	40%
<i>Other nationalities details (n = 374)</i>		
UK and Ireland	93	25%
USA and Canada	75	20%
Australia and New-Zealand	27	7%
Other WEOG*	90	24%
Eastern European Group*	36	10%
Other Asia-Pacific Group*	35	9%
Others	18	5%
<i>Occupations (n = 932)</i>		
Students	841	90%
Others	91	10%
<i>Recruitment origin (n = 932)</i>		
Facebook	876	94%
Reddit	56	6%
<i>Age (n = 932)</i>		
	21.25 (Mean)	3.96 (SD)

Note: *Western European and Others Group (WEOG), Eastern European Group and Asia-Pacific Group are United Nations regional groups of member states.

(Baek et al., 2014) and loneliness (De Cock, Vangeel, Klein, Minotte, Rosas & Meerkerk, 2014; Xu & Tan, 2012) are also related to SNS use. Then, when analyzing the relations between social anxiety, parasocial relationships and YouTube addiction, the effects of these others variables must be controlled for.

2. Methodology

2.1. Sample and procedure

This study adopted a cross-sectional design. The survey was conducted online using LimeSurvey, an open source web surveying platform. As the young adult population is the one most using YouTube (Pew Research Center, 2018), the survey initially targeted French university students by posting on French students' Facebook groups. In a second step, the study has been extended to include international participants. However, due to the difficulty to recruit international students, the study has been extended to non-student international participants and the survey was posted both on student's Facebook groups and Reddit.

A French version and an English version of the questionnaire have been used to recruit participants. A total of 862 Facebook students' group administrators (252 French students' groups and 610 groups of students from other countries) were contacted. Among them, 163 administrators (71 French and 92 from other countries) accepted to spread the online questionnaire in their group. Table 1 presents the characteristics of the Facebook groups whose administrators accepted to participate to the research. Participants must be over 18 to complete the questionnaire. Participants were informed that their participation was entirely voluntary and that their answers would remain strictly anonymous and confidential. After providing consent, participants were directed to the survey content.

A total of 1836 individuals responded to the survey among which 1077 completed the full questionnaire. We excluded 145 responses from the data base because 1) the respondents were presenting a mental health disorder, 2) the respondents were not able to name a favorite YouTuber, 3) the respondents declared having spent more than 100 h on YouTube in the last week, which appears unrealistic. Finally, 932 responses (558 French respondents and 374 respondents from other countries) were retained for data analysis.

2.2. Measures

2.2.1. YouTube addiction

There is currently no specific validated scale to measure YouTube addiction severity. Thus, this dimension was assessed using an adapted version of the Internet Addiction Test (Young, 1998a; IAT) and its French validated version (Khazaal et al., 2008) (Appendix A, Table A1). This scale measures the severity of self-reported compulsive use of the media. The IAT is the most frequently used and the most validated scale to assess Internet addiction and has been used as the basis for the development of many other scales (Laconi, Rodgers, & Chabrol, 2014). The IAT is composed of 20 items rated on a Likert-type scale ranging from 1 (rarely) to 5 (always) with a non-applicable response option (0). The term YouTube was used instead of "online" or "Internet" (e.g. "How often do you neglect household chores to spend more time on YouTube?"). Items have been modified in order to fit the context of YouTube use. The total score ranges from 0 to 100. In the present study, a Cronbach's alpha of 0.90 is found which indicates a good internal consistency.

2.2.2. Social anxiety

Social anxiety symptom severity was assessed using the self-report version of the Liebowitz Social Anxiety Scale (Fresco et al., 2001; Liebowitz, 1987; LSAS-SR) and its French version (Yao et al., 1998) (Appendix A, Table A2). In this questionnaire, respondents are asked to state their level of both fear and avoidance related to 24 statements describing different social situations (e.g. "meeting strangers"). For each situation, fear and avoidance in the last week are rated on a 4 point Likert-type scale, ranging from 0 (none and never, respectively) to 3 (severe and usually, respectively). Based on the 48 items, a total score ranging from 0 to 144 is calculated. Research has shown that LSAS-SR has good psychometric properties (Baker, Heinrichs, Kim, & Hofmann, 2002; Fresco et al., 2001; Oakman, Van Ameringen, Mancini, & Farvolden, 2003; Rytwinski et al., 2009). In the present study a

Cronbach's alpha of 0.95 is found which indicates an excellent level of internal consistency.

2.2.3. Parasocial relationship

Parasocial relationship intensity was assessed using an adapted version of the 10-item version of the Parasocial Interaction Scale (Rubin & Perse, 1987; Rubin, Perse, & Powell, 1985; PSI-Scale) (Appendix A, Table A3). The PSI-Scale was originally designed to measure the parasocial relationship of viewers with local TV newscasters (Rubin et al., 1985). The PSI Scale has been adapted to several other media characters (Auter, 1992; Grant, Guthrie & Ball-Rokeach, 1991; Kim & Song, 2016; Rubin & Perse, 1987; Rubin & Step, 2000; Sun & Wu, 2012; Thorson & Rodgers, 2006; Wang, Fink, & Cai, 2008). The PSI-Scale (Rubin et al., 1985), especially the 10-item version (Rubin & Perse, 1987), is the most used instrument to assess parasocial relationships understood as a long term social involvement (Dibble et al., 2016). The wording has been adapted to the YouTube context. "Soap opera character" was replaced by "YouTuber" and several items were modified coherently. Each item is rated on a 5-point Likert-type scale (1 = Strongly Disagree; 5 = Strongly agree). Scores for each item are then summed to compute a total parasocial relationship intensity score with higher scores indicating higher parasocial relationship intensity. The translation and adaptation of the scale into French was performed using the translation back-translation method, generating a consensus among the translators.

As there is no validation of a French version of this scale, a Confirmatory Factor Analysis (CFA) has been conducted. Three items were dropped because their loadings were below 0.45. After analyzing covariance between errors, the maximum modification indices were found between items 3 ("I look forward to watching my favorite YouTuber on his or her next video") and 4 ("If my favorite YouTuber appeared in a video on another YouTube channel, I would watch that video"). Correlated errors can emerge from items that are semantically close (Brown, 2015; Khazaal et al., 2008). As these two items are worded in a rather similar way and are the only items of the scale related to the fact of watching a favorite YouTuber, items 3 and 4 have been specified with correlated errors for further CFA and Structural Equation Modeling (SEM) analyses.

To verify the model fit, four fit indices were calculated: the normed chi square (χ^2/df), the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR) and the comparative fit index (CFI). Hooper, Coughlan, and Mullen (2008) noted that a normed chi square lower than 5 has been considered as acceptable. A RMSEA lower or equal to 0.08 indicates an acceptable fit (Garver & Mentzer, 1999; MacCallum, Browne, & Sugawara, 1996). A SRMR lower or equal to 0.08 is also considered as acceptable (Hooper et al., 2008). A CFI higher or equal to 0.90 has been considered as acceptable in several studies (Foroudi, Gupta, Sivarajah, & Broderick, 2018; Garver & Mentzer, 1999; López-Miguens & Vázquez, 2017). The CFA suggests an acceptable fit ($\chi^2/df = 4.865$; RMSEA = 0.064; CFI = 0.951; SRMR = 0.035). Cronbach's alpha in this study is 0.73, which is acceptable (Garver & Mentzer, 1999; Nunnally, 1978).

2.2.4. Attachment styles

Attachment styles were evaluated using the Relationship Questionnaire (Bartholomew & Horowitz, 1991) (Appendix A, Table A4). The Relationship Questionnaire is composed of four paragraphs describing four different attachment styles (secure, preoccupied, dismissing and fearful). Participants are asked to rate their degree of correspondence with each description on four 7-point scales. Two attachment dimensions are computed from the four pattern ratings (Brennan, Clark, & Shaver, 1998; Griffin & Bartholomew, 1994; Monteoliva, García-Martínez, Calvo-Salguero, & Aguilar-Luzón, 2012). The self-model dimension, corresponding to the anxiety dimension, is constructed by summing the ratings of the preoccupied and fearful patterns and by subtracting the ratings of the secure and dismissing patterns. The other-model dimension, corresponding to the avoidance dimension, is constructed by summing the ratings of the dismissing and fearful patterns and by subtracting the ratings of the secure and preoccupied patterns. When attachment is a secondary area of investigation, as it is in the current study, the Relationship Questionnaire is considered to have a satisfactory reliability and a good face and discriminant validity (Ravitz, Maunder, Hunter, Sthankiya, & Lancee, 2010).

2.2.5. Measures of social isolation

Three dimensions of social isolation were assessed in order to have subjective and objective measures as well as external and internal measures (Zavaleta, Samuel, & Mills, 2017).

2.2.5.1. Internal measure: loneliness. The shortened 3-item version of the University of California Los Angeles (UCLA) Loneliness Scale (Hughes, Waite, Hawkey, & Cacioppo, 2004; Russell, 1996) and its French translation (De Grace, Joshi & Pelletier, 1993) were used to assess loneliness (Appendix A, Table A5). Then, the loneliness questionnaire consists in three items rated on a Likert-type scale ranging from 1 (never) to 4 (always). Scores of each item are summed to create a scale of loneliness with higher scores indicating greater degrees of loneliness. In this study, Cronbach's alpha is 0.81 which indicates a good internal consistency.

2.2.5.2. External and subjective measure: perceived social network support. The Multidimensional Scale of Perceived Social Support (Zimet, Powell, Farley, Werkman, & Berkoff, 1990; Zimet, Dahlem, Zimet, & Farley, 1988; MSPSS) and its French version (Denis, Callahan, & Bouvard, 2015) were used to assess perceived social network support (Appendix A, Table A6). The MSPSS is a widely used self-report scale which measures perceived social support from three distinct sources: family, friends and significant others. The MSPSS consists in 12 items. Each item is rated on a 7-point Likert scale ranging from very strongly disagree (1) to very strongly agree (7). All items are summed to create the total score. Higher scores indicate higher perceived social support. In this study, Cronbach's alpha is 0.91 which indicates a very good internal consistency.

2.2.5.3. External and objective measures: household composition and

frequency of contacts. A social isolation index has been calculated in order to have an external objective measure of social isolation. Three dichotomous items are used. Participants living alone at home score “1” while those living not alone at home score “0”. The household composition is a classic socio-demographic variable used to measure social isolation (Teo, Lerrigo, & Rogers, 2013). Participants who declare being single or separated score “1” while those who declare being in a relationship score “0”. Finally, participants who declare having met face-to-face “Few days” or “Never” with friends or relatives living outside the household in the last week scored “1” while those who declare having met them “Every day” or “Most days” score “0”. The frequency of contacts is an objective measure of social isolation that is strongly linked to wellbeing and is considered to be a good proxy for meaningful relations (Teo et al., 2013). This item was also used to measure social connections in a report on wellbeing of OECD (2011). All items were summed to create a social isolation index with scores ranging from 0 to 3.

2.2.6. Socio-demographic and YouTube use variables

Control variables related to socio-demographic characteristics and YouTube use include age, sex, nationality, time spent last week watching YouTube videos and a YouTube activity index. Sex was dummy-coded as 0 for female and 1 for male. Nationality was dummy-coded as 0 for French participants and 1 for non-French participants. As parasocial relationship has been shown to be positively associated with the amount of media viewing (Schiappa et al., 2007), participants were also asked to indicate how long they have been watching YouTube videos during last week. Participants who declare having spent more than 1 h watching YouTube videos in the last week are invited to report the number of hours. The responses of those who declare having spent less than 1 h are coded 0.5. The degree of activity on YouTube is estimated thanks to five items inspired by Yeo (2010) (Appendix A, Table A7). The participants were asked to estimate on a 5-point scale the frequency with which they subscribe to YouTube channels and rate, comment, share or upload videos. A higher score on the YouTube activity index indicates a higher degree of activity on YouTube.

2.3. Data analysis

The data were analyzed using STATA® (version 14.2) for Windows. Ordinary Least Square (OLS) regressions with robust standard errors were used to test hypotheses 1 to 3 and 5. Structural Equation Modeling (SEM) using maximum likelihood method with bootstrap percentile-based confidence intervals were used to test the hypotheses 4 and 6. SEM is a multivariate technique used in mediation analysis (Baron & Kenny, 1986; Frazier, Tix, & Barron, 2004; Iacobucci, 2008; Preacher & Hayes, 2004; Zhao, Lynch Jr & Chen, 2010) and moderated-mediation analysis (Preacher, Rucker, & Hayes, 2007). SEM includes two components: a measurement model and a structural model. The measurement model is a CFA and displays the relations of the observed variables with their respective latent constructs. Using simultaneous equations estimation, the structural model depicts the relations between the latent constructs and the observable variables in the proposed model. Bootstrapping approaches are nonparametric procedures whose use has been recommended for mediation analysis (Preacher & Hayes, 2004; Shrout & Bolger, 2002; Zhao, Lynch, & Chen, 2010) and moderated-mediation analysis (Preacher et al., 2007). Indeed, because the indirect effects are the product of two parameters, their distribution is often not normal and a nonparametric procedure is then desirable. The bootstrapping percentile method produced 95% percentile confidence intervals of the effects from 1000 resamples of the data. *P*-values less than 0.05 were considered to be significant in all cases.

Inspection of multivariate outliers using Mahalanobis distance was performed and no outlier was detected in the data. Prior to running regression analyses, assumptions about residuals for multiple regression analysis and assumption of no multicollinearity of the independent

variables were checked (Cohen, Cohen, West, & Aiken, 2013). Given the large sample size, the assumption of normality of residuals was examined through the calculation of skewness and kurtosis of residuals (Ghasemi & Zahediasl, 2012; Kim, 2013). The absolute values of skewness and kurtosis of residuals are less than 1 for all regressions, which indicates that the assumption of normality of residuals is acceptable (George, 2011; Ghasemi & Zahediasl, 2012; Kim, 2013). Robust standard errors have been used to control for heteroskedasticity (Hayes & Cai, 2007). Multicollinearity was evaluated using variance inflation factor (VIF) values and tolerance. All VIF values are less than 1.66 and all tolerance values are greater than 0.60, which has been considered as acceptable in other studies (Branley & Covey, 2018; Christy & Fox, 2016; Lee-Won, Herzog, & Park, 2015; Sheldon, Rauschnabel, Antony, & Car, 2017). As both the predictor and the moderator variables were measured on a continuous scale, they both have been centered before creating the interaction term for examining moderator effects (Frazier et al., 2004).

Following the recommendations of Little, Cunningham, Shahar, and Widaman (2002) and Matsunaga (2008), the indicators for two latent variables, social anxiety and YouTube addiction, were created using parcelling. Parcelling is a method used in several other studies based on a SEM approach (Dir, Cyders, & Coskunpinar, 2013; Kim & Koh, 2018; Moneta, 2011). This method can be applied on scales presenting an established unidimensionality (Matsunaga, 2008). Both the LSAS-SR and the IAT are efficiently used as unidimensional scales and proved to have one-single factor model with reasonable psychometric properties (Fresco et al., 2001; Heeren et al., 2012; Khazaal et al., 2008; Laconi et al., 2014). Parcels were built using the factorial algorithm method (Matsunaga, 2008). Five parcels and four parcels are described as the indicators of the two latent variables YouTube addiction and social anxiety respectively. The seven remaining items¹ of the parasocial interaction scale serve directly as the indicators for the latent variable parasocial relationship intensity with a favorite YouTuber.

3. Results

3.1. Descriptive statistics

The final sample consisted of 932 participants, 253 (27.1%) males and 679 females (72.9%). The mean age of respondents was 21.3 years ($SD = 4.0$). Table 2 displays the mean, the standard deviation and the correlations for all variables. As much as 50.9% of the respondents reported watching YouTube videos at least 4 h during the last week and 19.0% of the respondents reported watching YouTube videos less than 1 h. According to the classic cutoff scores of the IAT to detect the presence of Internet addiction, 17.7% ($n = 165$) of the participants of this study can be considered as presenting a mild level of YouTube addiction (score superior to 30) and 1% ($n = 10$) can be considered as presenting a moderate level of YouTube addiction (score superior or equal to 50). No significant differences were found between student and non-student participants in mean values of social anxiety ($t(930) = 1.4, p = 0.155$), intensity of parasocial relationship with a favorite YouTuber ($t(930) = -0.6, p = 0.568$) and YouTube addiction ($t(930) = 0.4, p = 0.723$).

YouTube addiction is significantly and positively associated with parasocial relationships with YouTubers ($r = 0.37, p < 0.001$) and social anxiety ($r = 0.32, p < 0.001$), which is consistent with both hypotheses 1 and 2. It can also be noted that parasocial relationships with YouTubers are significantly associated with social anxiety ($r = 0.18, p < 0.001$), the anxiety dimension of attachment ($r = 0.08, p = 0.021$) and loneliness ($r = 0.19, p < 0.001$) which is coherent with the parasocial compensation hypothesis (Hartmann, 2016).

¹ Three items of the parasocial interaction scale were dropped because their factor loadings were inferior to 0.45.

Table 2
Means, standard deviations and correlations for all study variables (n = 932).

	1	2	3	4	5	6	7	8	9	10	11	12
1. YouTube addiction	1.00											
2. Parasocial relationship intensity with a favorite YouTube	0.37*** (<i>p</i> < 0.001)	1.00										
3. Social anxiety	0.32*** (<i>p</i> < 0.001)	0.18*** (<i>p</i> < 0.001)	1.00									
4. Age	0.01 (<i>p</i> = 0.870)	-0.03 (<i>p</i> = 0.304)	-0.11*** (<i>p</i> < 0.001)	1.00								
5. YouTube activity index	0.23*** (<i>p</i> < 0.001)	0.33*** (<i>p</i> < 0.001)	0.09** (<i>p</i> = 0.008)	0.04 (<i>p</i> = 0.176)	1.00							
6. Time spent on YouTube last week (coded 0.5 for less than 1 h)	0.28*** (<i>p</i> < 0.001)	0.15*** (<i>p</i> < 0.001)	0.02 (<i>p</i> = 0.637)	0.03 (<i>p</i> = 0.409)	0.22*** (<i>p</i> < 0.001)	1.00						
7. Anxiety (attachment dimension)	0.12*** (<i>p</i> < 0.001)	0.08* (<i>p</i> = 0.021)	0.31*** (<i>p</i> < 0.001)	-0.01 (<i>p</i> = 0.656)	0.02 (<i>p</i> = 0.569)	0.02 (<i>p</i> = 0.515)	1.00					
8. Avoidance (attachment dimension)	0.05 (<i>p</i> = 0.159)	-0.04 (<i>p</i> = 0.223)	0.18*** (<i>p</i> < 0.001)	0.02 (<i>p</i> = 0.500)	-0.03 (<i>p</i> = 0.387)	0.03 (<i>p</i> = 0.391)	-0.03 (<i>p</i> = 0.334)	1.00				
9. Loneliness	0.28*** (<i>p</i> < 0.001)	0.19*** (<i>p</i> < 0.001)	0.47*** (<i>p</i> < 0.001)	-0.09** (<i>p</i> = 0.006)	0.13*** (<i>p</i> < 0.001)	0.10** (<i>p</i> = 0.002)	0.38*** (<i>p</i> < 0.001)	0.14*** (<i>p</i> < 0.001)	1.00			
10. Perceived social support	-0.18*** (<i>p</i> < 0.001)	-0.04 (<i>p</i> = 0.197)	-0.24*** (<i>p</i> < 0.001)	-0.04 (<i>p</i> = 0.262)	-0.05 (<i>p</i> = 0.098)	-0.13*** (<i>p</i> < 0.001)	-0.19*** (<i>p</i> < 0.001)	-0.22*** (<i>p</i> < 0.001)	-0.42*** (<i>p</i> < 0.001)	1.00		
11. Social isolation index	0.12*** (<i>p</i> < 0.001)	0.02 (<i>p</i> = 0.593)	0.13*** (<i>p</i> < 0.001)	-0.04 (<i>p</i> = 0.246)	0.07* (<i>p</i> = 0.035)	0.12*** (<i>p</i> < 0.001)	0.05 (<i>p</i> = 0.119)	0.17*** (<i>p</i> < 0.001)	0.24*** (<i>p</i> < 0.001)	-0.28*** (<i>p</i> < 0.001)	1.00	
12. Sex (male = 1)	0.02 (<i>p</i> = 0.545)	-0.00 (<i>p</i> = 0.907)	-0.17*** (<i>p</i> < 0.001)	0.09** (<i>p</i> = 0.005)	0.12*** (<i>p</i> < 0.001)	0.28*** (<i>p</i> < 0.001)	-0.08* (<i>p</i> = 0.010)	-0.03 (<i>p</i> = 0.330)	-0.09** (<i>p</i> = 0.007)	-0.15*** (<i>p</i> < 0.001)	0.07* (<i>p</i> = 0.044)	1.00
13. Nationality (French = 0; other = 1)	0.18*** (<i>p</i> < 0.001)	0.25*** (<i>p</i> < 0.001)	-0.11** (<i>p</i> = 0.001)	0.40*** (<i>p</i> < 0.001)	0.01 (<i>p</i> = 0.853)	0.12*** (<i>p</i> < 0.001)	-0.03 (<i>p</i> = 0.394)	0.04 (<i>p</i> = 0.282)	0.01 (<i>p</i> = 0.667)	-0.09** (<i>p</i> = 0.007)	-0.04 (<i>p</i> = 0.204)	0.03 (<i>p</i> = 0.331)
M	20.69	24.12	49.97	21.25	10.12	6.30	-0.52	0.54	7.08	64.77	1.32	-
SD	10.79	4.30	24.44	3.96	2.83	8.42	4.12	4.25	2.44	13.22	0.86	-

Note: **p* < 0.05; ***p* < 0.01; ****p* < 0.001.

3.2. Regressions of parasocial relationships with YouTubers and YouTube addiction

An OLS regression was conducted to assess the factors associated with parasocial relationships with YouTubers. The results of this regression are presented in Table 3 (left panel). In line with the parasocial compensation hypothesis and as predicted in hypothesis 3, social anxiety appears to be a significant and positive predictor of parasocial relationships ($\beta = 0.16, p < 0.001$). Moreover, it can be noted that both loneliness ($\beta = 0.09, p = 0.017$) and the avoidance dimension of attachment ($\beta = -0.07, p = 0.031$) are significantly associated with parasocial relationships with YouTubers, which is also coherent with the parasocial compensation hypothesis.

A second OLS regression was conducted to investigate the factors associated with YouTube addiction. The results of this regression are also presented in Table 3 (right panel). Confirming hypotheses 1 and 2, both social anxiety ($\beta = 0.23, p < 0.001$) and parasocial relationships with YouTubers ($\beta = 0.23, p < 0.001$) appear to be positive and significant predictors of YouTube addiction. Furthermore, as the beta values of these variables are the highest, social anxiety and parasocial relationships with YouTubers have the strongest influence in the regression model.

Parasocial relationships and social anxiety are both positively and significantly correlated with YouTube addiction while the coefficient on the interaction term between them is also significant and positive ($\beta = 0.08, p = 0.006$) confirming hypothesis 5 on the moderation effect. This moderation effect can be described as an enhancing interaction pattern (Frazier et al., 2004). This implies that the impact of parasocial relationships with YouTubers on YouTube addiction was more important among individuals with higher levels of social anxiety than among individuals with lower levels of social anxiety. Following the indications of Cohen et al. (2013), three values of social anxiety have been selected to represent graphically the interaction: the mean, one standard deviation above the mean and one standard deviation below the mean. Fig. 2 displays the effect of parasocial relationships on YouTube addiction for the three selected values of social anxiety.

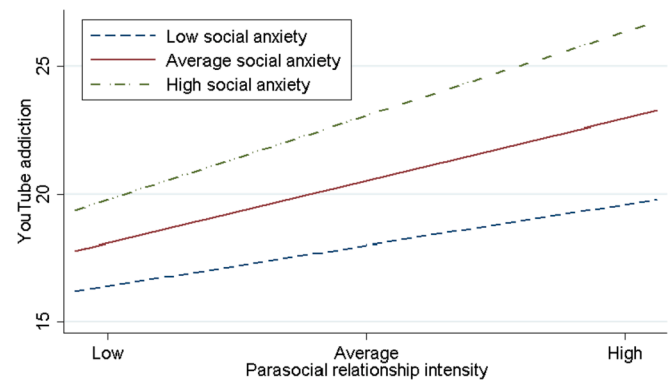


Fig. 2. Moderating effect of social anxiety on the relationship between the intensity of the parasocial relationship with a favorite YouTuber and YouTube addiction. Note: Low social anxiety: -1 standard deviation below the mean (25.5). Average social anxiety: mean value of social anxiety (50.0). High social anxiety: +1 standard deviation above the mean (74.4). Low parasocial relationship intensity: -1 standard deviation below the mean (19.8). Average parasocial relationship intensity: mean value of parasocial relationship intensity (24.1). High parasocial relationship intensity: +1 standard deviation above the mean (28.4).

3.3. Structural equation modeling: mediation and moderated-mediation effects

All the control variables (age, sex, nationality, attachment dimensions variables, social isolation variables and YouTube use variables) were kept as covariates within the SEM analyses. The overall fit of the measurement model is good ($\chi^2/df = 3.767$; RMSEA = 0.054; CFI = 0.966; SRMR = 0.040). The fit of the structural model is good as well ($\chi^2/df = 3.302$; RMSEA = 0.050; CFI = 0.938; SRMR = 0.037). The results of the SEM with a bootstrap procedure (1000 resamples) are consistent with the previous regression results. The direct effect of social anxiety on parasocial relationships with YouTubers is significant, with 0 outside the 95% percentile-based confidence interval

Table 3

Standardized and unstandardized regression coefficients for regression analyses on parasocial relationships and YouTube addiction.

Independent variables	Dependent variables							
	Parasocial relationships				YouTube addiction			
	β	p	SE	b	β	p	SE	b
Sex (1 = male)	-0.01	0.736	0.30	-0.10	-0.01	0.741	0.72	-0.24
Age	-0.15***	0.000	0.04	-0.16	-0.01	0.799	0.12	-0.03
Nationality (French = 0, other = 1)	0.32***	0.000	0.28	2.84	0.13***	0.000	0.76	2.91
Time spent on YouTube	0.06	0.061	0.02	0.03	0.20***	0.000	0.05	0.26
YouTube activity index	0.30***	0.000	0.05	0.50	0.08*	0.023	0.13	0.30
Anxiety (attachment dimension)	0.00	0.974	0.03	0.00	-0.00	0.923	0.08	-0.01
Avoidance (attachment dimension)	-0.07*	0.031	0.03	-0.07	-0.03	0.315	0.08	-0.08
Loneliness	0.09*	0.017	0.07	0.16	0.07	0.058	0.17	0.32
Perceived social support	0.06	0.087	0.01	0.02	-0.03	0.383	0.03	-0.03
Social isolation index	-0.02	0.607	0.16	-0.08	0.04	0.187	0.37	0.49
Social anxiety	0.16***	0.000	0.01	0.03	0.23***	0.000	0.01	0.10
Parasocial relationships					0.23***	0.000	0.08	0.57
Social anxiety x parasocial relationships					0.08**	0.006	0.00	0.01
Explained variance (R ²)		0.24			0.30			

Note: *p < 0.05; **p < 0.01; ***p < 0.001. β : standardized coefficient. SE: robust standard error. b: unstandardized coefficient.

Table 4
Effects of social anxiety, parasocial relationships and the interaction between them on YouTube addiction.

	YouTube addiction				
	β	b	SE	95% LL CI	95% UL CI
<i>Direct effects</i>					
Social anxiety	0.2167	0.0824	0.0151	0.0534	0.1132
Parasocial relationships	0.3527	1.6783	0.2793	1.2010	2.2848
Social anxiety x parasocial relationships	0.0803	0.0016	0.0006	0.0002	0.0027
<i>Indirect effect</i>					
Social anxiety	0.0690	0.0262	0.0070	0.0136	0.0414
<i>Total effect</i>					
Social anxiety	0.2857	0.1087	0.0149	0.0794	0.1370

Note: β : standardized coefficient. b: unstandardized coefficient. SE: bootstrapped standard error. LL: lower Limit. UL: upper limit. CI: percentile-based confidence intervals (1000 resamples).

($\beta = 0.1956$, $b = 0.0156$, $LL = 0.0087$, $UL = 0.0235$). The direct effects on YouTube addiction of social anxiety ($\beta = 0.2167$, $b = 0.0824$, $LL = 0.0534$, $UL = 0.1132$) and parasocial relationships with YouTubers ($\beta = 0.3527$, $b = 1.6783$, $LL = 1.2010$, $UL = 2.848$) are also significant. Moreover, the direct effect of the interaction between social anxiety and parasocial relationships with YouTubers on YouTube addiction is also significant ($\beta = 0.0803$, $b = 0.0016$, $LL = 0.0002$, $UL = 0.0027$).

The mediation effect was tested by analyzing the indirect effect of social anxiety on YouTube addiction via parasocial relationships with YouTubers (Zhao et al., 2010). The bootstrap method indicates that the indirect effect of social anxiety is significant, with 0 outside the 95% confidence interval ($\beta = 0.0690$, $b = 0.0262$, $LL = 0.0136$, $UL = 0.0414$). The results for the direct, indirect and total effects on YouTube addiction are presented in Table 4. The results for direct paths are also illustrated in Fig. 3. The mediation effect accounts for 24% of the total effect. Thus, as predicted in hypothesis 4, the intensity of the parasocial relationship with a favorite YouTuber mediates the relation between social anxiety and YouTube addiction.

Finally, the moderated-mediation effect was tested. The model tested in the current study corresponds to the model 74 described by Hayes (2017) and to the model 1 described by Preacher et al. (2007). The conditional indirect effect of social anxiety on YouTube addiction via parasocial relationships with YouTubers was examined at five values of social anxiety: the mean (average social anxiety), one and two standard deviations above the mean (high and very high social anxiety respectively) and one and two standard deviations below the mean (low and very low social anxiety respectively). The bootstrap procedure with percentile-based confidence intervals (1000 resamples) indicates that the conditional indirect effect is significant for all the five values of social anxiety tested. The more an individual is socially anxious, the

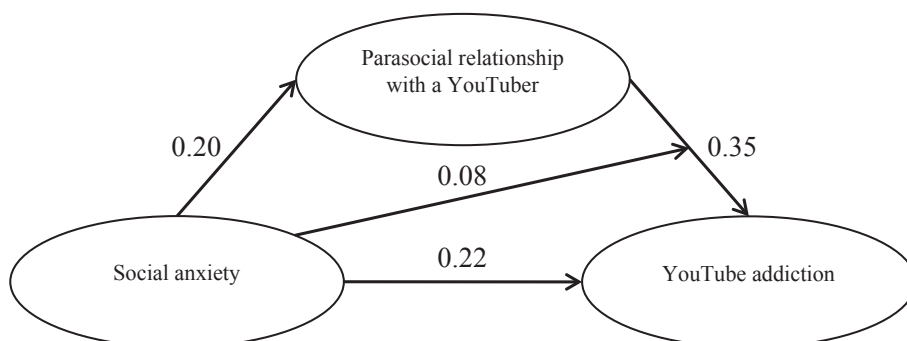


Fig. 3. Moderated-mediation model examining the relationships between social anxiety, the intensity of the parasocial relationship with a favorite YouTuber and YouTube addiction. Note: ovals represent latent constructs. For clarity of presentation, control variables, observed indicators and error terms are not shown. Standardized path coefficients are reported in the figure. All relationship paths in this model are significant, as noted in paragraph 3.3.

Table 5
Conditional indirect effect of social anxiety on YouTube addiction at different values of social anxiety.

	Conditional indirect effect				
	Social anxiety values	b	SE	95% LL CI	95% UL CI
<i>Levels of social anxiety</i>					
Very low (−2 SD)	2	0.0220	0.0066	0.0111	0.0367
Low (−1 SD)	26	0.0269	0.0072	0.0147	0.0422
Average	50	0.0275	0.0073	0.0150	0.0429
High (+1 SD)	74	0.0281	0.0075	0.0153	0.0438
Very high (+2SD)	98	0.0330	0.0087	0.0178	0.0517

Note: SD: standard deviation. b: unstandardized coefficient. SE: bootstrapped standard error. LL: lower Limit. UL: upper limit. CI: percentile-based confidence intervals (1000 resamples).

higher is the effect of social anxiety on YouTube addiction via parasocial relationships. These results, summarized in Table 5, are consistent with hypothesis 6.

4. Discussion

4.1. Consistency of the results with previous literature

The more intense the parasocial relationship with a favorite YouTuber is, the higher YouTube addiction is. This result is consistent with prior literature on parasocial relationships and SNS addiction (Baek et al., 2014; 2013) and with studies that highlight negative effects on well-being of extreme forms of parasocial relationships (Maltby et al., 2001, 2004; McCutcheon et al., 2002). Furthermore, the development of these parasocial relationships with YouTubers is influenced by the degree of social anxiety of an individual. This finding is consistent with the parasocial compensation hypothesis (Hartmann, 2016).

As a result, parasocial relationships with YouTubers appear to mediate the relation between social anxiety and YouTube addiction. More precisely, parasocial relationships mediate 24% of the total effect of social anxiety on YouTube addiction. Moreover, social anxiety also moderates the relation between parasocial relationships with YouTubers and YouTube addiction as well as the indirect effect of social anxiety on YouTube addiction via parasocial relationships with YouTubers. This implies that the more socially anxious individuals are, the more their parasocial relationships have an impact on their YouTube addiction. Such results underline the role of social anxiety as an important risk factor for YouTube addiction which is consistent with previous literature supporting the preponderant role of social anxiety in Internet addiction (Caplan, 2006; Davis, 2001; Ko et al., 2014; Lee & Stapinski, 2012; Prizant-Passal et al., 2016; Yen, Ko, Yen, Wu, & Yang, 2007).

4.2. A cognitive-behavioral model of YouTube addiction

In line with a cognitive-behavioral approach of YouTube addiction (Davis, 2001; Griffiths, 1997) the current findings strengthen the role of social anxiety as a predisposed vulnerability and the role of parasocial relationships with YouTubers as a reinforcement within the YouTube addiction model. Social anxiety makes individuals feel comfortable online and establish parasocial relationships to fulfill their need to belong. Doing so, these individuals put themselves in a position of vulnerability toward addictive behaviors online, especially on YouTube where parasocial relationships appear to be easily flourishing. On the one hand, parasocial relationships with YouTubers play the roles of positive responses that drive individuals to continue their online activity on YouTube. On the other hand, the predisposed vulnerability role of social anxiety within the YouTube addiction model is reinforced by the fact that social anxiety also fosters the establishment of parasocial relationships.

Indeed, the moderated-mediation model of YouTube addiction suggests that the more socially anxious individuals are, the more their parasocial relationships with YouTubers may lead to YouTube addiction. From a theoretical point of view, social anxiety seems to make individuals more sensitive to the effect of parasocial relationships with YouTubers on the satisfaction of their need to belong. This could be explained by the fact that socially anxious individuals might be more dependent on parasocial relationships to fulfill their need to belong than other individuals. This probably makes socially anxious individuals especially vulnerable to YouTube addiction.

Then, the YouTube addiction model presented in this article also unveils the importance to take into account parasocial relationships with YouTubers when studying YouTube use. The specific architecture of YouTube seems to encourage the development of celebrity figures through parasocial relationships, which is consistent with previous literature (Ferchaud Grzeslo, Orme & LaGroue, 2018; Hartmann, 2016; Smith, 2014). In comparison with other social media sites that have extended social networking features, YouTube seems to have different functionalities that specifically promote asymmetrical relationships between viewers and YouTubers. In the same way that social networking is believed to satisfy fundamental human needs (Kuss & Griffiths, 2017; Turel & Serenko, 2012), “parasocial networking” seems to satisfy the need to belong of individuals. Compared to social networking sites, YouTube appears more as a “parasocial networking site” through its specific architecture that promotes parasocial relationships.

4.3. Limitations

Some limitations of this study can be noted. First, despite having a large total number of participants ($n = 932$), the sample is unbalanced regarding gender with only 27% of participants being men. However, gender was never significantly associated with YouTube addiction or parasocial relationships in regression and SEM analyses. Furthermore, the absolute number of male participants was large enough ($n = 253$) to conduct the analyses as planned. The over-representation of women in the sample might be related to the Facebook groups that accepted to share the link of the survey. Indeed, 34% of the Facebook groups whose administrators accepted to share the link to the survey were groups of psychology students. Facing overrepresentation of women in her study about Internet addiction, Young (1998b) suggested that women may participate more to this type of study because they are more likely to discuss emotional issues or problems than men.

Second, the recruitment of participants through students Facebook groups and the fact that participants were all YouTube users who were able to name a favorite YouTuber constitutes a limitation to the generalization of the results. Future research should be conducted among adolescents in middle and high schools or among adults to enhance the generalizability of the current findings.

Third, in the regression analyses, the current study shows significant

differences between French participants and non-French participants regarding parasocial relationships and YouTube addiction. It shows that non-French participants develop more intense parasocial relationships and higher YouTube addiction than French participants. Indeed, there is a significant difference in the level of parasocial relationships with favorite YouTubers between French and non-French participants ($t(930) = -5.7, p < 0.001$). Non-French participants report higher parasocial relationships ($M = 25.4, SD = 4.0$) than French participants ($M = 23.2, SD = 4.3$). Moreover, there is also a significant difference in the level of YouTube addiction between French and non-French participants ($t(930) = -7.9, p < 0.001$). Non-French participants report higher YouTube addiction scores ($M = 23.1, SD = 11.4$) than French participants ($M = 19.1, SD = 10.1$).

However, conclusions on cultural differences toward the development of parasocial relationships with YouTubers and YouTube addiction should not be drawn from these results. Differences in parasocial relationships and YouTube addiction between French and non-French participant might be related to the recruitment process. The recruitment of non-French participants was more complicated than the recruitment of French participants. The 553 French participants were recruited on Facebook through the posting of the questionnaire on 71 French Facebook groups (7.8 participants recruited per group). On the other hand, to recruit 318 non-French participants on Facebook, the questionnaire has been posted on 92 non-French Facebook groups (3.5 participants recruited per group). It follows that, in the current study, the non-French participants might be more interested by the thematic of the research than the French participants. Further studies are needed to explore potential cultural differences regarding YouTube addiction and the development of parasocial relationships with YouTubers.

Fourth, the average score of social anxiety among the participants in this study is high ($M = 50.0, SD = 24.4$). Through the information and consent form, the participants were informed that social anxiety was a variable of interest in the current study. This might have biased the recruitment in such a way that the respondents who took part in this study might be more socially anxious than the general population. Moreover, social anxiety is known to be positively associated with a problematic use of Facebook (Lee-Won et al., 2015). Then, the fact that the recruitment was done exclusively online, and especially on Facebook, could also explain the high level of social anxiety among respondents.

Fifth, to keep the research model parsimonious, the current study focuses specifically on the roles of social anxiety and parasocial relationships with YouTubers on YouTube addiction. Indeed, the current study is based on the viewers' use of YouTube. However, users can also be content creators. Through their activity as content creators, users satisfy other fundamental needs (Chen, 2016) that are not explored in the current paper.

Sixth, the study only uses cross-sectional data. A longitudinal design is encouraged in future research to facilitate the inference of causal effects. Seventh, based on the cognitive-behavioral model of Davis (2001), the current study focuses on the analysis of distal contributory causes to YouTube addiction. Future studies could measure and analyze the relation between distal and proximal causes, such as maladaptive cognitions, within the same research framework.

4.4. Clinical implications and future research directions

The current study focuses on the role of parasocial relationships on the development of addictive behaviors on YouTube. However, parasocial relationships are not negative in themselves. Parasocial relationships constitute a way to satisfy a fundamental human need, the need to belong. Doing so, they put individuals at risk of addictive behaviors toward the media that permit to establish such relationships. Nevertheless, they also represent a powerful resource for individuals. For instance, clinical implications can also be drawn from the current findings. The fact that socially anxious individuals seem to be appealed

by YouTubers' video formats could constitute interesting elements for improving stepped care psychotherapy model to treat social anxiety disorder. Such model is composed of three phases: psychoeducation, guided Internet treatment and face-to-face cognitive-behavioral therapy. Improving adherence to treatment and reducing attrition, especially during the second phase of the treatment, appears to be a key issue (Nordgreen et al., 2016). During the second step of the therapy, YouTube video formats could substitute the e-mail communications between patients and therapists. Positive parasocial relationships can have beneficial effects such as increasing performance on cognitive tasks (Gardner & Knowles, 2008) or fostering desirable social effects (Papa et al., 2000). Thus, opting for a media that permits the establishment of a strong and positive parasocial relationship between socially anxious patients and their therapist may help improving adherence to treatment. This first clinical implication could be explored in future research. Another clinical implication of the current study is to provide professionals, who base their practice on a cognitive-behavioral treatment model for Internet addiction (Young, 2011), relevant information about the role of social anxiety and parasocial relationships with YouTubers for patients presenting a YouTube addiction. Furthermore, the development of the Internet constitutes an attractive channel for health education (Bernhardt & Hubley, 2001). Social media sites appear to be useful for reaching new audiences and maintaining relations with them while improving population health outcomes (Bliss, Zarco, Trovato, & Miller, 2018; Costa-Sánchez & Míguez-González, 2018). Building on the development of positive parasocial relationships, YouTube videos, recognized as efficient learning tools (Shoufan, 2019), could also be used to broadcast health education messages.

Based on the results obtained in this study, new research directions could be explored. Future studies could investigate precisely the factors underlying the development of parasocial relationships between viewers and YouTubers. More studies are also needed to understand the role of parasocial relationships regarding the use of other social media sites. In line with other authors (Kuss & Griffiths, 2017), this paper supports the idea that individuals become specifically addicted to the activities they engage in online. The particular functioning of specific online platforms plays a fundamental role in the development of

addictive behaviors (Davis, 2001; Griffiths, 1997; Kuss & Griffiths, 2017). Therefore, it appears essential to analyze the particular functioning of the different platforms. Moreover, could an intense parasocial relationship with a specific YouTuber lead to addictive behaviors on other social media platforms than YouTube? Theoretically, parasocial relationships with YouTubers may lead to addictive behaviors toward other social media platforms if these platforms promote the development of parasocial relationships with YouTubers through their architecture. Further studies are needed to evaluate the global impact of intense parasocial relationships on the development of addictive behaviors towards multiple online platforms that enable the establishment of parasocial relationships.

5. Conclusion

The purpose of this research was to investigate the phenomenon of YouTube addiction within a cognitive-behavioral framework by taking into account the roles of parasocial relationships with YouTubers and social anxiety. A moderated-mediation model of YouTube addiction fitted well the data. The research emphasizes the preponderant role of social anxiety as a predisposed vulnerability and the role of parasocial relationships with YouTubers as a reinforcement for YouTube addiction. The current study also draws attention to the importance to consider the concept of parasocial relationships when studying YouTube use and YouTubers. It also positions YouTube as a “parasocial networking site” within the scope of social media sites. Results are contributing to the literature about parasocial compensation hypothesis and YouTube addiction.

Declarations of interest

None.

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Appendix A. Scales

Table A.1
IAT adapted to YouTube.

N°	French version	English version
1	Vous arrive-t-il de rester sur YouTube plus longtemps que vous en aviez l'intention au départ ?	How often do you find that you stay on YouTube longer than you intended?
2	Vous arrive-t-il de négliger des tâches ménagères pour passer plus de temps sur YouTube ?	How often do you neglect household chores to spend more time on YouTube ?
3	Vous arrive-t-il de préférer l'excitation/l'amusement de YouTube , à l'intimité avec votre partenaire ?	How often do you prefer the excitement of YouTube to intimacy with your partner?
4	Vous arrive-t-il de créer de nouvelles relations en ligne avec d'autres utilisateurs de YouTube ?	How often do you form new relationships with fellow YouTube users?
5	Vos proches vous reprochent-ils que vous passez trop de temps sur YouTube ?	How often do others in your life complain to you about the amount of time you spend on YouTube ?
6	Arrive-t-il que vos notes ou vos devoirs scolaires souffrent du temps que vous passez sur YouTube ?	How often do your grades or school work suffer because of the amount of time you spend on YouTube ?
7	Vous arrive-t-il de regarder d'abord des vidéos sur YouTube avant d'accomplir une chose nécessaire et urgente ?	How often do you watch YouTube videos before something else that you need to do?
8	Arrive-t-il que vos performances au travail ou votre productivité souffrent à cause de YouTube ?	How often does your job performance or productivity suffer because of YouTube ?
9	Vous arrive-t-il d'être sur la défensive ou de refuser de répondre si quelqu'un vous demande ce que vous faites sur YouTube ?	How often do you become defensive or secretive when anyone asks you what you do on YouTube ?
10	Vous arrive-t-il de chasser les soucis de votre vie quotidienne par la pensée réconfortante d'aller sur YouTube ?	How often do you block out disturbing thoughts about your life with soothing thoughts of YouTube ?
11	Vous arrive-t-il de vous réjouir du moment où vous irez de nouveau sur YouTube ?	How often do you find yourself anticipating when you will go on YouTube again?
12	Vous arrive-t-il de penser que la vie sans YouTube serait ennuyeuse, vide et sans joie ?	How often do you fear that life without YouTube would be boring, empty, and joyless?
13	Vous arrive-t-il de répondre d'un ton brusque, de crier ou de vous montrer agacé si quelqu'un vous dérange pendant que vous êtes sur YouTube ?	How often do you snap, yell, or act annoyed if someone bothers you while you are on YouTube ?
14	Vous arrive-t-il de manquer de sommeil parce que vous êtes resté tard sur YouTube ?	How often do you lose sleep due to late-night YouTube videos watching ?

(continued on next page)

Table A.1 (continued)

N°	French version	English version
15	Lorsque vous n'êtes pas sur YouTube , vous arrive-t-il de penser activement ou rêver y être ?	How often do you feel preoccupied with YouTube when off-line, or fantasize about watching videos on YouTube ?
16	Vous arrive-t-il de dire « juste encore quelques minutes » lorsque vous êtes sur YouTube ?	How often do you find yourself saying “just a few more minutes” when watching videos on YouTube ?
17	Vous arrive-t-il d'essayer de diminuer le temps que vous passez sur YouTube sans y arriver ?	How often do you try to cut down the amount of time you spend on YouTube and fail?
18	Vous arrive-t-il de cacher aux autres combien de temps vous avez passé sur YouTube ?	How often do you try to hide how long you've been on YouTube ?
19	Vous arrive-t-il de choisir de passer plus de temps sur YouTube plutôt que de sortir avec des proches ?	How often do you choose to spend more time on YouTube over going out with others?
20	Vous arrive-t-il de vous sentir déprimé, de mauvaise humeur ou énervé lorsque vous n'êtes pas sur YouTube , puis de vous sentir mieux lorsque vous y êtes ?	How often do you feel depressed, moody, or nervous when you are off-line, which goes away once you are back on YouTube ?

Scale: not applicable (0), rarely (1), occasionally (2), frequently (3), often (4), always (5).

Table A.2

LSAS-SR.

N°	Items in French	Items in English
1	Téléphoner en public	Telephoning in public
2	Participer au sein d'un petit groupe	Participating in small groups
3	Manger dans un lieu public	Eating in public places
4	Boire en compagnie dans un lieu public	Drinking with others in public places
5	Parler à des gens qui détiennent une autorité	Talking to people in authority
6	Jouer, donner une représentation ou une conférence	Acting, performing or giving a talk in front of an audience
7	Aller à une soirée	Going to a party
8	Travailler en étant observé(e)	Working while being observed
9	Ecrire en étant observé(e)	Writing while being observed
10	Contacter par téléphone quelqu'un que vous ne connaissez pas très bien	Calling someone you don't know very well
11	Parler à des gens que vous ne connaissez pas très bien	Talking to people you don't know very well
12	Rencontrer des inconnu(e)s	Meeting strangers
13	Uriner dans les toilettes publiques	Urinating in a public bathroom
14	Entrer dans une pièce alors que tout le monde est déjà assis	Entering a room when others are already seated
15	Etre le centre d'attention	Being the centre of attention
16	Prendre la parole à une réunion	Speaking up at a meeting
17	Passer un examen	Taking a written test
18	Exprimer son désaccord ou sa désapprobation à des gens que vous ne connaissez pas très bien	Expressing appropriate disagreement or disapproval to people you don't know very well
19	Regarder dans les yeux des gens que vous ne connaissez pas très bien	Looking at people you don't know very well in the eyes
20	Faire un compte-rendu à un groupe	Giving a report to a group
21	Essayer de « draguer » quelqu'un	Trying to pick up someone
22	Rapporter des marchandises dans un magasin	Returning goods to a store where returns are normally accepted
23	Donner une soirée	Giving an average party
24	Résister aux pressions d'un vendeur insistant	Resisting a high pressure salesperson

Participants are asked to rate each item on two 4-point scales according to their level of anxiety and their frequency of avoidance.

For anxiety, the 4-point scale is: none (0), mild (1), moderate (2), severe (3).

For avoidance, the 4-point scale is: never (0), occasionally (1), often (2), usually (3).

Table A.3

PSI-SCALE adapted to YouTube.

N°	French version	English version
1	Mon YouTuber préféré me fait me sentir à l'aise, comme si j'étais avec un ami	My favorite YouTuber makes me feel comfortable, as if I am with a friend
2	Je considère mon YouTuber préféré comme une personne nature et terre à terre	I see my favorite YouTuber as a natural, down-to-earth person
3	J'ai hâte de regarder mon YouTuber préféré dans sa prochaine vidéo	I look forward to watching my favorite YouTuber on his or her next video
4	Si mon YouTuber préféré apparaissait dans une vidéo sur une autre chaîne YouTube, je regarderais cette vidéo	If my favorite YouTuber appeared in a video on another YouTube channel, I would watch that video
5	Mon YouTuber préféré semble comprendre le genre de choses que je veux connaître	My favorite YouTuber seems to understand the kinds of things I want to know
6	Si je voyais une histoire sur mon YouTuber préféré dans un journal ou un magazine, je la lirais	If I saw a story about my favorite YouTuber in a newspaper or magazine, I would read it
7	Mon YouTuber préféré me manque quand il est malade ou en vacances	I miss seeing my favorite YouTuber when he or she is ill or on vacation
8	J'aimerais rencontrer mon YouTuber préféré en personne	I would like to meet my favorite YouTuber in person
9	J'ai de la peine pour mon YouTuber préféré quand il fait une erreur	I feel sorry for my favorite YouTuber when he or she makes a mistake
10	Je trouve que mon YouTuber préféré est séduisant	I find my favorite YouTuber to be attractive

Each item is rated on a 5-point scale: (1) strongly disagree, (2) disagree, (3) neither disagree nor agree, (4) agree, (5) strongly agree.

Table A.4
Relationship questionnaire.

French version	English version
<p>A</p> <p>Je me sens facilement proche des autres quand je partage des émotions avec eux. Je me sens bien lorsque je dépends d'eux et qu'eux dépendent de moi. Je n'ai pas peur d'être seul(e). Je n'ai pas peur que les autres ne m'aient pas.</p>	<p>A</p> <p>It is relatively easy for me to become close to others. I am comfortable depending on others and having others depending on me. I don't worry about being alone or having others not accept me.</p>
<p>B</p> <p>Je ne suis pas à l'aise lorsque je suis proche des autres. J'aimerais des relations proches lorsqu'il s'agit d'émotions mais je trouve difficile de faire complètement confiance aux gens ou d'être dépendant(e) d'eux. J'ai peur, si je me permets d'être proche des gens, d'être blessé(e) par eux.</p>	<p>B</p> <p>I am somewhat uncomfortable getting close to others. I want emotionally close relationships, but I find it difficult to trust others completely, or to depend on them. I sometimes worry that I will be hurt if I allow myself to become too close to others.</p>
<p>C</p> <p>J'aimerais ne pouvoir faire qu'un(e) avec les gens mais j'ai souvent l'impression que eux ne veulent pas être aussi proches de moi que je le souhaiterais. Je ne me sens pas bien lorsqu'il n'y a personne autour de moi dont je me sente proche. Mais, en même temps, j'ai parfois peur de tenir plus aux gens que eux à moi.</p>	<p>C</p> <p>I want to be completely emotionally intimate with others, but I often find that others are reluctant to get as close as I would like. I am uncomfortable being without close relationships, but I sometimes worry that others don't value me as much as I value them.</p>
<p>D</p> <p>Je suis bien sans avoir de proches autour de moi. C'est très important pour moi de me sentir indépendant(e) et de me suffire à moi-même. Je préfère ne pas dépendre des gens et qu'eux ne dépendent pas de moi.</p>	<p>D</p> <p>I am comfortable without close emotional relationships. It is very important to me to feel independent and self-sufficient, and I prefer not to depend on others or have others depend on me.</p>

Participants are asked to indicate their degrees of agreement for each of the following four propositions (A, B, C and D) from a 7-point scale. 1 (not at all similar to me), 4 (somewhat similar to me), 7 (very similar to me). Then they are asked to select the description that best suits them among the four available.

Table A.5
UCLA Loneliness Scale 3-item adapted version

N°	French version	English version
1	Je n'ai pas assez de compagnie	I lack companionship
2	Je me sens exclu(e)	I feel left out
3	Je me sens isolée des autres	I feel isolated from others

Participants are asked to indicate on a 4-point scale how often they feel the way described in each of the following statements: never (1), rarely (2), sometimes (3), often (4).

Table A.6
MSPSS.

N°	Items in French	Items in English
1	Il y a une personne en particulier qui est là quand j'en ai besoin	There is a special person around when I am in need
2	Il y a une personne en particulier avec laquelle je peux partager mes joies et mes peines	There is a special person I share joys and sorrows with
3	Ma famille essaie vraiment de m'aider	My family tries to help me
4	Je reçois de ma famille toute l'aide émotionnelle et le soutien dont j'ai besoin	I get emotional help and support from my family
5	Je connais une personne en particulier qui est une vraie source de réconfort pour moi	I have a special person who is source of comfort
6	Mes amis essaient vraiment de m'aider	My friends really try to help me
7	Je peux compter sur mes amis quand les choses vont mal	I can count on my friends when things go wrong
8	Je peux parler de mes problèmes avec ma famille	I can talk about my problems with my family
9	J'ai des amis avec lesquels je peux partager mes joies et mes peines	I have friends with whom I share joys and sorrows
10	Il y a quelqu'un de spécial dans ma vie qui s'inquiète de ce que je ressens	There is a special person who cares about my feelings
11	Ma famille est prête à m'aider à prendre des décisions	My family is willing to help me make my decisions
12	Je peux parler de mes problèmes avec mes amis	I can talk about my problems with my friends

Participants are asked to rate the items according to their level of agreement with the different statements from a 7-point scale. Very strongly disagree (1), strongly disagree (2), disagree (3), indifferent (4), agree (5), strongly agree (6), very strongly agree (7).

Table A.7
YouTube activity index

N°	Items in French	Items in English
1	Noter des vidéos (like/dislike)	Rate a video (like/dislike)
2	Poster un commentaire	Post a comment
3	Partager une vidéo	Share a video
4	Vous abonner à une chaîne	Subscribe to a channel
5	Uploader une vidéo	Upload a video

Each item is rated on a 5-point scale: (1) never, (2) rarely, (3) sometimes, (4) often, (5) always.

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