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The Effect of Belongingness on Obsessive-Compulsive Disorder in the Use of Online Social Networks

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ABSTRACT

Online social networks (OSNs) continue to have a transformative influence on how people socialize, partially because they help facilitate social contact that is crucial to fulfilling an innate *need to belong*. However, there is increasing evidence that some users suffer from OSN addiction, expressed as OSN obsessive-compulsive disorder (OCD). Using the need-to-belong theory as our foundation, we seek a deeper understanding of the relationship between OSN belongingness and OSN OCD by examining the effects OSN-specific uses and gratifications (U&Gs) and negative emotions have on it. We find that OSN belongingness is positively associated with use of the OSN to gratify needs for purposive value, self-discovery, maintaining interpersonal interconnectivity, social enhancement, and entertainment value. However, gratification of only the purposive value and social enhancement needs increase the likelihood of OSN OCD. Furthermore, we find that while OSN belongingness decreases the likelihood of OSN envy and anxiety, it slightly increases the likelihood of OSN fear of missing out; notably, all three of these negative emotions drive OSN OCD. Our findings indicate healthy socialization use by well-adjusted individuals decreases OSN OCD risks, but those experiencing unstable emotional responses or unhealthy socialization on the OSN should avoid use.

Keywords: online social networks (OSNs); OSN obsessive-compulsive disorder; OSN addiction; OSN belongingness; need-to-belong theory; uses and gratifications theory; Facebook

INTRODUCTION

Online social networks (OSNs) (aka "social networking sites") enable individuals to maintain social connections, make new connections, and interact with others who may have similar interests [19, 83, 143]. OSNs are relatively new, but within a short time, they have revolutionized socialization by opening a new world of communication possibilities across a wide array of technologies. Facebook is the most popular OSN worldwide. As of December 2016, Facebook reported 1.23 billion daily active users and 1.86 billion monthly active users [33]. Given its popularity, it is not surprising that researchers have found Facebook has the potential to influence the socialization processes of its users considerably, including changing the way they communicate and associate with one another [9, 25, 32, 103, 108, 125, 131].

Social psychology research indicates all humans have a desire for a minimum number of healthy relationships with others [6], a phenomenon referred to as the *need to belong*. One means of maintaining healthy relationships with others is frequent social contact [6], which OSNs facilitate. In the current study, we use the term OSN belongingness to refer to feelings of connectedness or togetherness derived from individuals' friends on an OSN [42]. Research shows people have a strong desire for social contact reflective of the need to belong [48], and studies indicate the "need to interact with others" is a primary reason for younger people's social media use [1, p. 248]. OSN use "grants people enjoyable feelings of affiliation, belonging, and social support; similar to face-to-face contexts, they engage in social interactions and develop interpersonal relationships by sharing personal information" [143, p. 240]. Thus, feelings of belongingness are desired and bring pleasure to individuals; however, such desires taken too far can become maladaptive, resulting in addictive disorders such as OSN obsessive-compulsive disorder (OSN OCD). In fact, one study found that individuals had difficulty resisting the desire to use media (e.g., OSN, email, Web surfing, television), even suggesting that "media-consumption behaviors might […] turn into strong habits or forms of pathological media abuse" and stating that "whether under-regulation of media use causes

serious problems for modern Westerners is an intriguing issue" [48, p. 587].

For these reasons, our study grounds its theoretical model on the relationship between OSN belongingness and OSN OCD, a manifestation of addiction. Indications of OSN addiction and OCD have been reported in previous research. In one study where subjects were asked to "unplug" from all media for one day, one subject wrote [88, p. 1]:

> *I think that was one hour and I wanted to turn on my computer and see what's going on in Facebook and Twitter. Between 4 and 6 pm it was horrible. I couldn't focus on my study. Even in my dreams I see myself chatting, using Skype, Twitter and adding people on Facebook.*

Previous research indicates that "reducing and jeopardizing academic, social, and recreational activities are considered as criteria for substance dependence and may thus be considered as valid criteria for behavioral addictions, such as SNS [social networking site] addiction" [62, p. 3538]. Subjects participating in the "unplug" study also used the words "obsessed" and "addicted" and suggested they felt socially disconnected. For example, one wrote "I'm so obsessed with checking my cell phone and my Facebook and the *New York Times* Web site that I lose track of the people who are physically with me sometimes" [88, p. 1]. Another wrote "From my lack of social networking I had no idea what people were up to, no idea what was happening and generally didn't know what to do with myself. I even found myself thinking of status's I could put if I was to go on" [88, p. 1].

Behavioral online addictions—such as online gambling, Internet addiction, Internet gaming addiction—are starting to be recognized, along with their similarities to substance abuse disorders [49, 126]. However, only gambling is currently included in the current Diagnostic and Statistical Manual of Mental Disorders (DSM-5) [2, 8]. The DSM-5 also suggests Internet gaming disorder is a condition that should be further studied for possible future inclusion [2, 8]. Internet addiction has been written about rather extensively [7, 8, 15, 24, 43, 63, 140], but recently researchers have suggested it may not be "simply the use of the Internet that is potentially addictive, but rather involvement in specific online activities" [49, p. 2080]. In fact, many researchers have focused their

investigations on OSN addiction (sometimes referred to as social media or Facebook addiction) [4, 44, 45, 49, 55, 62, 66, 107, 111, 126, 127]. What is commonly noted is that these behavioral addictions "share defining features of substance dependence, including excessive use, tolerance, withdrawal and negative repercussions from use" [49, p. 2079].

OSN addiction has been defined as "a failure to regulate usage, which leads to negative personal outcomes" [107, p. 133]. In the information systems (IS) literature, *technology addiction* has been defined as "a user's maladaptive psychological state of dependency on IT [information technology] use which is manifested through an obsessive pattern of IT-seeking and IT-use behaviors that take place at the expense of other important activities" [127, p. 514].[i] Technology addiction, of which OSN addiction is a subtype, is important to study because such maladaptive use results in individuals experiencing negative personal repercussions, such as decreased happiness and vitality, obesity, death, social isolation, social inhibition, alterations in mood, and decreased performance at work or school [15, 17, 52, 66, 127, 130, 141, 142].

In our study, we examine OCD on Facebook as a manifestation of OSN addiction. Specifically, we use an obsessive-compulsive scale originally developed to examine pathological gambling [93] that was adapted to measure obsessive-compulsive use of SNSs [111]. We examine the possibility that certain benign OSN uses and gratifications (U&Gs) (i.e., use of the OSN to gratify needs for social enhancement or entertainment value) can fan the desire for social contact, causing users to think about and "check in" pathologically with the OSN (i.e., OSN OCD). Similarly, certain context-specific negative emotions—such as OSN envy, OSN fear of missing out (FOMO), and OSN anxiety—can also reinforce the tendency to stay in constant contact with the OSN, leading to OSN OCD. We leverage the need-to-belong theory (NTBT) to propose that individuals' OSN U&Gs and OSN negative emotions are an outgrowth of their sense of belongingness on the OSN—leading to OSN OCD. This is an important link because OSNs provide an environment in which neuroses can fester and a host of desires can be gratified. We test our model with 798 experienced Facebook users

and find strong support for the line of reasoning above. Our study supplements the literature on OSN addiction by providing a rich model of how users' sense of belongingness on the OSN filters through OSN U&Gs and OSN negative emotions, increasing the likelihood of OSN OCD.

OBSESSIVE-COMPULSIVE DISORDER (OCD)

Prior IS research has studied technology addiction through the measurement of OCD, stating, "behavioral addictions can be captured with measures of obsessive-compulsive disorder, a closely related concept" [128, p. 1050]. DSM-5 states OCD is characterized by the "presence of obsessions, compulsions, or both" [2, p. 237]. *Obsessions* are "recurrent and persistent thoughts, urges, or images" [2, p. 237] that are unwanted and that the individual attempts to suppress. *Compulsions* are "repetitive behaviors" that "the individual feels driven to perform in response to an obsession" and are "aimed at preventing or reducing anxiety or distress, or preventing some dreaded event or situation" [2, p. 237]. OCD results in negative personal outcomes for the individual that are not attributable to other physical or mental health conditions [2].

The Yale–Brown obsessive compulsive scale (YBOCS) was developed in the late 1980s to measure OCD symptoms [41]. The YBOCS was adapted for pathological gambling, referred to as PG-YBOCS [93]. Turel et al. [128] introduced the PG-YBOCS into the IS literature by adapting it to examine online auction addiction. This scale was later adapted by Serenko and Turel [111] for OSNs. We use the latter scale to explore OSN addiction, as expressed and measured using OSN OCD, as the dependent variable in our model.

THEORETICAL FOUNDATION, MODEL, AND HYPOTHESES

Before describing our use of OSN belongingness to explain OSN OCD, Figure 1 provides an overview of our proposed model. The basic premise is that the more users feel connected to their OSN social group, the more prone they will be to OSN OCD. We expect this direct relationship to be partially mediated by OSN U&Gs—such as the use of the OSN to gratify purposive value; self-discovery; maintaining interpersonal interconnectivity; social enhancement; and entertainment value

desires—and OSN negative emotions that increase OSN OCD—such as OSN envy, OSN FOMO,

Figure 1. Operational Model of Hypotheses, Covariates, and Controls
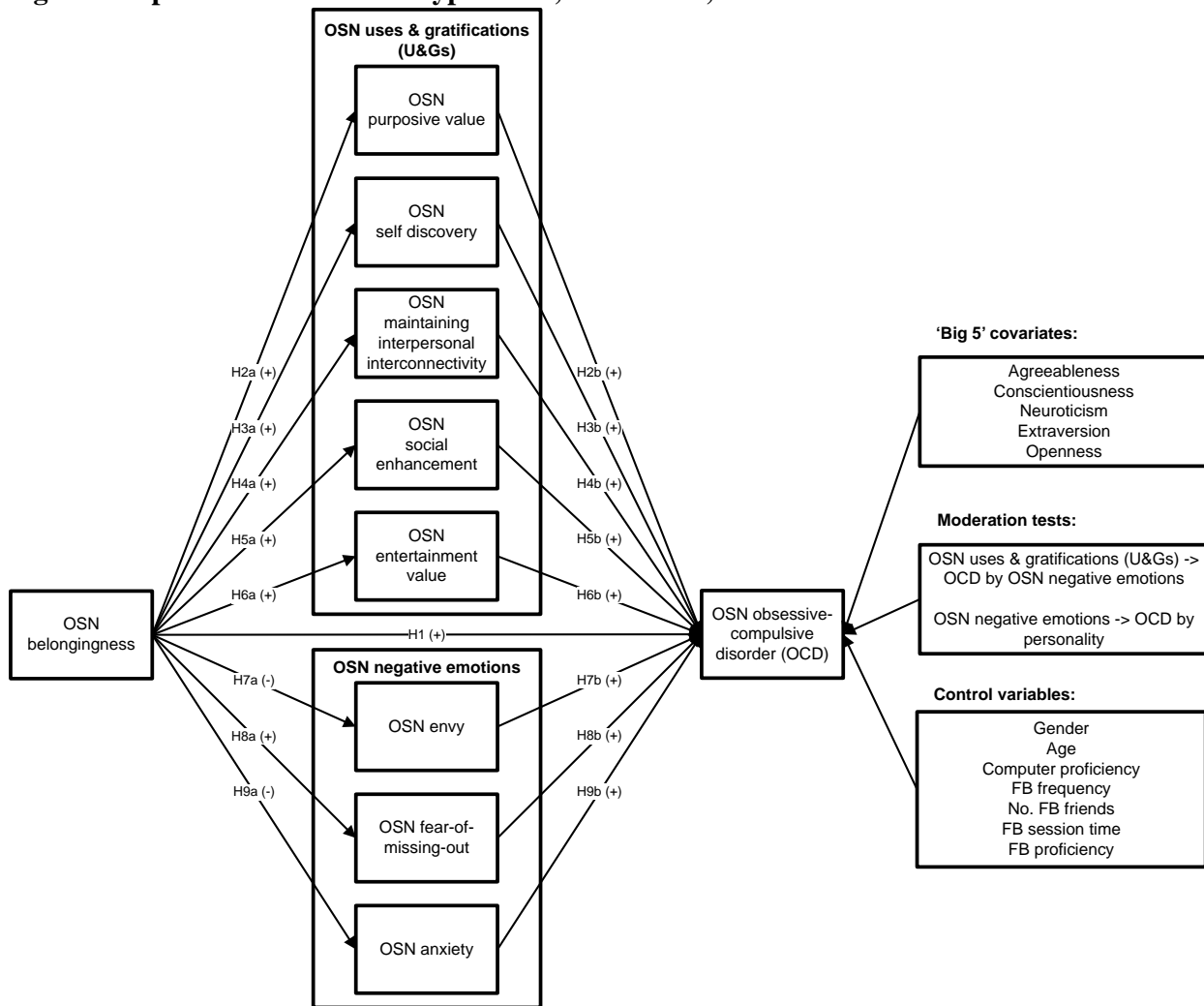
and OSN anxiety. We also test for possible moderation by the OSN negative emotions (i.e., OSN

envy, OSN FOMO, and OSN anxiety) of the relationships between the OSN U&Gs (i.e., OSN

purposive value, OSN self-discovery, OSN maintaining interpersonal interconnectivity, OSN social

enhancement, and OSN entertainment value) and OSN OCD because such neuroses may enhance or

diminish the association between use to gratify a particular desire and OSN OCD. We also test for

possible moderation by users' personality traits (e.g., conscientiousness, openness) of the

relationships between the OSN negative emotions (i.e., OSN envy, OSN FOMO, and OSN anxiety)

and OSN OCD.

Need-to-Belong Theory (NTBT)

NTBT arose from the idea that "fear of being rejected and abandoned by others" was a predominant cause of anxiety. In proposing NTBT, Baumeister and Leary [6] state "the belongingness hypothesis is that human beings have a pervasive drive to form and maintain at least a minimum quantity of lasting, positive, and significant interpersonal relationships" (p. 497). They also suggest "satisfying this drive involves two criteria: First, there is a need for frequent, affectively pleasant interactions with a few other people, and second, these interactions must take place in the context of a temporally stable and enduring framework of affective concern for each other's welfare" [6, p. 497]. Notably, belongingness is not a new concept [6]. In fact, it is represented in Maslow's Hierarchy of Needs as half of the "love and belongingness need" [80]. They also state it is possible the need to belong "is part of the human biological inheritance" [6, p. 518]; thus, this need is not just socialized but is genetically inherited and is difficult to countermand.

For positive fulfillment of the need to belong, people need to have social bonds, maintained through frequent non-negative interaction with a small number of others. Notably, it may be possible to satiate the need to belong with a relatively small number of close relationships. In addition, the influence of new relationships diminishes as more are added [6]. Relationships may also be substituted; for example, if a person ends a friendship, another may take its place and satisfy the need to belong. Such socialization may be facilitated by an OSN. To feel a sense of belongingness on an OSN, users must have a social bond with at least some of their OSN friends. Moreover, the interaction with these important *others* needs to be healthy (i.e., non-negative) to fulfill the need to belong. Thus, if users feel a strong sense of OSN belongingness, they are most likely experiencing social bonds with at least some of the other users on the OSN, and interactions with those users are generally positive.

Not fulfilling the need to belong has many negative physical and psychological consequences

[6]. Research suggests that psychological well-being may be influenced by the connectedness one feels to the OSN social group and that there is a link between belongingness and OSN addiction and between belongingness and Internet addiction [87, 122]. It also suggests OSNs can provide an outlet for healthy socialization that could have positive outcomes for general well-being, which may explain their popularity. However, it also alludes to severe negative physical and psychological consequences if socialization becomes maladjusted [4, 82, 95]. Because the need to belong is innate and its fulfillment is satisfying, then like other pleasurable activities, the drive to satiate this need could become addictive under certain conditions.

In our model, we propose a key explanatory factor of *OSN belongingness*, which is feelings of social connectedness to others on an OSN. Thus, as the user's belongingness with his/her social network increases (i.e., the user feels ever more strongly connected to his/her social network), the user's desire to maintain the pleasant feelings resulting from belonging can ultimately lead to OSN OCD. The OSN environment is especially conducive to this phenomenon because OSNs provide different ways to overstimulate users socially—such as building a large network of "friends" (many of whom might not be legitimate friends), conversing with these friends anytime and anywhere, and browsing friends' activities with or without interaction. NTBT suggests people form social attachments with ease and are highly motivated to do so. In fact, frequent social contact is the only reliable factor needed to form social attachments, and a relationship without frequent interaction does not fully satisfy the need to belong [6]. The OSN provides the means to accomplish both frequent social contact and to form social attachments.

Additionally, "not only do relationships emerge quite naturally, but people invest a great deal of time and effort in fostering supportive relationships with others" [6, p. 502]. Positive feelings of belongingness reinforced by the unlimited social stimulation provided by the OSN may lead to OSN OCD. Importantly, there are few controls on the attainment of social stimulation on an OSN, in which people can spend as much time and effort fostering their relationships as desired. Many users

have access to these networks of friends on a mobile phone to which they have continuous access, thus preventing normal limits on such social stimulation (e.g., face-to-face socialization may end at the conclusion of a physical social event, whereas the OSN is available at all times). Some OSN uses can be undertaken in ways that may go unnoticed, thus preventing normal social constraints that stifle such behavior offline (e.g., being perceived as overly needy or as a stalker).

We propose the form the social stimulation takes can be a factor mediating the relationship between OSN belongingness and OSN OCD. Research suggests Facebook-specific motives as mediators of the relationship between relatedness (i.e., belongingness) and OSN addiction [82]. Similarly, we suggest that as users feel a greater sense of belongingness to their social group on the OSN, the desire to socialize on the OSN may influence how they employ it (i.e., which needs users turn to the OSN to satisfy), and some forms of use may indicate those more prone to OSN OCD. To examine how OSN belongingness is associated with needs gratification, we draw from work on U&G Theory (UGT) to explore U&Gs on OSNs. Such an examination of context-specific OSN U&Gs may help determine what types of OSN U&Gs characterize individuals more prone to OSN OCD.

Baumeister and Leary [6] also point to facets of the need to belong that have obvious negative implications. They suggest people will make extraordinary efforts to avoid the dissolution of relationships, even unhealthy ones, and state that "people interpret situations and events with regard to their implications for relationships, and they think more thoroughly about relationship (and interaction) partners than about other people" [6, p. 505]. OSNs provide a tremendous amount of social content that can provide fodder for such contemplation. For example, some OSNs allow people to view some of their friends' experiences and observe interactions between people in their social group; such content can easily be over-analyzed or misinterpreted, leading to feelings of envy, anxiousness, or exclusion. Such OSN negative emotions could drive users to think obsessively about what is happening on the OSN and drive them to use it ever more frequently to assuage their negative feelings. In our study, we suggest that such OSN negative emotions drive OSN OCD and that they

may moderate the relationships between the OSN U&Gs and OSN OCD.

Positive and negative emotional responses to a given situation are driven by the existence (or non-existence) of social connections, and social bonds can intensify emotions [6]. In fact, "actual or possible changes in belongingness status constitute an important cause of emotions" [6, p. 508]. Moreover, being "unfriended," excluded, or misinterpreting social cues on an OSN may mimic belongingness status changes and could lead to negative emotional responses [10]. Importantly, social bonds with other users on the OSN may foster emotional responses to content created by or interaction with valued others. Because research suggests "anxiety and general distress seem to be a natural consequence of being separated from important others" [6, p. 506], healthy OSN socialization may provide a method of avoiding these feelings—or alternatively, the OSN may become a breeding ground for maladaptive emotional responses. In our model, we propose that feelings of OSN belongingness may both mitigate and enhance different OSN-specific negative emotional responses. Thus, our overarching model, using NTBT as a foundation, explores the interplay of feelings of belongingness on the OSN with OSN U&Gs and OSN negative emotions and how this interplay may ultimately lead to OSN OCD.

Belongingness and OSN Obsessive-Compulsive Disorder

Given the assumptions of NTBT juxtaposed with the unique social interaction facilitated by the OSN environment, it becomes clear how a strong sense of OSN belongingness could drive OSN OCD. Again, belonging is a core biological need that can adversely influence the physical and psychological health of individuals if not obtained [5]. An individual has a need for "regular social contact with those to whom one feels connected" [6, p. 501]. This suggests that as belongingness with an online social group increases, the need for regular social interaction with that group increases. Regardless of quantity, social interaction without a social bond (i.e., connectedness) does not satisfy the need to belong [5]. Thus, in the presence of a social bond, OSN interaction with these important others is strongly desired because it increases pleasurable social contact. An unchecked

drive to feel the pleasure resulting from belonging can become addictive. Additionally, OSNs do not have many traditional social (e.g., non-verbal cues one is being too pushy) or regulatory checks on their use, which may make it harder to catch or correct maladaptive behaviors.

We thus argue that OSNs can be the breeding ground for addictive behaviors and the need to belong is a driver. The OSN environment provides users with unprecedented access to the lives of the people in their online social group. Individuals can access the OSN any time they desire and can be connected to the OSN continuously. The OSN provides an extraordinary amount of social information. Prior research indicates users' desire for social connectedness (i.e., belongingness) influences the ways they use OSNs. Individuals who identify with an online social group, which includes drawing emotional significance and self-worth from belonging to the group, have a greater desire to participate in virtual communities and a greater joint intention to participate in OSN-facilitated team collaboration [112]. The need to belong has been demonstrated to exert a positive effect on attitudes toward SNSs [37]. Notably, a study of university students found users with a great need to belong were more likely to have addictive tendencies regarding OSN use [95]. Research found OSN belongingness to be distinct from offline belongingness and discovered that feelings of social connectedness could lead to positive outcomes, such as reduced depression and anxiety and increased satisfaction with life [42]. These findings suggest feelings of social acceptance, belongingness, or connectedness on an OSN are possible and can be positive.

We argue that traditional obstacles to constant socialization present in the offline context are less likely to obstruct the pursuit of pleasurable feelings from social acceptance, belongingness, or connectedness in an online context (i.e., OSN). For example, an OSN is available at all times and users can access some features of certain OSNs without notice and as frequently as desired; whereas in the offline environment, social events have fixed times and locations, and people disperse at the end of the event until the next gathering. Although OSN belongingness may result in positive outcomes, we suggest that the drive to obtain the pleasurable feelings generated from such

connectedness to one's online social group may become maladaptive in some people, resulting in OSN OCD. Belongingness thus leads to a desire for regular social contact and inspires happiness, which can lead to OSN OCD to perpetuate the positive feelings. OSNs also provide an environment conducive to addictive behaviors, and the general need to belong has been found to be associated with addictive OSN tendencies. Thus,

> *H1. A user's **OSN belongingness** is positively associated with **OSN OCD**.*

UGT and OSN Obsessive-Compulsive Disorder

Here, we further ground our NTBT-based model in UGT to explain how people with a high level of OSN belongingness are motivated to use the OSN to gratify certain pleasurable desires. Research shows people are motivated to use OSNs for many reasons (e.g., to maintain relationships, to seek information, or to relax) [21, 54, 107]. Katz et al. [56] indicate that UGT research on media is concerned with "(1) the social and psychological origins of (2) needs, which generate (3) expectations of (4) the mass media or other sources, which lead to (5) differential patterns of media exposure (or engagement in other activities), resulting in (6) need gratifications and (7) other consequences, perhaps mostly unintended ones" (p. 510). Following their framework, we isolate OSN belongingness as our psychological origin of needs, which influences OSN U&Gs (i.e., OSN purposive value, OSN self-discovery, OSN maintaining interpersonal connectivity, OSN social enhancement, OSN entertainment value) and OSN negative emotions (i.e., OSN FOMO, OSN envy, and OSN anxiety) that we suggest lead to increased OSN OCD.

Researchers have examined OSNs and addiction through motivations for OSN use, negative consequences of OSN use, emotions, OSN use patterns, and personalities of OSN users [62]. Whereas we focus on the first three, we include the last two as controls to test our model robustly. In our study, we adopt the five OSN U&Gs specified by Cheung et al. [22] and defined in Table 1— OSN purposive value, OSN self-discovery, OSN maintaining interpersonal interconnectivity, OSN social enhancement, and OSN entertainment value. We suggest they drive OSN OCD because they

are extremely motivating reasons for use, likely resulting from strong feelings of belongingness to the OSN that may encourage users to return more and more frequently to the OSN.

Predicting relationships with OSN U&Gs

Previous research categorizes OSN U&Gs commonly found in the literature as entertainment, information-seeking, self-presentation, escapism, socializing, and meeting new people [20, 57, 82, 94, 118]. We use a preexisting scale [22] that measures five OSN U&Gs that encompasses most of these motives (see Table 1).

Table 1. Source of items

OSN U&Gs	Definitions from Cheung et al. [22, p. 1338]
OSN purposive value	"value derived from accomplishing some pre-determined informational and instrumental purpose"
OSN self-discovery	"understanding and deepening salient aspects of one's self through social interactions"
OSN maintaining interpersonal interconnectivity	"social benefits derived from establishing and maintaining contact with other people such as social support, friendship, and intimacy"
OSN social enhancement	"value that a participant derives from gaining acceptance and approval of other members, and the enhancement of one's social status within the community on account of one's contribution to it"
OSN entertainment value	"fun and relaxation through playing or otherwise interacting with others"

Previous research links belongingness, U&Gs, and OSN addiction. Importantly, a study found support for the mediation of the relationship between belongingness and OSN addiction by some U&Gs [82]. This suggests belongingness may influence OSN U&Gs and that these OSN U&Gs may in turn affect OSN OCD. The same study found that the use motives of self-presentation and meeting new people were associated with increases in OSN addiction. The authors tested only the "self-presentation" and "meeting new people" motives in a mediated model and found a lack of belongingness increased these two use motivations, which is logical given the focus of these two use motivations on recruiting new friends. Previous research associates belongingness or the need to belong with use of, participation on, and continuance on OSNs [58, 65, 67, 69, 91] but not directly with increases in particular motives or uses. Our set of OSN U&Gs is more comprehensive and less focused on making new friends. Thus, we posit that positive socialization with friends (i.e., feelings

of belongingness with the social group) while using the OSN will increase the likelihood of any use, especially when the social aspect could make the activity more rewarding. We argue the social aspect could make any of the five OSN U&Gs we are testing more rewarding and therefore we expect to find a positive relationship between OSN belongingness and OSN purposive value, OSN self-discovery, OSN maintaining interpersonal interconnectivity, OSN social enhancement, and OSN entertainment value. Thus,

> *H2a-H6a. A user's **OSN belongingness** is positively associated with **OSN use to satisfy purposive value, self-discovery, maintaining interpersonal relationships, social enhancement, and entertainment value needs***.

Research on the influence of U&Gs on OSN use links several different U&Gs to intention to use OSNs, frequency of OSN use, and OSN addiction (sometimes referred to as *problematic OSN use*). Researchers found the OSN U&Gs of maintaining interpersonal interconnectivity, social enhancement, and entertainment value increase individuals' joint intention to use the OSN [22]. Using UGT, researchers discovered a link between socialization, relationship building, and addiction on a Chinese SNS called Xiaonei.com [134]. Researchers also discovered links between relationship building, self-presentation, diversion, and "problematic SNS use," which they described as "users' compulsive behaviors and excessive form of use on SNSs" [20, p. 806]. Narcissism has greatly increased among younger generations of "digital natives," and prior research shows a strong relationship between using Facebook for social impression management and compulsive disorders [105]. Other research links entertainment gratifications and addiction [51]. The desire to relax, play, pass time, and so on is prevalent in most work on systems-use motivations [26, 50, 73, 101, 138, 139].

Satisfying social connection gratifications and the desire to surveil one's peers have also been demonstrated to increase OSN frequency of use [54]. Another study showed that excessive time commitment (time on Facebook ranging from 10 minutes to 70 hours and 15 minutes per week with an average of 7 hours per week) and social motivation to use Facebook lead to OSN addiction [59].

Research has linked virtual community, monetary compensation, diversion, and personal status gratifications to Internet addiction tendencies [119]. Entertainment, escape, caring for others, and seeking excitement are also shown to be associated with Internet addiction [57]. Thus, interconnectivity or relationship building, social enhancement or self-presentation, and entertainment or diversion have all been linked to OSN use or addiction. We have no compelling reason to suggest that any of the OSN U&Gs will not predict OSN OCD, and thus we hypothesize a positive relationship between all the OSN U&Gs and OSN OCD:

> *H2b-H6b. A user's **OSN use to satisfy purposive value, self-discovery, maintaining interpersonal relationships, social enhancement, and entertainment value needs** is positively associated with **OSN OCD**.*

Negative Emotions and OSN Obsessive-Compulsive Disorder

OSN addiction has been examined using motivations for OSN use, negative consequences of OSN use, OSN use patterns, personalities of OSN users, and emotions [62]. Going forward, we will examine three negative emotions from the literature that have been used in technology contexts and could be influenced by a strong sense of belongingness to the OSN: OSN envy, OSN FOMO, and OSN anxiety. We also suggest these OSN negative emotions can lead to increased OSN OCD. Negative emotions discussed in association with OSN use in prior literature include mood swings [123], low self-esteem [132], jealousy [98], anxiety [36], envy [60, 61], FOMO [60, 102], loneliness, and depression [64]. NTBT also specifically links belongingness and emotions:

> *Many of the strongest emotions people experience, both positive and negative, are linked to belongingness. Evidence suggests a general conclusion that being accepted, included, or welcomed leads to a variety of positive emotions (e.g., happiness, elation, contentment, and calm), whereas being rejected, excluded or ignored leads to potent negative feelings (e.g., anxiety, depression, grief, jealousy, and loneliness)* [6, p. 508].

Moreover, a core function of emotional change is "to regulate behavior so as to form and maintain social bonds" [6, p. 508]. Thus, social satisfaction and feelings of OSN belongingness may reduce negative emotional responses driven by dissatisfaction with social relationships, while increasing

emotional responses driven by fears of losing social contact.

Predicting relationships with OSN envy

Envy can be defined as "the feelings aroused when one person desires another's advantage" [117, p. 1008]. *Jealousy* is a related concept but involves a third person as a rival to whom an individual could lose a (usually romantic) partner. Envy involves only two people—one who covets what another has (possessions or experiences). In our context, we define *OSN envy* as a negative emotion resulting from OSN use in which a user covets the possessions or life experiences of another person who belongs to the same social network [61, 117], regardless of whether the user knows him/her personally.

Envy has been linked to *upward social comparisons* (i.e., comparisons to those perceived as one's betters), to the relevance of the condition or object being envied, and to the similarity of the two individuals [61, 109, 116]. It has been suggested that OSNs provide an environment of similar others rich in information for social comparison where others often invoke positive self-presentation management (i.e., showcase their best faces), which would encourage OSN envy [61]. However, it is argued that envy is an emotional response associated with "unsatisfactory relational states" [34, p. 172]. A high sense of OSN belongingness should signal satisfactory relationships, and therefore may reduce the likelihood of OSN envy. However, a lower sense of OSN belongingness is likely suggestive of less rewarding socialization, possibly even feelings of not fitting in or social rejection that may lead to an environment more conducive to upward social comparisons and OSN envy.

For those individuals who feel less accepted on the OSN, OSNs provide a wealth of information to use for social comparison. Prior research finds those prone to OSN envy consume large amounts of social information to fuel such social comparisons, which would indicate a need to use the OSN frequently to obtain this information. Research also shows that users who "lurk" (i.e., spent a lot of time browsing social information, which provides information for social comparison, rather than posting information themselves) are more likely to feel envy, which in turn decreases

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their life satisfaction [60].

In addition, OSNs provide a platform for users to manage their self-presentation in a way that flatters them the most, if desired. Thus, many people project an idealized version of themselves on an OSN [39]. Indeed, research shows that OSNs are an ideal medium for attention-seeking narcissists because they are able to exaggerate their self-importance, overstate their accomplishments and enjoyment of life, blatantly show off, and even selectively show or alter photographs to make themselves look better [12]. Such narcissists tend to be the heaviest users of and contributors to OSN sites [12, 135]. If the individual's goal is to "maintain appearances" to be in line with desired group norms and therefore uses a plethora of possibly overoptimistic social information on OSNs for social comparison, OSN OCD may result.

We propose that those who feel a strong sense of belongingness to the OSN, indicative of healthy socialization, will be less prone to OSN envy. Individuals experiencing OSN envy are more likely to use the OSN to fuel the negative emotion by attaining social information to make social comparisons and may be more likely to exhibit OSN OCD. Therefore,

*H7a. A user's **OSN belongingness** is negatively associated with **OSN envy**.*

*H7b. A user's **OSN envy** is positively associated with **OSN OCD**.*

Predicting relationships with OSN fear-of-missing-out

FOMO can be defined as the "pervasive apprehension that others might be having rewarding experiences from which one is absent" [102, p. 1841]. In our context, we define OSN FOMO as a negative consequence of OSN use, in which users feel the disruptive apprehension that they will miss either social announcements or social events unless they frequently monitor their OSNs.

FOMO is not a minor problem. Research suggests that FOMO, combined with the wide array of readily available communication technologies, may distract individuals from real extemporaneous social experiences in the physical world [129]. FOMO can even lead to automobile accidents because individuals may feel they must check their digital device while driving to ensure they do not miss out

on anything [129]. FOMO is also associated with perceived low social rank, which can lead to feelings of inferiority and general unhappiness [102, 137]. Research suggests that FOMO can negatively impact an individual's psychological health and even lead to depression [102].

OSNs can be an especially problematic source of FOMO because they provide an efficient means for establishing a constant connection with current activities and a greater number of social connections online, which exacerbates the problem [102]. Ironically, FOMO may be responsible for much of the success of OSNs because users rely on the technology to keep up with events [47].

OSN FOMO can be viewed as separation from the OSN manifesting as a fear of being excluded—purposefully or not. Thus, as OSN belongingness increases, users will be more likely to experience FOMO on social interactions that could arouse pleasant feelings. Furthermore, because the primary way to try to relieve OSN FOMO is to check in on an OSN, OSN FOMO is a highly likely predictor of OSN OCD. Thus,

*H8a. A user's **OSN belongingness** is positively associated with **OSN FOMO**.*

*H8b. A user's **OSN FOMO** is positively associated with **OSN OCD**.*

Predicting relationships with OSN anxiety

Anxiety generally refers to an unpleasant state of mind that involves feelings of worry, stress, uneasiness, and dread concerning a perceived future threat [110]. Anxiety should not be conflated with *fear*, which is more situation-specific involving negative cognitive, affective, and physical responses to a real or imagined danger to oneself [11]. *Social anxiety* is stress or anxiety created by social pressures [16]. We thus define *OSN anxiety* as feelings of worry and stress related to the social pressures of OSN use.[ii]

Although we are investigating OSN anxiety, the original proposition of the need to belong was that the leading cause of general anxiety was concerns related to social exclusion [5]. Thus, stable social relationships should minimize anxiety. Lowered trait anxiety for women who experienced higher levels of belongingness was found in [68]. More recently, a study reported that a

strong sense of social belongingness or connectedness on an OSN was associated with less anxiety

and depression and greater satisfaction with life [42]. Therefore, we would expect a strong sense of

OSN belongingness to decrease OSN anxiety.

Conversely, OCD is associated with anxiety because obsessive behaviors are often an attempt

to assuage anxiety. *Compulsions* are defined as "repetitive behaviors" that "the individual feels

driven to perform in response to an obsession" and are "aimed at preventing or reducing anxiety or

distress, or preventing some dreaded event or situation" [2, p. 237]. For example, anxious individuals

may be relying on the OSN to boost self-esteem through social approval, such as posts being "liked"

on Facebook. Research shows that online feedback can contribute to self-esteem; however, users can

become dependent on such feedback, leading to addiction [32, 62, 132]. Studies on Facebook users

have also related both general and technology-related anxiety with compulsive use [59, 64, 105]. For

this reason, we posit that as OSN anxiety increases, OSN OCD will also increase. Therefore,

*H9a. A user's **OSN belongingness** is negatively associated with **OSN anxiety**.*

*H9b. A user's **OSN anxiety** is positively associated with **OSN OCD**.*

Considering the Negative Emotions as Moderators

There are some obvious links between the OSN U&Gs and the OSN negative emotions. For example,

we argue OSN envy will lead to increased OSN OCD because those who envy will more frequently

check the OSN to update social comparison information, and we suggest narcissists who are likely

motivated to use the OSN for social enhancement are prime candidates for such behavior. Thus, one

might expect high levels of OSN envy to amplify the relationship between OSN social enhancement

use and OSN OCD.

Although we can logically describe how the OSN negative emotions might moderate the

relationships between the OSN U&Gs and OSN OCD, we do not have the literature support to form

separate hypotheses for the moderation of the relationships between every OSN U&G and OSN OCD

by each of our OSN negative emotions. In general, we would expect OSN negative emotions to

amplify the relationships between the OSN U&Gs and OSN OCD, following such logic as given in the example above. Thus, to robustly explore these links, we test all possible interactions between the OSN U&Gs that are found to have a significant relationship with OSN OCD and all the OSN negative emotions in our model.

Considering the Big-5 Personality Model Traits as Covariates and Moderators

Although the focus of the current study is on the relationship between OSN belongingness and OSN OCD, exploratory research suggests personality may play a role in OSN addiction [62]. To provide a robust model, we therefore considered the most frequently used personality traits in psychology research and used them as covariates. We used the five-factor model of personality, which is also known as the Big-5 personality model [29, 30, 40].

Research has investigated the relationship between people's personality traits and their OSN use [e.g., 3, 28, 89, 106, 108, 136]. However, this research centers on use characteristics (e.g., frequency of use, size of social network) rather than on actual OSN OCD. For example, a person can have high frequency of use but not experience OSN OCD, so these should not be conflated. We thus introduce each of the five major personality traits and briefly explain how they might be related to OSN OCD. We incorporate these traits as covariates or counterarguments, and we take no definite stand regarding their predicted direction because we have no theoretical reason to believe they are more compelling than NTBT, which we believe is better suited to our context.

The five dimensions of the five-factor model represent a person's extraversion, agreeableness, neuroticism, conscientiousness, and openness to experience [29, 85]. *Extraversion* relates to whether a person typically exhibits factors such as being "sociable, fun-loving, affectionate, friendly, and talkative" [84, p. 87]. One of the core components of extraversion is "sociability–the enjoyment of others' company" [84, p. 87], and it has been suggested that extraverts like others but that does not necessarily mean they are likable [84]. *Agreeableness* measures characteristics such as altruism, caring, and emotional support. *Neuroticism* reflects the tendency of an individual to

experience nervous tension, depression, frustration, guilt, and self-consciousness. *Conscientiousness* measures the extent to which an individual is thorough, neat, well organized, diligent, and achievement-oriented. Finally, *openness to experience* represents the scope of an individual's creativity, intellectual interests, and his/her aesthetic sensitivity [85].

METHODOLOGY

Scale Development and Pilot Testing

For our survey instrument, we adapted items from existing social science or IS literature for all our latent constructs. We used an existing OSN envy scale [61] and an existing OSN belongingness scale [42], with minor grammatical changes suggested by an expert panel familiar with survey methods consisting of approximately five faculty and graduate students. The Big-5 inventory is a widely recognized scale in the social sciences and has been extensively adopted in previous IS literature to measure the five-factor (i.e., "Big-5") model of personality [53]; it was used without modification in our study. The scales for the five OSN U&Gs [22] were also used in our study without modification. We employed an OCD scale [93] modified by Serenko and Turel [111] but replaced "this social networking website" with "Facebook." The scales for OSN FOMO and OSN anxiety were adapted from previous scales [102, 124] in a previous data collection. In doing so, we followed accepted procedural methods [27, 78]. The first step was to employ a panel of 11 content experts (moderate-to-heavy Facebook users) to evaluate the items to ensure they reflected the intent of the study. We provided the panel with the items, and the participants were asked to comment on both the phrasing and the appropriateness of the items for the purpose intended. Their comments were then compiled and evaluated. This process led to refinement of the items, including rephrasing and dropping a few items. The advice of the experts provided multiple perspectives on the instrument, which also helps diminish common method bias in later instrument application [99, 120].

A pilot test of the complete instrument was conducted using Mechanical Turk (mTurk)

during June 2016. We collected 100 responses, and the statistical analysis of the pilot data revealed an acceptable factor structure. We proceeded with the full data collection, which included the first 100 responses collected during the pilot, without further modification of the instrument. Online Appendix A provides the full details of items.

Final Data Collection

The survey was created using Qualtrics™ online survey software, and the respondents were provided with a link to gain access to it. To reduce common method bias, the items were randomized [99]. Another approach to reducing common method variance is to grant anonymity to the respondents so they do not feel it necessary to gauge the expectations of the survey administrators (e.g., social desirability bias) and answer accordingly [99]. The final survey was administered on mTurk. The respondents were informed that their participation was voluntary and anonymity was guaranteed. Behavioral researchers assessing the use of mTurk for data collection suggest it is a reliable source for data and may provide more demographic diversity than traditional methods employing student respondents [13, 81].

Participant Profile

A total of 909 responses were collected, but 10 were dropped because the respondents did not complete the survey. The remaining 899 responses were subjected to further data filtering. First, it was necessary that our respondents were regular Facebook users. We used a filter question at the beginning of the survey to determine if the respondent was a regular Facebook user (at least 2–3 times a week), and if not, the respondent was redirected to the end of the survey. We filtered out 12 respondents who were not frequent Facebook users.

Second, we used "attention trap" questions to discard responses that were not carefully considered. This has been established as an effective approach to enhancing data quality in social psychology [92] and IS studies [71, 74]. Each "attention trap" question required the respondents to select the correct answer from among several options specified in the text of the question; the

questions are provided in Online Appendix A. We excluded responses with an incorrect answer from the final dataset. The "attention trap" questions resulted in the exclusion of 89 responses from the sample. Failure of the instructional manipulation checks in the experiments by Oppenheimer et al. [92], on which the concept of attention traps are based, ranged from 14 to 46% of the participants. Thus, our failure rate of approximately 10% is comparatively low. The final dataset included 798 valid responses.

The gender distribution of the sample was 259 males (32%) and 539 females (68%). Age, employment, and education details for the sample are reported in Table 2. All respondents were based in the United States; this was specified as a criterion in mTurk.

Table 2. Sample demographic information (n = 798)

Age distribution		Employment		Education	
18–21 yrs.	51	Employed full time	482	Grade school (K–8 grade)	1
22–24 yrs.	76	Employed part time	143	High school or equivalent (e.g., GED)	84
25–27 yrs.	113	Not employed	173	Some college credit, no degree	182
28–30 yrs.	102			Trade/technical/vocational training	35
31–35 yrs.	137			Associate degree	85
36–40 yrs.	98			Bachelor's degree	268
41–50 yrs.	125			Master's degree	120
51–60 yrs.	71			Professional degree	12
61 + yrs.	25			Doctorate degree	11

We also collected data on the respondents' technical and Facebook proficiency. We asked the respondents to state how many hours a day they spend on Facebook, how often they go on Facebook per day, and their approximate number of Facebook friends. This data confirms the participants were technically comfortable using the platform in question. We also used these variables as controls in our model. As expected, the majority of the respondents reported their computer and Facebook proficiency levels as intermediate or advanced. Furthermore, the majority of respondents reported spending four hours a day or less on Facebook, using Facebook multiple times a day, and having more than 100 Facebook friends. The Table 3 statistics indicate the sample met our target criteria.

ANALYSIS AND RESULTS

All model analyses were conducted using via partial least squares (PLS) regression using SmartPLS

version 2.0 [104]. PLS is more suitable than covariance-based structural equation modeling (SEM) for preliminary model building of unestablished models (such as ours) and is more robust for analysis with less normalized data [23, 35, 72, 96]. Thus, it has been used in a large number of recent, leading IS research studies, including those involving maladaptive social behaviors online [77].

Table 3. Technical exposure of sample (n = 798)

Computer proficiency		Facebook proficiency		Hours on Facebook		Frequency on Facebook		No. Friends on Facebook	
Novice	24	Novice	26	< 1 hour	262	Less than once a week	14	1–30	42
Intermediate	301	Intermediate	225	1–2 hours	353	Less than once a day	70	31–100	124
Advanced	371	Advanced	391	3–4 hours	131	Once a day	142	101–300	309
Expert	102	Expert	156	5–6 hours	29	2–5 times a day	365	301–500	154
				7–8 hours	8	6–10 times a day	139	501–1000	120
				8–9 hours	5	More than 10 times a day	68	1001+	49
				> =10 hours	10				

Pre-analysis and Factorial Validity

We carefully followed the latest guidelines on applying PLS to behavioral research [23, 38, 72]. First, we conducted extensive pre-analysis and data validation according to the latest standards for four purposes: (1) to establish the factorial validity of the measures through convergent and discriminant validity; (2) to establish that multicollinearity was not a problem with any of the measures; (3) to check for common method bias; and (4) to establish strong reliabilities. Our pre-analyses, provided in Online Appendix B, confirms acceptable convergent and discriminant validity through the application of four established techniques, which establishes the factorial validity of our final instrumentation. Three checks, in addition to steps undertaken in the research design, suggest that common method bias is unlikely in our model. We also examine the variance inflation factors to find that our model does not suffer from multicollinearity issues. Finally, we provide three reliability scores for each of our constructs that show that our scales exhibit strong reliabilities. In summary, the results of our validation procedures show that our model data meets or exceeds the rigorous validation standards expected in PLS-based analysis [18, 31, 72, 96, 97].

Results of Analyses

We used SmartPLS to analyze our model. The path coefficients, *t*-statistics, and *p*-values are

summarized in Table 4. Figure 2 shows the R^2 value for OSN OCD and the path coefficients (and

Figure 2. Summary of Significant Results of Operational Model Testing
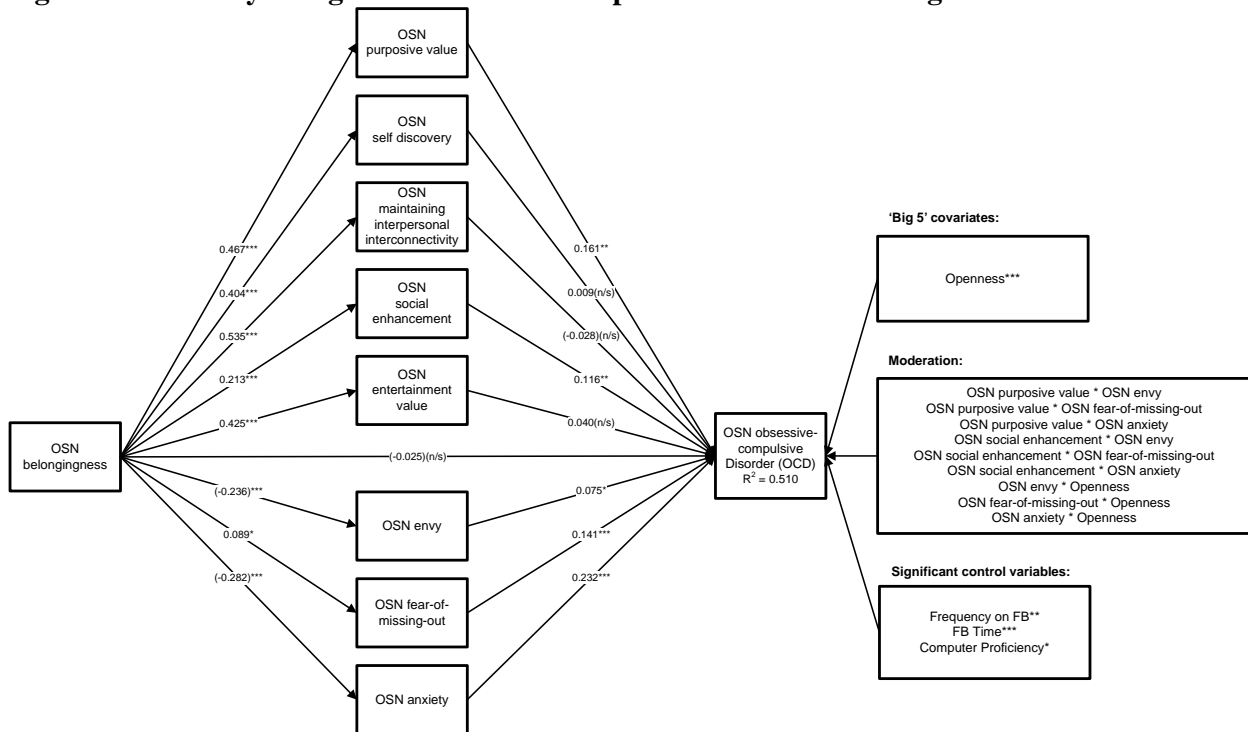
*** = $p < 0.001$; ** = p < 0.010, * = p < 0.050, n/s = not significant

associated *p*-values) for all significant relationships. To further assess the quality and robustness of

our results, we checked to ensure the effect sizes were strong[iii] and had predictive relevance.[iv] We

then checked for mediation and moderation relationships.

Checking for mediation

The first intriguing finding was that the predicted direct relationship between OSN belongingness

and OSN OCD did not hold in the full model; yet, all the predicted relationships between OSN

belongingness and the other social constructs did. This outcome informed us that the relationship

between OSN belongingness and OSN OCD was not partially mediated by the OSN U&Gs and the

OSN negative emotions as we had expected. Therefore, two possibilities remained: (1) OSN

belongingness has no relationship with OSN OCD, or (2) OSN belongingness has a fully mediated

relationship with OSN OCD.

To determine which of the two possibilities occurred, we applied the Baron and Kenny

mediation check as adopted for staged testing for PLS [72, 75]. Accordingly, to establish full mediation, a PLS model must adhere to four conditions. First, the proposed independent variable (IV) must covary with the dependent variable (DV). Second, the IV must covary with the mediators. Third, the proposed mediators must covary with the DV. Fourth, when all paths are run in the same model, the previous significant relationship between the proposed mediated construct (IV) and the DV is no longer significant. Online Appendix B depicts these outcomes. Based on this, we conclude that OSN belongingness has a fully mediated relationship (not partially mediated) with OSN OCD.

Exploring the Second-Order Factor Model

Our results shown in Figure 2 and Table 4 indicate that both OSN U&Gs and OSN negative emotions drive OSN OCD. This finding leads to the question: which of these categories (i.e., OSN U&Gs and OSN negative emotions) is more salient? We explore this question by constructing a second-order factor model in SmartPLS using the repeated indicator approach[v] described in Lowry and Gaskin [72]. The illustrations of the second-order factor models are provided in Online Appendix B, and show that the OSN negative emotions are more salient.

Table 4. Detailed Results of Tested Hypotheses, Covariates, and Control Variables

Tested hypothesis/path	β	t-statistic	Support?
Hypotheses			
H1. OSN belongingness → OSN OCD	(-0.025)	0.649 (n/s)	No
H2a. OSN belongingness → OSN purposive value	0.467	15.520***	Yes
H2b. OSN purposive value → OSN OCD	0.161	3.457**	Yes
H3a. OSN belongingness → OSN self-discovery	0.404	12.510***	Yes
H3b. OSN self-discovery → OSN OCD	0.009	0.227 (n/s)	No
H4a. OSN belongingness → OSN m. interpersonal interconnectivity	0.535	18.584***	Yes
H4b. OSN m. interpersonal interconnectivity → OSN OCD	(-0.028)	0.848 (n/s)	No
H5a. OSN belongingness → OSN social enhancement	0.213	6.065***	Yes
H5b. OSN social enhancement → OSN OCD	0.116	2.891**	Yes
H6a. OSN belongingness → OSN entertainment value	0.425	13.544***	Yes
H6b. OSN entertainment value → OSN OCD	0.040	1.197 (n/s)	No
H7a. OSN belongingness → OSN envy	(-0.236)	6.101***	Yes
H7b. OSN envy → OSN OCD	0.075	2.057*	Yes
H8a. OSN belongingness → OSN FOMO	0.089	2.506*	Yes
H8b. OSN FOMO → OSN OCD	0.141	3.718***	Yes
H9a. OSN belongingness → OSN anxiety	(-0.282)	8.267***	Yes
H9b. OSN anxiety → OSN OCD	0.232	5.891***	Yes
Covariates and controls			
Agreeableness → OSN OCD	-0.026	0.809 (n/s)	No
Conscientiousness → OSN OCD	-0.043	1.424 (n/s)	No

Neuroticism → OSN OCD	-0.033	1.038 (n/s)	No
Openness → OSN OCD	-0.136	5.412***	Yes
Gender → OSN OCD	-0.007	0.256 (n/s)	No
Age → OSN OCD	-0.018	0.555 (n/s)	No
Computer proficiency → OSN OCD	-0.057	2.018*	Yes
Frequency on FB → OSN OCD	0.110	3.378**	Yes
No. of FB friends → OSN OCD	0.029	0.942 (n/s)	No
FB time → OSN OCD	0.213	6.185***	Yes
FB proficiency → OSN OCD	0.022	0.726 (n/s)	No

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, and n/s = not significant.

Checking for Moderation

We also tested for moderation for two groups: (1) moderation of the significant relationships between the OSN U&Gs (OSN purposive value and OSN social enhancement) and OSN OCD by the OSN negative emotions (OSN envy, OSN FOMO, OSN anxiety) and (2) moderation of the relationships between the OSN negative emotions and OSN OCD by the Big-5 personality traits (agreeableness, neuroticism, conscientiousness, and openness). We tested for moderation using the bootstrapping method [46, 115, 133].[vi] The bounds and the indicated significance due to the presence of zero between them are detailed in Online Appendix B for each interaction examined in our model, and show that (1) all three OSN negative emotions amplify the paths between OSN purposive value, OSN social enhancement, and OSN OCD and (2) openness moderates the relationships between the OSN negative emotions and OSN OCD.

DISCUSSION

Behavioral addictions, of which OSN addiction is frequently suggested as a subtype, result in disruptions to the addicted individual's life and often inhibit their normal functioning. OSN addiction, as manifested by OSN OCD, has two important features: unwanted obsessive thoughts about OSN use and compulsive use that attempts to assuage the obsession. Individuals with behavioral addictions often suffer from many negative personal outcomes, such as decreased psychological well-being, depression, and impaired function at work or school. As more people throughout the world continue to rely on OSNs for at least part of their socialization experience, factors influencing maladaptive use are important to determine and study. Our aim was to gain a

deeper understanding of some of the root causes and constructs underlying OSN OCD. By better understanding these phenomena, it is more likely OSN OCD can be prevented or treated.

OSNs by definition are digital platforms for socialization that provide the means and opportunity for frequent social contact, and frequent social contact is the way healthy and meaningful social relationships that fulfill the need to belong are maintained. Because fulfilling the need to belong through at least a small number of positive, satisfying social connections is an innate desire; we suggest that in some cases this desire can become maladaptive, leading to OSN OCD. That is, the positive feelings obtained from the sense of connectedness from the OSN social group may result in some individuals obsessively thinking about their OSN (recall our example in the introduction where the individuals forced to go without the OSN stated they dreamt of it and spent time thinking about what statuses they would post if they could) and compulsive behavior (e.g., spending so much time on the OSN that it prevents completion of normal activities).

The foundation of our theoretical model is the NTBT, supplemented with UGT. We isolated OSN belongingness as our psychological origin of needs, which influences OSN U&Gs (i.e., OSN purposive value, OSN self-discovery, OSN maintaining interpersonal interconnectivity, OSN social enhancement, and OSN entertainment value) and OSN negative emotions (i.e., OSN envy, OSN FOMO, and OSN anxiety) that we suggest lead to increased OSN OCD. In addition, we explored a second-order factor model to determine which of the categories (i.e., OSN U&Gs or OSN negative emotions) was more prominent in the model. Our granular analysis also explored moderation in our model. Specifically, we tested for (1) moderation of the relationships between the OSN U&Gs and OSN OCD by the OSN negative emotions, and (2) moderation of the relationships between the OSN negative emotions and OSN OCD by the Big-5 personality traits. To examine our model's robustness, we not only included control variables but also examined the Big-5 personality traits as possible covariates. We tested our model using data collected from a cross-sectional survey of 798 experienced Facebook users.

Summary of Results

Most hypotheses were supported. We found strong (i.e., large coefficients, $p < 0.001$), positive relationships between OSN belongingness and OSN purposive value (H2a), OSN self-discovery (H3a), OSN maintaining interpersonal interconnectivity (H4a), OSN social enhancement (H5a), and OSN entertainment value (H6a). These findings suggest a sense of connectedness with one's Facebook friends drives every OSN U&G we examined. We found strong, negative relationships between OSN belongingness and OSN envy (H7a) and OSN anxiety (H9a) and a weaker ($p < 0.050$) but significant positive relationship between OSN belongingness and OSN FOMO (H8a). These findings suggest feelings of belongingness with one's Facebook friends can reduce feelings of envy and anxiety, which indicates healthy fulfillment of the need to belong on an OSN may decrease negative, socially driven emotions. Moreover, the more connected individuals feel to their Facebook friends, the more they fear missing out on activities.

Interestingly, we found no direct relationship between OSN belongingness and OSN OCD (H1 rejected), but we discovered that OSN belongingness is fully mediated in the model. Thus, it has an important, indirect relationship with OSN OCD. Most of the mediators in the model were supported. We found strong (i.e., large coefficients, $p < 0.010$ or $p < 0.001$), positive relationships between the following mediators and OSN OCD: OSN purposive value (H2b), OSN social enhancement (H5b), OSN FOMO (H5b), and OSN anxiety (H6b). OSN envy had a weak but significant relationship with OSN OCD when the full model was analyzed (H7b). OSN self-discovery, OSN maintaining interpersonal interconnectivity, and OSN entertainment value did not have supported relationships with OSN OCD (H2b, H3b, and H5b rejected). The results of the post-hoc second-order factor models illustrate that the OSN negative emotions have a greater overall effect on OSN OCD. Specifically, the betas for the OSN negative emotions second-order construct are higher than the OSN U&Gs second-order construct in both the full second-order model and the base second-order model with only the two second-order factors predicting OSN OCD.

Regarding the Big-5 personality traits, we were surprised to find that only openness exhibited a significant relationship with OSN OCD (we were not able to test extraversion because of weak reliabilities in the items). Openness was also found to moderate the relationships between the OSN negative emotions and OSN OCD. The OSN negative emotions were found to moderate the significant relationships between OSN purposive value, OSN social enhancement, and OSN OCD. In addition, two control variables showed positive relationships with OSN OCD: frequency on Facebook and Facebook time. These findings add robustness to our analyses, and show OSN U&Gs and OSN negative emotions are more important in influencing OSN OCD than personality traits.

Contributions to Research and Theory

Our primary contribution is showing that NTBT, supplemented with UGT, is a strong foundation for explaining and predicting OSN OCD. We provide theoretical and empirical evidence that OSN belongingness drives the OSN U&Gs and OSN negative emotions that lead to OSN OCD. This study is also one of the first to examine OSN U&Gs and OSN negative emotions as mediators of OSN OCD. Our second-order factor model reveals that OSN negative emotions are more prominent in explaining OSN OCD than OSN U&Gs. We also explored moderation in our model, which illustrates that the OSN negative emotions amplify the paths between the OSN purposive value and OSN social enhancement U&Gs and OSN OCD. Together these findings indicate that the OSN negative emotions play an important role in OSN OCD.

Another important contribution is the discovery that OSN belongingness is not a partial mediator in our model; instead, it is mediated fully by OSN U&Gs and OSN negative emotions. This result is particularly notable because full mediation is seldom found, especially in cross-sectional surveys, and such mediation has profound theoretical implications. As the IS discipline has matured, it has increasingly made use of mediation models to better understand potential causal mechanisms in theoretical models [e.g., 14, 75, 133].

Mediation models are a central focus in the social sciences because they enable researchers to

formulate improved explanations of associations by breaking them down into a chain of causal

components, thus fostering causal theoretical model development [114]. Mediation models have the

potential to "identify fundamental processes underlying human behavior that are relevant across

behaviors and contexts" [79, p. 16]. Furthermore, once mediating variables are identified, it is

possible to design interventions that efficiently target the variables in the mediated causal process

[114]. Thus, our mediation results will not only facilitate theoretical model development but also

enable researchers to better target the causes and mediators of OSN OCD through focused

interventions.

Implications for Society and Practice

Our findings have interesting implications for society and practice. We discovered that the

relationship between OSN belongingness and OSN OCD is fully mediated by other factors. That is, a

strong sense of OSN belongingness does not necessarily lead to OSN OCD without the presence of

other factors (e.g., maladaptive emotional responses or certain motivations for use). This indicates it

is possible for socialization on an OSN to be healthy and reinforces results suggesting that OSNs can

positively influence individuals' well-being by fulfilling their need to belong [42]. Importantly, our

integrative model provides findings that start to unravel the conditions under which individuals may

experience OSN addiction as manifested through OSN OCD. Whereas OSN use may have positive

outcomes for some individuals, it can lead to negative results in others. Our study provides insight

into what characterizes individuals experiencing OSN OCD.

One interesting pattern that emerged from our data is that feeling connected to one's online

social group drives all the OSN U&Gs we tested—OSN purposive value, OSN self-discovery, OSN

maintaining interpersonal interconnectivity, OSN social enhancement, and OSN entertainment value.

Individuals who feel a sense of belonging with their Facebook friends are more likely to use the OSN

to gratify all the needs we tested from prior UGT research. This result suggests individuals whose

need to belong is being fulfilled through OSN use are more likely to turn to the OSN to satisfy

desires. For example, an OSN user with a strong sense of belongingness is likely employing Facebook to maintain interpersonal interconnectivity, and this user may find the socialization entertaining or relaxing because they feel accepted by and connected to these friends. Interestingly, not all the OSN U&Gs increased the likelihood of OSN OCD. This is important because it suggests that perhaps some U&Gs are more likely to lead to OSN OCD than are others. For example, pure socialization motives, where the network is being used to maintain relationships (i.e., the OSN belongingness is driving use of the OSN to satisfy the OSN maintaining interpersonal interconnectivity desires), do not lead to OSN OCD.

However, OSN purposive value and OSN social enhancement U&Gs were found to drive OSN OCD. Cheung et al. [22] did not find a significant relationship between purposive value and joint intention of a group of people to use the OSN. Our results add explanatory depth to their outcome by discovering that OSN purposive value is associated with OSN OCD. The purposive value motive means the individuals are using the OSN for more functional outcomes, such as learning, information seeking, information generation, and making decisions. Relying on a social group for such tasks may indicate an overreliance on others' guidance. Prior research indicates a relationship between impression management goals and compulsive disorders [105], which our results also confirm given the positive relationship between satisfying social enhancement needs and OSN OCD. Social enhancement motives on an OSN may signal unsatisfying social relationships, similar to OSN envy, self-esteem issues, or a narcissistic disposition. Future research should investigate these linkages in more detail. What our results indicate is that OSN U&Gs hinting at possible dissatisfaction with social relationships or socialization disorders (i.e., OSN purposive value or social enhancement) are predictors of OSN OCD.

Another key contribution of our work is discovering that OSN negative emotions interacted with the two significant OSN U&Gs (OSN purposive value and OSN social enhancement) to amplify their association with OSN OCD. All three of the OSN negative emotions tested in this study

significantly moderated the paths between OSN social enhancement, OSN purposive value, and OSN OCD.

Consider one scenario that could explain these findings: An individual who uses Facebook for social enhancement by posting pictures of his or herself on the OSN in hopes that others will "like" or "comment" (e.g., have a reaction) to the pictures. This person may view the number of "likes" or "comments" as a gauge of his or her reputational or social influence (i.e., social enhancement through recognition from others). Our findings suggest that this type of individual is more prone to OSN OCD, with one possible explanation being that this person compulsively checks Facebook to see how many people have "liked" or posted a comment on a post as a way of tracking his or her social standing. Our findings suggest this relationship between OSN social enhancement and OSN OCD is amplified by OSN envy. That is, if the individual using the OSN for social enhancement also consumes social information posted by others in his or her network (e.g., that individual is looking at his or her friends' pictures) and feels envy towards the possessions and experiences of others, he or she will be even more likely to experience OSN OCD. One explanation is that this individual sees what another person has and worries that it may garner more accolades, leading to more obsession (e.g., worry over what he or she posted not being good enough to improve his or her social standing) and more compulsive checking of the OSN. This suggests that for certain OSN U&Gs, unhealthy emotions can further exacerbate the tendency towards OSN OCD.

Additionally, all three of the negative emotions users experienced on the OSN were shown to have a direct impact on OSN OCD. This suggests individuals' emotional states are important determinants of OSN OCD. This finding was further reinforced through the second-order factor model that shows OSN negative emotions to be the most prominent category of predictors of OSN OCD. Users experiencing negative emotional responses on the OSN may want to consider consciously reducing or stopping OSN use to prevent OSN addiction. Also interesting is the finding that feelings of OSN belongingness actually reduced susceptibility to OSN envy and OSN anxiety,

indicating that if the OSN is promoting healthy relationships, negative emotional responses may be less common. However, OSN FOMO was positively associated with OSN belongingness, which was expected. This is not a negative emotional response to unsatisfying relationships; it is concern over missing a pleasurable experience because the individual was not online at the time the experience was planned or executed. Thus, it is unsurprising that the fear of missing activities individuals want to participate in would lead to higher levels of OSN OCD or that OSN belongingness would drive OSN FOMO. This indicates users are experiencing socialization on the OSN that is enjoyable and that they want to be a part of, but reflects the fact that the platform facilitates such socialization, thus driving OSN OCD due to the users' desire to stay connected with their social group.

Finally, although the Big-5 personality traits were not substantial factors in our model, openness to experience had a direct, negative effect on OSN OCD and moderated the relationships between the OSN negative emotions and OSN OCD (i.e., openness diminishes the negative emotional responses on the OSN). These findings are aligned with prior research on OSN use [106] that found limited influence of personality factors. One study linked the openness to experience personality trait to "a greater tendency to be sociable through Facebook," [106, p. 582] which indicates this finding may reinforce our previous conclusion that healthy socialization use by well-adjusted individuals decreases OSN OCD risks, but those experiencing unstable emotional responses or unhealthy socialization on the OSN should avoid use.

Overall, our findings suggest healthy socialization is possible on OSNs but that in the presence of OSN negative emotions—suggestive of unstable relationships or social neuroses—or OSN U&Gs, OSN OCD can result. This is consistent with previous research suggesting emotional instability may result in more frequent use [28]. Our results suggest traditional psychological interventions to promote healthy social interaction, emotional stability, and impression management may be possible and recommended, especially because our results indicate personality traits were not positively related to OSN OCD. For example, cognitive or family therapy or support groups have

been recommended to help treat Internet addiction in the literature [90]. The transference of more of people's everyday socialization to the OSN environment makes the investigation of factors influencing OSN addiction extremely important, and our study provides new insight into this.

Limitations and Future Research

Although our study opens possibilities for future research, its main limitation is that the results have limited generalizability. The scope of our model was restricted to the prediction of OSN OCD and did not include other negative conditions that may be related, such as loneliness or depression. Although we argue that OSN OCD is highly related to these, further research should test these assumptions. We also used Facebook as our OSN, and although it is still one of the most popular social networking platforms, it would be useful to examine OSN OCD on other social media (e.g., Twitter, Instagram, LinkedIn) that have different forms and functions to see if the findings are generalizable across OSNs. Although outside the scope of the current project, future research could consider the unique aspects of different OSN platforms to determine if design characteristics influence OSN OCD.

Further investigation is required to consider other cultural environments because cultural differences are shown to strongly influence the outcomes of technology use [76, 121, 144], including the use of various forms of social networking [e.g., 70, 100]. Moreover, various legal differences among countries could influence our model. For example, hundreds of millions of Chinese consumers use several OSNs designed for the Chinese market (e.g., Sina Weibo, Tecent Weibo, Renren, QQ, WeChat). These are culturally isolated and unique because almost no one outside China uses these, as they operate in an environment of strict government censorship and control, which includes severe punishments for spreading rumors or even mild punishments for having too many followers. Anonymity and use of pseudonyms have also recently been banned. Such controls could strongly influence one's self-presentation online, which requires further research.

Another key limitation is that we used a cross-sectional survey that captured users' responses

at one point in time. Although we were able to establish mediation in our model, which points to possible causal mechanisms, we cannot claim causation without further experimentation that controls for the time between cause and effect, and without an underlying delivery of control and treatment conditions. For increased realism, it is likely best to achieve such causation through longitudinal field studies with actual OSN use rather than in the laboratory.

Finally, we cannot completely rule out the potential role of personality or other dispositional traits even if most of these controls were insignificant. Previous studies on non-OSN IT have concluded that the Big-5 personality traits influence technology adoption and use [30, 86, 113]; thus, they might play a role in our context. We used the official 44-item version of the Big-5 personality model, and thus its lengthy instrumentation might have caused unnecessary testing fatigue, which could have diminished the salience of these traits. Future research may consider the use of a truncated version of this instrument. Furthermore, it may be possible that the factorial stability of the Big-5 scales has changed over time, which may necessitate further work on instrumentation to measure personality traits. It may also be interesting in future work, given our findings, to explore other dispositional traits, such as narcissism [12, 108].

Conclusion

We proposed a model based on NTBT to better represent the factors underlying OSN OCD. NTBT suggests positive and negative emotions are a result of concerns about social acceptance and rejection and that "one of the basic functions of emotion is to regulate behavior so as to form and maintain social bonds" [6, p. 508]. Testing our model, we discovered that belongingness influences OSN U&Gs and OSN negative emotions, some of which may lead to OSN OCD. We found that as OSN belongingness increased, the more attractive all OSN U&Gs were to users. However, only OSN purposive value and OSN social enhancement were found to indicate OSN OCD. Furthermore, OSN belongingness led to OSN FOMO, which could result from satisfying social relationships and social acceptance, and OSN belongingness decreased OSN envy and OSN anxiety, both of which may be

indicative of dissatisfying social relationships or possibly concerns about social rejection. All three

negative emotions increased the likelihood of OSN OCD and amplified the relationships between

OSN purposive value, OSN social enhancement, and OSN OCD. In summary, our results shed light

on online socialization and the intricacies of adapting to social interaction in this environment. As

online socialization becomes increasingly widespread, it is crucial to understand both the advantages

that can be derived from new technological options and the disadvantages of converting social

interaction to this platform. Our study provides an important first step in this process.

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[i] Turel et al. [128, p. 1044] introduced a more detailed definition of technology addiction into the IS literature, as follows: "a state of maladaptive dependency on the use of a technology to such a degree that the following typical behavioral addiction symptoms arise: (1) salience – the technology dominates a user's thoughts and behaviors; (2) withdrawal – negative emotions arise if a person cannot use the technology; (3) conflict – the use of the technology conflicts with other tasks, which impairs normal functioning; (4) relapse and reinstatement – a

user is unable to voluntarily reduce the use of the technology; (5) tolerance – a person has to use the technology to a greater extent to produce thrill; and (6) mood modification – using the technology offers thrill and relief and results in mood changes".

[ii] Although we use the computer anxiety construct and measurement items as a guide, our OSN anxiety construct is fundamentally different. Computer anxiety relates feelings of worry and stress related to the use of the technology itself, whereas our construct explores the feelings of worry and stress related to the socialization facilitated through the use of the technology (OSN).

[iii] Following the Peng and Lai [96] guidelines for researchers using PLS, we conducted post-hoc analyses to assess the effect sizes in our model and the statistical power and the Stone-Geisser blindfold. Effect sizes cannot be estimated from PLS beta coefficients; instead, a conservative approach is to use Pearson's r for the supported paths. Table B.3 in Online Appendix B summarizes this analysis and indicates that most supported relationships had medium to large effect sizes. The relevant effect sizes for r are as follows: small ($> .10$), medium ($> .30$), large ($> .50$), and very large ($> .70$).

[iv] Regarding the Stone-Geisser blindfold, we performed the Stone-Geisser (Q^2) test of "predictive relevance, which tests whether a model can predict data points that are explicitly excluded. According to Peng and Lai [96, p. 473], "If $Q^2 > 0$, then the model is viewed as having predictive relevance." In every case, Q^2 was greater than zero.

[v] The repeated indicators [72] approach consists of two stages. In the first stage, a second-order construct is created using all of the items of all the first-order factors. Then, a separate construct is created for each of the first-order factors and a formative relationship is defined between each of the first-order factors and the second-order construct containing all the items. When SmartPLS is run, the R^2 for the second-order factor will be 1.0 (i.e., the first-order factors will perfectly predict the second-order factor). Thus, this first stage model is used only to obtain the latent variable scores (LVSs) for the constructs in the model. In the second stage, the LVSs are used to test the structural model. Using the LVSs as the indicators in the model, we tested a full model (i.e., OSN belongingness, OSN U&Gs, OSN negative emotions, OSN OCD and controls) and a base model (i.e., OSN U&Gs, OSN negative emotions, OSN OCD only). The path coefficient was higher for the path between the OSN negative emotions and OSN OCD in both models, indicating OSN negative emotions are more salient.

[vi] Bootstrapping is the process of resampling from the dataset a predefined number of times and calculating statistical values over all the resamples. Statistical significance for the loadings and path coefficients in PLS are obtained in this manner. Mediation and moderation can also be examined in this way, and the approach is advocated because it provides greater statistical power [46, 115, 133]. To examine interactions through the bootstrapping method, it is necessary to resample a very large number of times; the recommendation is 1,000 times or more [46]. For our study, we resampled 2,500 times. SmartPLS provides the path coefficients for each one of the 2,500 resamples as output.

To examine the significance of the interaction effects using the bootstrapping method, we calculated the interaction by multiplying the path coefficient for the two paths under consideration for each of the 2,500 resamples for each interaction of interest. This multiple was then sorted for each interaction. Based on the number of resamples, a lower and upper bound are calculated using the formula $k(.5-ci/200)$ for the lower bound and the formula $1+k(.5+ci/200)$ for the lower bound, where k is the number of resamples and ci is the desired confidence interval (we specified 95%). It is then determined if zero is found between the lower and upper bound of the multiplied path coefficients for each interaction effect. If zero does not occur in the interval between the bounds, then the moderation effect is significant; otherwise, it is not.

The Effect of Belongingness on Obsessive-Compulsive Disorder in the Use of Online Social Networks

<u>**Note to editors and reviewers:**</u> These are supplementary online appendices for review purposes, not for print publication with the main article.

ONLINE APPENDIX A. MEASUREMENT ITEMS

Table A.1. Measurement Item Details and Sources

Construct (Source)	Construct indicator	Item
OSN belongingness; adapted from Grieve et al. [7]	n/a	**Prompt:** Following are a number of statements that reflect various ways in which we view ourselves. Rate the degree to which you agree or disagree with each statement: 7-point Likert-type scales from 1 = "Strongly disagree" to 7 = "Strongly agree"
	Belong1	I am in tune with my Facebook friends.
	Belong2	There is no sense of camaraderie among my Facebook friends. (R)
	Belong3	I fit in well in new Facebook situations.
	Belong4	I feel close to people on Facebook.
	Belong5	I feel disconnected from my Facebook friends.
	Belong6	Even when interacting with people on Facebook, I don't feel that I really belong. (R)
	Belong7	I see Facebook friends as friendly and approachable.
	Belong8	I feel understood by people on Facebook.
	Belong9	I am able to relate to my Facebook friends.
	Belong10	I have little sense of togetherness with my Facebook friends. (R)
	Belong11	I find myself actively involved in Facebook friend's lives.
	Belong12	I am able to connect with other people on Facebook.
	Belong13	I don't feel related to most people on Facebook. (R)
	Belong14	My Facebook friends feel like family.
OSN fear-of-missing-out; adapted from Przybylski et al. [17]	n/a	**Prompt:** Please indicate your extent of agreement with the following statements on the scale shown below: 5-point Likert-type scales from 1 = "Strongly disagree" to 5 = "Strongly agree"
	FOMO1	It bothers me that I may fail to notice a gathering planned on Facebook.
	FOMO2	I get worried that I will not see an activity announced on Facebook.
	FOMO3	I have concerns that I will miss seeing an event that is announced on Facebook.
	FOMO4	If I miss out on a get-together announced on Facebook, it bothers me.
OSN envy; adapted from Krasnova et al. [9]	n/a	**Prompt:** When using Facebook, how often are you thinking that: 7-point Likert-type scales from 1 = "Never" to 7 = "Always"
	Envy1	Most of my Facebook friends have it better than I do.
	Envy2	The posts of my Facebook friends get more attention (e.g., "likes", comments, etc.) than mine.
	Envy3	I usually see myself as an underdog on Facebook.

	Envy4	It is somewhat annoying to see on Facebook how successful some of my Facebook friends are.
	Envy5	It is somewhat disturbing to see how popular some others are on Facebook.
	Envy6	It is somehow disturbing when I see on Facebook how much others can afford.
OSN obsessive-compulsive disorder; adapted from Pallanti et al. [12], and Serenko and Turel [19]	n/a	**Prompt:** Following are a number of statements that reflect various ways in which we view ourselves. Rate the degree to which you agree or disagree with each statement: 7-point Likert-type scales from 1 = "Strongly disagree" to 7 = "Strongly agree"
	OCD1	Much of my time is occupied by thoughts about Facebook.
	OCD2	My thoughts about Facebook interfere with my social, school, work, or role functioning.
	OCD3	My thoughts about Facebook cause me anxiety and/or distress.
	OCD4	I often try to turn my attention away from thoughts about Facebook.
	OCD5	I have much control over my thoughts about Facebook. (R)
	OCD6	I spend much of my time using Facebook.
	OCD7	My use of Facebook interferes with my social, school, work and/or role functioning.
	OCD8	I become anxious and/or distressed when I am prevented from using Facebook.
	OCD9	I often try to resist my Facebook usage compulsion.
	OCD10	I have much control over my use of Facebook. (R)
OSN anxiety; adapted from Thatcher and Perrewe [23]	n/a	**Prompt:** Please indicate your extent of agreement with the following statements on the scale shown below: 5-point Likert-type scales from 1 = "Strongly disagree" to 5 = "Strongly agree"
	Anx1	Using Facebook makes me feel uneasy.
	Anx2	Using Facebook causes me stress.
	Anx3	I sometimes feel anxious when I use Facebook.
OSN purposive value; Cheung et al. [3]	n/a	**Prompt:** Please indicate how often do you use Facebook to satisfy the following needs?: 5-point Likert-type scales from 1 = "Never" to 5 = "Always"
	Pv1	to get information
	Pv2	to learn how to do things
	Pv3	to provide others with information
	Pv4	to contribute to a pool of information
	Pv5	to generate ideas
	Pv6	to negotiate or bargain
	Pv7	to get someone to do something for me
	Pv8	to solve problems
	Pv9	to make decisions
OSN self discovery; Cheung et al. [3]	Sd1	to learn about myself and others
	Sd1	to gain insight into myself
OSN maintaining interpersonal interconnectivity; Cheung et al.	Mii1	to have something to do with others
	Mii2	to stay in touch

[3]		
OSN social enhancement; Cheung et al. [3]	Se1	to impress
	Se2	to feel important
OSN entertainment value; Cheung et al. [3]	Ev1	to be entertained
	Ev2	to play
	Ev3	to relax
	Ev4	to pass time away when bored
Big-5: Extraversion; John et al. [8]	n/a	**Prompt:** Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please choose the extent to which you agree or disagree with each statement below. I see myself as someone who... 5-point Likert-type scales from 1 = "Disagree strongly" to 5 = "Agree strongly"
	Extrav1	is talkative
	Extrav2	is reserved (R)
	Extrav3	is full of energy
	Extrav4	generates a lot of enthusiasm
	Extrav5	tends to be quiet (R)
	Extrav6	has an assertive personality
	Extrav7	is sometimes shy, inhibited (R)
	Extrav8	is outgoing, sociable
Big-5: Agreeableness; John et al. [8]	Agree1	tends to find fault with others (R)
	Agree2	is helpful and unselfish with others
	Agree3	starts quarrels with others (R)
	Agree4	has a forgiving nature
	Agree5	is generally trusting
	Agree6	can be cold and aloof (R)
	Agree7	is considerate and kind to almost everyone
	Agree8	is sometimes rude to others (R)
	Agree9	likes to cooperate with others
Big-5: Neuroticism; John et al. [8]	Neur1	is depressed, blue
	Neur2	is relaxed, handles stress well (R)
	Neur3	can be tense
	Neur4	worries a lot
	Neur5	is emotionally stable, not easily upset (R)
	Neur6	can be moody
	Neur7	remains calm in tense situations (R)
	Neur8	gets nervous easily
Big-5: Conscientiousness; John et	Consc1	does a thorough job

al. [8]	Consc2	can be somewhat careless (R)
	Consc3	is a reliable worker
	Consc4	tends to be disorganized (R)
	Consc5	tends to be lazy (R)
	Consc6	perseveres until the task is finished
	Consc7	does things efficiently
	Consc8	makes plans and follows through with them
	Consc9	is easily distracted (R)
Big-5: Openness; John et al. [8]	Open1	is original, comes up with new ideas
	Open2	is curious about many different things
	Open3	is ingenious, a deep thinker
	Open4	has an active imagination
	Open5	is inventive
	Open6	values artistic, aesthetic experiences
	Open7	prefers work that is routine (R)
	Open8	likes to reflect, play with ideas
	Open9	has few artistic interests (R)
	Open10	is sophisticated in art, music, or literature
Attention Traps	At1	Please answer "Strongly Agree" to this question.
	At2	Please answer "Rarely" for this item.
	At3	The United States is on the continent of Asia.

(R) = reverse scaled

ONLINE APPENDIX B. FACTORIAL VALIDITY AND RELIABILITY DETAILS

Convergent and Divergent Validity to Establish Factorial Validity

Factorial validity is established by utilizing both *convergent validity*[i] and *discriminant validity*,[ii] which are two highly interrelated concepts that must coexist. To establish the factorial validity of our latent constructs, we used two established techniques to determine convergent validity and two established techniques to determine discriminant validity.

First, we examined the outer model loadings, as summarized in Appendix B Table B.1. Convergent validity can be established when the loadings are reasonably high (>0.500) and the *t*-values of the outer model loadings are significant. Interestingly, all of items for the OSN measures but one had high loadings and were highly significant. OCD4 had a loading of 0.499 (t-value: 14.330, p<0.001), so we removed the item from further analysis. Severe problems with convergence were found with the extroversion items from the previously established Big Five personality measures. All of the extroversion items had low loadings that were not significant. Accordingly, we dropped the entire extraversion sub-construct to address this issue. There were also lower than desired loadings for items Agree4 (0.490, t-value: 6.589, p<0.001), Agree5 (0.310, t-value: 3.775, p<0.001), and Open3 (0.483, t-value: 3.705, p<0.001) and these items were also dropped.

As a second check, we correlated the latent variable scores against the indicators as a form of factor loadings and then examined the indicator loadings and cross loadings to establish convergent validity (see Table B.2). Although this approach is typically used to establish discriminant validity, convergent validity and discriminant validity are interdependent and help establish each other [22]. Thus, convergent validity is also established when each loading for a latent variable is substantially higher than those for other latent variables, which was true in every case but one. OCD3 has a troubling cross loading, and was therefore dropped from the remaining analysis.

Similarly, we also used two approaches to establish discriminant validity, as described in [6] and demonstrated recently in [10]. First, as with convergent validity, we examined the factor loadings but this time to ensure significant overlap did not exist between the constructs. Again, see Table B.2, in which discriminant validity is strongly shown. Second, we used the approach of examining the square roots of the AVEs against the correlations of the latent variables. The square roots of the AVEs are shown in the diagonal for the constructs (bolded and underlined) in Table B.3 of measurement model statistics. The basic standard followed here is that the square root of the AVE for any given construct (latent variable) should be higher than any of the correlations involving the construct [5, 20]. The square root of the AVE for OSN purposive value is 0.694 and the latent variable correlation between OSN purposive value and OSN self discovery is 0.676 (while 0.694 > 0.676, this is not an ideal difference between the two). However, acceptable discriminant validity was shown for all latent constructs.

Establishing the Lack of Common Methods Bias

As noted in the methodology section, our research was designed a priori so that common methods bias (a.k.a., mono-method bias) would likely not result in our study, following the leading literature on the subject [1, 11, 16]. However, we still test for common methods bias to establish that it is not a likely negative factor in our analysis.

The most important point of common methods bias is that if it exists, the constructs of the model will be highly correlated with each other. Thus, the first approach that we used was to simply examine a correlation matrix of the constructs and to determine if any of the correlations were above 0.90, which would be evidence that common methods bias may exist [13]. These correlations are observed in the measurement model statistics in Table B.3—all of which are significantly below the 0.90 threshold. Another check is the Harmon's single factor test. This resulted in 87 distinct factors, the largest of which only accounts for 15.024% of the variance, which is said to indicate a lack of common methods bias. However, several researchers dispute the value of this method [16].

As an additional conservative check, which is increasingly accepted, we used the marker-variable technique for PLS as described in [18]. With this method, the key is to find a latent construct that could be

subject to social desirability bias that is measured in the same way and has low correlations with other latent constructs. Conveniently, the selected marker variable need not exhibit reliability for our data [18]. In a previous data collection extroversion was also unreliable and unrelated to our dependent variable; thus, we again chose the dropped variable of extroversion as our marker variable. The marker variable was used to estimate the method variance by correlating the individual latent construct items in the model again against the marker variable's items. In doing so, the range of the correlations was from -0.247 to 0.276. To estimate the method variance correlation, we calculated the average correlation of the model's items against the marker variable's item, resulting in 0.1086. The average correlation of the marker variable's items against the model's items should ideally be close to zero. Rönkkö and Ylitalo [18] proposed a rule of thumb of an average of 0.05. For our marker variable, we exceed this recommendation slightly, but given our care in survey design and a low value, common methods bias in our model is not likely.

Checking for Multicollinearity

Another key threat to check for with SEM—especially with PLS—is the potential threat of multicollinearity. In Table B.4 we report the variance inflation factors (VIFs) for each item. The highest VIF score was 3.340 (and most were below 2.0), which is far below the latest standards for reflective latent constructs (<5.0) [2, 14]. We conclude our model does not suffer from multicollinearity that would negatively influence the results.

Establishing Reliabilities

As a product of our rigorous pre-analysis, all of our reflective sub-constructs exhibited high levels of reliability.[iii] To establish reliability, PLS computes a composite reliability score as part of its integrated model analysis. This score is a more accurate measurement of reliability than Cronbach's alpha because it does not assume loadings or error terms of the items to be equal. However, as a conservative check, we also considered Cronbach's alpha. The composite reliabilities, Cronbach's alphas and AVEs are reported in Table B.3.

Summary of Pre-analysis Validation

Our pre-analyses show that our data exhibit acceptable factorial validity of the constructs, little multicollinearity, strong reliabilities, and that they lack mono-method bias. In summary, the results of our validation procedures show that our model data meets or exceeds the rigorous validation standards expected in PLS-based analysis [2, 4, 10, 14, 15].

Table B.1. Outer Model Loadings to Establish Convergent Validity

Latent construct	Items	Outer loading	t-statistic
OSN belongingness; adapted from Grieve et al. [7]	Belong1	0.828	53.058***
	Belong2	0.621	20.294***
	Belong3	0.740	37.014***
	Belong4	0.823	55.133***
	Belong5	0.785	35.536***
	Belong6	0.656	21.132***
	Belong7	0.774	43.364***
	Belong8	0.795	58.526***
	Belong9	0.796	48.570***
	Belong10	0.646	19.615***
	Belong11	0.737	34.898***
	Belong12	0.606	21.448***
	Belong13	0.748	34.772***
	Belong14	0.797	57.851***
OSN fear-of-missing-out; adapted from Przybylski et al. [17]	FOMO1	0.879	63.187***
	FOMO2	0.902	84.141***
	FOMO3	0.906	87.050***
	FOMO4	0.874	71.809***
OSN envy; adapted from Krasnova et al. [9]	Envy1	0.758	36.859***
	Envy2	0.609	20.998***
	Envy3	0.797	48.492***
	Envy4	0.865	75.394***
	Envy5	0.826	59.931***
	Envy6	0.821	54.955***
OSN obsessive-compulsive disorder; adapted from Pallanti et al. [12], and Serenko and Turel [19]	OCD1	0.798	46.762***
	OCD2	0.822	55.320***
	OCD3	0.691	26.844***
	OCD4	0.499	(d) 14.330***
	OCD5	0.505	12.433***
	OCD6	0.656	28.568***
	OCD7	0.799	45.800***
	OCD8	0.779	46.414***
	OCD9	0.601	21.644***
	OCD10	0.589	15.154***
OSN anxiety; adapted from Thatcher and Perrewe [23]	Anx1	0.894	95.520***
	Anx2	0.914	111.446***
	Anx3	0.892	87.253***
OSN purposive value; Cheung et al. [3]	Pv1	0.604	20.674***
	Pv2	0.686	30.734***
	Pv3	0.629	23.436***
	Pv4	0.758	44.257***
	Pv5	0.731	39.746***
	Pv6	0.616	19.026***
	Pv7	0.652	23.646***
	Pv8	0.781	43.592***
	Pv9	0.758	39.647***
OSN self discovery; Cheung et al. [3]	Sd1	0.843	47.922***
	Sd1	0.874	61.776***
OSN maintaining interpersonal	Mii1	0.842	43.467***

interconnectivity; Cheung et al. [3]	Mii2	0.815	37.442***
OSN social enhancement; Cheung et al. [3]	Se1	0.920	111.600***
	Se2	0.928	138.322***
OSN entertainment value; Cheung et al. [3]	Ev1	0.811	44.450***
	Ev2	0.728	27.044***
	Ev3	0.835	58.071***
	Ev4	0.594	12.466***
Big-5: Extraversion; John et al. [8]	Extrav1	-0.258	(d) 0.64(n/s)
	Extrav2	0.435	(d) 1.357(n/s)
	Extrav3	-0.466	(d) 1.000(n/s)
	Extrav4	-0.432	(d) 0.929(n/s)
	Extrav5	0.396	(d) 1.264(n/s)
	Extrav6	-0.140	(d) 0.472(n/s)
	Extrav7	0.415	(d) 1.333(n/s)
	Extrav8	-0.123	(d) 0.368(n/s)
Big-5: Agreeableness; John et al. [8]	Agree1	0.722	19.118***
	Agree2	0.572	8.356***
	Agree3	0.763	17.197***
	Agree4	0.490	6.589***
	Agree5	0.310	3.775***
	Agree6	0.630	13.865***
	Agree7	0.608	9.253***
	Agree8	0.698	16.677***
	Agree9	0.505	6.911***
Big-5: Neuroticism; John et al. [8]	Neur1	0.723	25.624***
	Neur2	0.730	19.662***
	Neur3	0.713	21.577***
	Neur4	0.808	40.223***
	Neur5	0.709	18.753***
	Neur6	0.671	20.027***
	Neur7	0.586	12.254***
	Neur8	0.797	35.789***
Big-5: Conscientiousness; John et al. [8]	Consc1	0.662	20.677***
	Consc2	0.726	24.028***
	Consc3	0.655	19.752***
	Consc4	0.684	20.736***
	Consc5	0.729	27.263***
	Consc6	0.635	18.408***
	Consc7	0.682	22.78***
	Consc8	0.638	19.789***
	Consc9	0.649	18.471***
Big-5: Openness; John et al. [8]	Open1	0.670	5.409***
	Open2	0.642	7.144***
	Open3	0.483	3.705***
	Open4	0.579	4.002***
	Open5	0.616	4.714***
	Open6	0.615	4.752***
	Open7	0.597	5.941***
	Open8	0.641	5.165***
	Open9	0.700	8.631***
	Open10	0.546	3.996***

$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, (n/s) = not significant, and (d) = dropped to improve convergent validity.

Table B.2. Cross Loadings

Items	Belong	FOMO	Envy	OCD	Anx	Pv	Sd	Mii	Se	Belong	Open	Consc	Neur	Agree
Belong1	0.828	0.108	-0.169	0.118	-0.207	0.398	0.342	0.472	0.220	0.400	0.219	-0.195	0.242	-0.034
Belong2	0.621	-0.036	-0.161	-0.072	-0.191	0.219	0.181	0.295	0.024	0.223	0.196	-0.146	0.164	0.081
Belong3	0.740	0.096	-0.141	0.115	-0.189	0.446	0.369	0.414	0.256	0.340	0.163	-0.185	0.215	0.023
Belong4	0.823	0.145	-0.124	0.159	-0.173	0.416	0.378	0.443	0.230	0.386	0.192	-0.134	0.155	-0.028
Belong5	0.785	-0.014	-0.274	-0.049	-0.347	0.249	0.209	0.391	0.077	0.288	0.253	-0.269	0.294	-0.036
Belong6	0.656	-0.099	-0.372	-0.153	-0.367	0.136	0.099	0.243	-0.041	0.154	0.264	-0.286	0.294	0.015
Belong7	0.774	0.018	-0.204	0.001	-0.275	0.334	0.280	0.419	0.132	0.327	0.232	-0.203	0.248	0.051
Belong8	0.795	0.121	-0.170	0.109	-0.186	0.409	0.368	0.408	0.233	0.357	0.214	-0.185	0.197	-0.015
Belong9	0.796	0.047	-0.222	0.018	-0.260	0.369	0.316	0.403	0.159	0.359	0.252	-0.185	0.225	0.049
Belong10	0.646	-0.003	-0.220	-0.043	-0.234	0.199	0.183	0.309	0.036	0.205	0.220	-0.199	0.215	-0.005
Belong11	0.737	0.208	-0.040	0.207	-0.066	0.468	0.427	0.468	0.285	0.380	0.104	-0.084	0.132	-0.016
Belong12	0.606	-0.021	-0.162	-0.043	-0.222	0.260	0.177	0.360	0.094	0.246	0.216	-0.124	0.204	0.082
Belong13	0.748	0.013	-0.213	-0.016	-0.242	0.287	0.266	0.375	0.071	0.249	0.198	-0.162	0.222	-0.016
Belong14	0.797	0.128	-0.157	0.165	-0.141	0.433	0.381	0.454	0.190	0.353	0.218	-0.188	0.186	-0.039
FOMO1	0.073	0.879	0.358	0.415	0.391	0.269	0.245	0.182	0.400	0.132	-0.184	0.169	-0.132	-0.134
FOMO2	0.059	0.902	0.343	0.468	0.462	0.335	0.309	0.174	0.429	0.085	-0.170	0.126	-0.141	-0.139
FOMO3	0.071	0.906	0.330	0.445	0.427	0.316	0.305	0.171	0.407	0.113	-0.188	0.101	-0.165	-0.136
FOMO4	0.112	0.874	0.339	0.438	0.403	0.300	0.293	0.194	0.448	0.119	-0.181	0.159	-0.150	-0.084
Envy1	-0.126	0.260	0.757	0.282	0.363	0.133	0.124	0.025	0.221	0.083	-0.174	0.332	-0.273	-0.112
Envy2	-0.167	0.169	0.608	0.148	0.217	0.042	0.074	-0.012	0.195	0.050	-0.188	0.220	-0.166	-0.049
Envy3	-0.225	0.307	0.797	0.332	0.462	0.113	0.161	0.003	0.276	0.054	-0.226	0.315	-0.271	-0.058
Envy4	-0.223	0.345	0.865	0.361	0.485	0.087	0.121	-0.008	0.369	0.054	-0.298	0.347	-0.261	-0.088
Envy5	-0.211	0.356	0.826	0.355	0.495	0.119	0.161	0.033	0.353	0.049	-0.272	0.318	-0.264	-0.060
Envy6	-0.147	0.321	0.821	0.346	0.435	0.126	0.131	0.043	0.326	0.050	-0.267	0.328	-0.259	-0.074
OCD1	0.182	0.377	0.284	0.807	0.331	0.409	0.383	0.233	0.433	0.306	-0.100	0.097	-0.117	-0.172
OCD2	0.065	0.419	0.298	0.824	0.366	0.359	0.274	0.161	0.386	0.192	-0.156	0.075	-0.144	-0.157
OCD3	-0.155	0.378	0.386	0.688	0.632	0.174	0.176	0.005	0.308	0.034	-0.247	0.260	-0.292	-0.087
OCD5	-0.106	0.258	0.239	0.512	0.328	0.087	0.079	-0.046	0.181	-0.011	-0.211	0.162	-0.163	-0.158
OCD6	0.275	0.289	0.198	0.666	0.135	0.421	0.347	0.326	0.376	0.375	-0.049	0.104	-0.109	-0.077
OCD7	0.043	0.396	0.300	0.806	0.322	0.329	0.235	0.132	0.382	0.167	-0.193	0.125	-0.220	-0.147
OCD8	0.107	0.447	0.311	0.786	0.341	0.384	0.294	0.185	0.438	0.261	-0.204	0.161	-0.180	-0.163
OCD9	-0.019	0.246	0.283	0.574	0.335	0.204	0.156	0.094	0.262	0.084	-0.106	0.144	-0.178	-0.020
OCD10	-0.027	0.278	0.243	0.597	0.307	0.169	0.176	0.041	0.249	0.067	-0.157	0.164	-0.191	-0.118
Anx1	-0.305	0.405	0.475	0.396	0.894	0.071	0.091	-0.073	0.238	-0.107	-0.264	0.297	-0.309	-0.084
Anx2	-0.258	0.428	0.513	0.457	0.914	0.089	0.108	-0.022	0.275	-0.062	-0.251	0.351	-0.333	-0.028
Anx3	-0.198	0.446	0.469	0.457	0.892	0.137	0.161	0.018	0.304	0.004	-0.227	0.337	-0.304	-0.032

Pv1	0.286	0.195	0.105	0.215	0.075	0.604	0.408	0.298	0.332	0.340	0.013	-0.043	0.016	0.082
Pv2	0.320	0.210	0.092	0.295	0.045	0.685	0.483	0.296	0.329	0.408	0.027	-0.019	-0.004	0.021
Pv3	0.454	0.161	-0.027	0.177	-0.028	0.629	0.427	0.489	0.329	0.312	0.118	-0.073	0.043	0.135
Pv4	0.450	0.240	0.080	0.266	0.067	0.758	0.534	0.441	0.396	0.379	0.056	-0.034	0.001	0.150
Pv5	0.380	0.173	0.028	0.245	-0.005	0.731	0.503	0.353	0.354	0.414	0.070	-0.047	0.033	0.101
Pv6	0.136	0.235	0.119	0.305	0.136	0.615	0.321	0.133	0.319	0.163	-0.115	-0.050	-0.073	-0.046
Pv7	0.203	0.257	0.118	0.342	0.146	0.652	0.429	0.254	0.463	0.225	-0.111	-0.057	-0.107	-0.028
Pv8	0.316	0.311	0.150	0.374	0.118	0.781	0.541	0.279	0.443	0.311	-0.062	-0.042	-0.058	0.012
Pv9	0.282	0.353	0.189	0.408	0.159	0.758	0.518	0.266	0.526	0.318	-0.095	-0.017	-0.093	-0.057
Sd1	0.390	0.230	0.092	0.214	0.068	0.504	0.843	0.441	0.370	0.404	0.038	0.010	-0.026	0.012
Sd1	0.307	0.322	0.192	0.379	0.156	0.650	0.874	0.359	0.514	0.383	0.004	0.011	-0.055	-0.010
Mii1	0.419	0.260	0.078	0.273	0.026	0.491	0.474	0.841	0.355	0.511	0.084	0.003	0.009	-0.023
Mii2	0.469	0.069	-0.050	0.043	-0.077	0.265	0.288	0.816	0.170	0.273	0.224	-0.077	0.156	0.082
Se1	0.192	0.433	0.336	0.440	0.283	0.490	0.452	0.281	0.920	0.329	-0.172	0.140	-0.140	-0.045
Se2	0.200	0.441	0.365	0.466	0.277	0.547	0.506	0.311	0.929	0.337	-0.166	0.114	-0.179	-0.070
Ev1	0.368	0.060	0.022	0.176	-0.068	0.376	0.366	0.438	0.294	0.810	0.137	0.005	0.073	-0.029
Ev2	0.306	0.143	0.087	0.237	0.051	0.429	0.380	0.305	0.307	0.730	0.034	0.060	0.004	-0.038
Ev3	0.401	0.089	0.006	0.179	-0.136	0.373	0.384	0.406	0.272	0.835	0.136	-0.014	0.099	-0.100
Ev4	0.095	0.097	0.179	0.184	0.008	0.131	0.176	0.244	0.185	0.592	0.017	0.124	0.000	-0.121
Agree1	0.217	-0.146	-0.267	-0.150	-0.216	0.057	0.094	0.152	-0.138	0.076	0.720	-0.385	0.325	0.107
Agree2	0.283	-0.102	-0.173	-0.098	-0.155	0.071	0.048	0.165	-0.082	0.116	0.568	-0.184	0.289	0.179
Agree3	0.094	-0.214	-0.214	-0.250	-0.223	-0.139	-0.090	0.051	-0.215	0.016	0.773	-0.255	0.330	0.090
Agree6	0.246	-0.073	-0.215	-0.111	-0.184	0.056	0.067	0.165	-0.077	0.092	0.625	-0.323	0.302	0.021
Agree7	0.215	-0.069	-0.113	-0.067	-0.092	0.048	0.058	0.171	-0.010	0.189	0.603	-0.141	0.246	0.118
Agree8	0.142	-0.138	-0.224	-0.098	-0.191	0.002	0.021	0.130	-0.090	0.099	0.698	-0.310	0.322	0.033
Agree9	0.276	-0.041	-0.171	-0.054	-0.107	0.091	0.065	0.163	-0.035	0.164	0.498	-0.215	0.259	0.095
Neur1	-0.256	0.148	0.373	0.139	0.357	-0.028	0.047	-0.053	0.132	0.011	-0.350	0.718	-0.414	-0.031
Neur2	-0.182	0.057	0.226	0.085	0.215	-0.119	-0.050	-0.094	0.015	-0.016	-0.275	0.736	-0.370	-0.101
Neur3	-0.185	0.093	0.272	0.116	0.234	-0.051	-0.032	-0.043	0.082	0.004	-0.347	0.709	-0.253	-0.023
Neur4	-0.149	0.147	0.343	0.189	0.292	-0.039	0.005	0.000	0.117	0.051	-0.248	0.806	-0.270	-0.090
Neur5	-0.129	0.117	0.221	0.112	0.217	-0.021	0.025	-0.048	0.112	0.040	-0.298	0.713	-0.348	-0.078
Neur6	-0.177	0.085	0.289	0.138	0.224	-0.026	-0.023	-0.006	0.090	0.026	-0.459	0.668	-0.337	0.012
Neur7	-0.082	0.087	0.162	0.110	0.180	-0.042	0.043	-0.003	0.066	0.010	-0.157	0.598	-0.294	-0.159
Neur8	-0.197	0.124	0.334	0.191	0.324	-0.047	0.030	-0.038	0.128	0.053	-0.232	0.796	-0.339	-0.142
Consc1	0.194	-0.127	-0.202	-0.180	-0.266	-0.025	-0.062	0.107	-0.094	0.087	0.267	-0.172	0.662	0.139
Consc2	0.222	-0.141	-0.249	-0.181	-0.269	-0.056	-0.073	0.019	-0.129	0.020	0.411	-0.352	0.726	-0.036
Consc3	0.103	-0.151	-0.188	-0.205	-0.228	-0.108	-0.117	0.039	-0.165	0.011	0.319	-0.222	0.655	0.132
Consc4	0.189	-0.083	-0.265	-0.142	-0.248	-0.048	-0.012	0.021	-0.122	0.011	0.273	-0.307	0.682	-0.116

Consc5	0.206	-0.120	-0.265	-0.174	-0.247	-0.025	-0.037	0.053	-0.167	-0.017	0.372	-0.387	0.728	0.051
Consc6	0.222	-0.036	-0.161	-0.100	-0.176	0.037	0.016	0.117	-0.046	0.095	0.238	-0.210	0.638	0.101
Consc7	0.186	-0.084	-0.157	-0.149	-0.213	0.009	-0.011	0.094	-0.094	0.076	0.239	-0.287	0.684	0.107
Consc8	0.222	-0.057	-0.202	-0.138	-0.225	0.012	0.023	0.084	-0.074	0.125	0.232	-0.316	0.639	0.031
Consc9	0.190	-0.140	-0.240	-0.183	-0.230	0.033	0.036	0.078	-0.111	0.054	0.341	-0.438	0.648	-0.003
Open1	0.121	-0.077	-0.096	-0.094	-0.110	0.142	0.035	0.105	0.025	0.014	0.124	-0.190	0.197	0.666
Open2	0.036	-0.091	-0.039	-0.112	-0.040	0.081	0.005	0.106	-0.043	-0.010	0.124	-0.018	0.069	0.645
Open4	0.074	-0.036	0.011	-0.014	-0.011	0.156	0.065	0.168	0.065	0.078	0.056	-0.009	-0.013	0.579
Open5	0.021	-0.057	-0.092	-0.049	-0.067	0.095	0.004	0.043	0.002	-0.016	0.066	-0.164	0.099	0.618
Open6	0.070	-0.071	-0.030	-0.054	-0.003	0.120	0.087	0.074	0.033	0.020	0.140	-0.003	0.026	0.630
Open7	-0.109	-0.070	-0.062	-0.141	-0.020	-0.093	-0.077	-0.085	-0.099	-0.162	-0.019	-0.064	-0.089	0.592
Open8	0.022	-0.065	-0.018	-0.066	0.023	0.152	0.087	0.088	0.057	0.015	0.104	-0.054	0.063	0.639
Open9	-0.029	-0.141	-0.076	-0.167	-0.025	-0.018	-0.024	-0.052	-0.108	-0.107	0.113	-0.046	0.045	0.709
Open10	0.017	-0.007	-0.013	0.001	-0.006	0.087	0.076	0.048	0.078	-0.022	0.073	-0.101	0.040	0.554

Table B.3. Measurement Model Statistics and AVEs

| Latent construc	C.R.	C.A.	AVE	Belong	FOMO	Envy	OCD	Anx	Pv	Sd	Mii	Se	Ev	Agree	Neur	Consc	Open
Belong	0.94	0.93	0.55	**0.743**													
FOMO	0.93	0.91	0.79	0.089	**0.891**												
Envy	0.90	0.87	0.61	-0.236	0.384	**0.784**											
OCD	0.88	0.85	0.50	0.120	0.484	0.374	**0.712**										
Anx	0.92	0.88	0.81	-0.282	0.473	0.539	0.420	**0.900**									
Pv	0.89	0.86	0.48	0.467	0.343	0.135	0.441	0.109	**0.694**								
Sd	0.84	0.64	0.73	0.404	0.324	0.168	0.361	0.132	0.676	**0.858**							
Mii	0.81	0.54	0.68	0.535	0.203	0.020	0.223	-0.028	0.462	0.464	**0.828**						
Se	0.92	0.83	0.85	0.213	0.473	0.379	0.493	0.302	0.562	0.519	0.321	**0.924**					
Ev	0.83	0.74	0.56	0.425	0.125	0.072	0.282	-0.062	0.466	0.457	0.479	0.360	**0.748**				
Agree	0.82	0.78	0.41	0.269	-0.205	-0.307	-0.202	-0.276	-0.014	0.019	0.179	-0.186	0.117	**0.643**			
Neuro	0.89	0.86	0.51	-0.234	0.155	0.397	0.172	0.363	-0.059	0.012	-0.042	0.137	0.039	-0.401	**0.720**		
Consc	0.88	0.85	0.45	0.277	-0.167	-0.320	-0.222	-0.351	-0.038	-0.051	0.095	-0.174	0.068	0.453	-0.443	**0.673**	
Open	0.85	0.83	0.39	0.002	-0.139	-0.091	-0.181	-0.051	0.064	0.000	0.032	-0.064	-0.087	0.132	-0.103	0.069	**0.62**

Note: Bolded, underlined values represent the square root of the AVEs

Table B.4. Collinearity Statistics

Latent construct	Items	VIF	Latent construct	Items	VIF
OSN belongingness	Belong1	2.714	OSN self discovery	Sd1	1.290
	Belong2	1.629		Sd1	1.290
	Belong3	1.988	OSN maintaining interpersonal interconnectivity	Mii1	1.161
	Belong4	2.834		Mii2	1.161
	Belong5	2.928	OSN social enhancement	Se1	2.010
	Belong6	2.116		Se2	2.010
	Belong7	2.239	OSN entertainment value	Ev1	1.587
	Belong8	2.419		Ev2	1.315
	Belong9	2.444		Ev3	1.635
	Belong10	1.780		Ev4	1.342
	Belong11	2.064	Big-5: Agreeableness	Agree1	1.457
	Belong12	1.507		Agree2	1.507
	Belong13	2.251		Agree3	1.317
	Belong14	2.563		Agree4	1.409
OSN fear-of-missing-out	FOMO1	2.687		Agree7	1.628
	FOMO2	3.192		Agree8	1.624
	FOMO3	3.340		Agree9	1.400
	FOMO4	2.526	Big-5: Neuroticism	Neur1	1.684
OSN envy	Envy1	1.920		Neur2	2.204
	Envy2	1.460		Neur3	1.754
	Envy3	1.932		Neur4	2.111
	Envy4	2.789		Neur5	1.976
	Envy5	2.211		Neur6	1.537
	Envy6	2.358		Neur7	1.752
OSN obsessive-compulsive disorder	OCD1	2.195		Neur8	1.945
	OCD2	2.727	Big-5: Conscientiousness	Consc1	1.646
	OCD5	1.516		Consc2	1.893
	OCD6	1.659		Consc3	1.512
	OCD7	2.598		Consc4	1.853
	OCD8	1.975		Consc5	1.772
	OCD9	1.287		Consc6	1.701
	OCD10	1.687		Consc7	1.630
OSN anxiety	Anx1	2.409		Consc8	1.556
	Anx2	2.696		Consc9	1.510
	Anx3	2.392	Big-5: Openness	Open1	1.934
OSN purposive value	Pv1	1.418		Open2	1.413
	Pv2	1.622		Open4	1.691
	Pv3	1.570		Open5	1.829
	Pv4	1.973		Open6	1.982
	Pv5	1.769		Open7	1.150
	Pv6	1.574		Open8	1.646
	Pv7	1.714		Open9	1.405
	Pv8	2.144		Open10	1.772
	Pv9	2.086			

Mediation and Moderation Details

Figure B.1. Empirical Results Showing that OSN Belongingness Is Fully Mediated
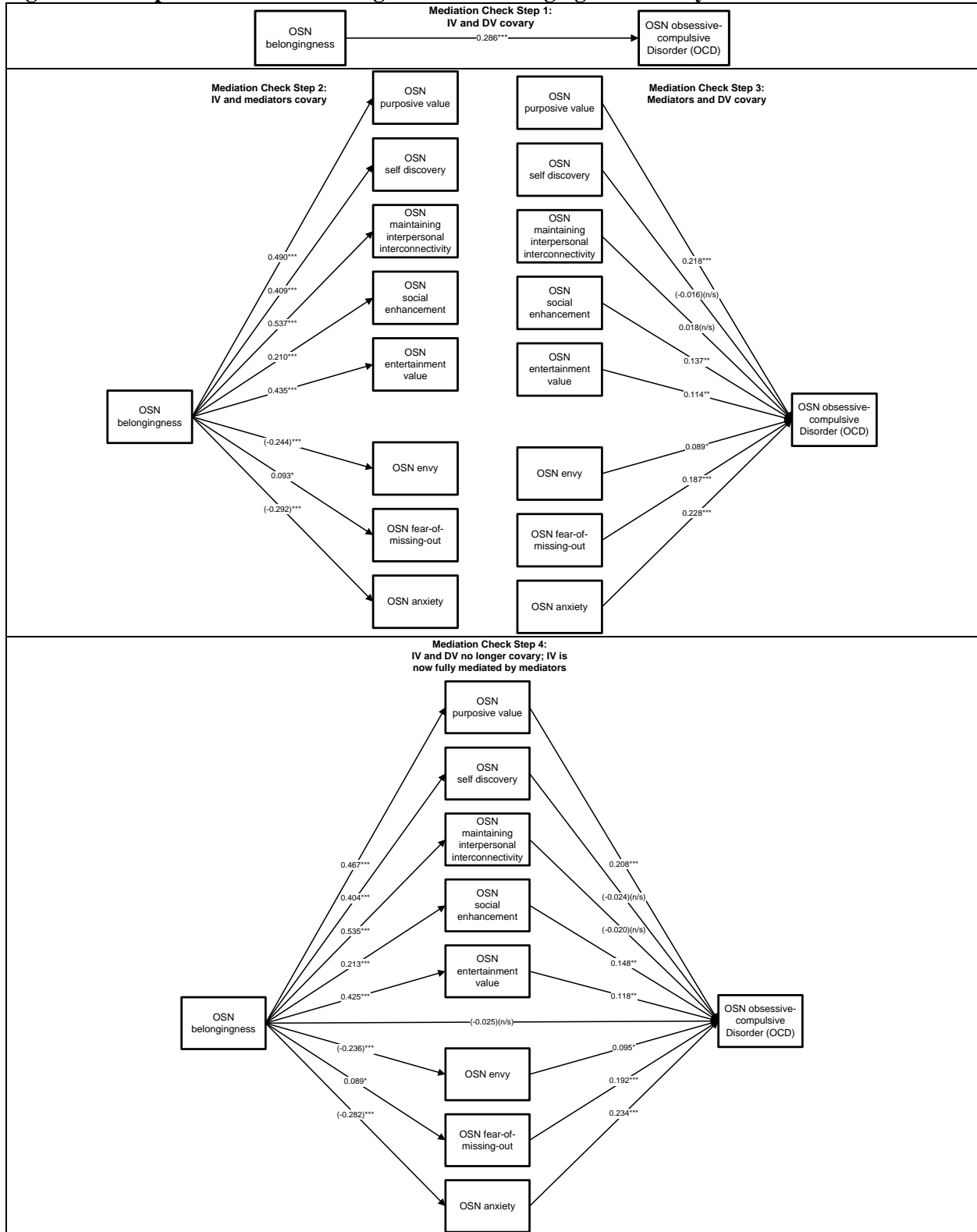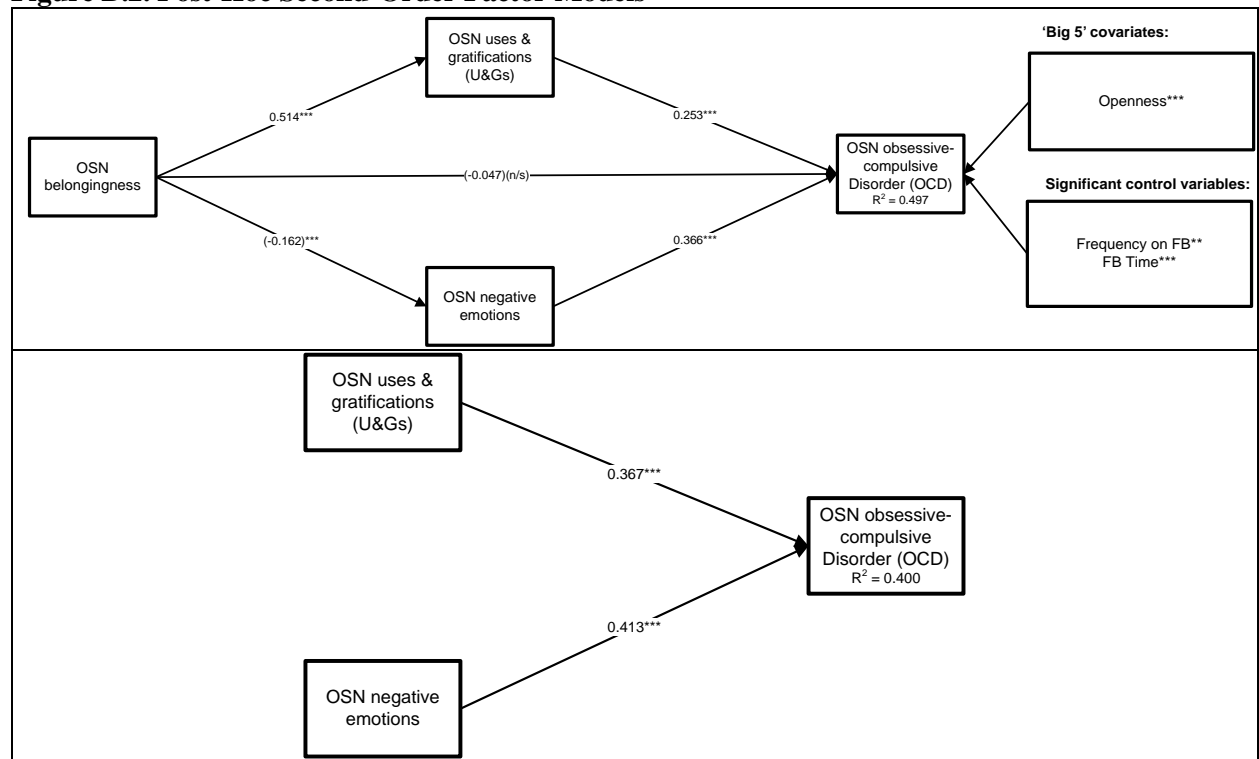

*p < 0.05, **p < 0.01, ***p < 0.001, and n/s = not significant.

Table B.5. Bootstrapped CI Tests for Moderation

Interaction	2.5% lower bound	97.5% upper bound	Zero included?	Support?
Moderation of Uses & Gratifications -> OCD by Negative Emotions				
OSN purposive value * OSN envy → OSN OCD	0.0005	0.0267	No	Yes
OSN purposive value * OSN FOMO → OSN OCD	0.0084	0.0408	No	Yes
OSN purposive value * OSN anxiety → OSN OCD	0.0169	0.0607	No	Yes
OSN social enhancement * OSN envy → OSN OCD	0.0004	0.0186	No	Yes
OSN social enhancement * OSN FOMO → OSN OCD	0.0047	0.0291	No	Yes
OSN social enhancement * OSN anxiety → OSN OCD	0.0084	0.0463	No	Yes
Moderation of Negative Emotions -> OCD by Personality				
OSN envy * Agreeable → OSN OCD	-0.0084	0.0023	Yes	No
OSN envy * Conscientiousness → OSN OCD	-0.0101	0.0011	Yes	No
OSN envy * Neuroticism → OSN OCD	-0.0091	0.0019	Yes	No
OSN envy * Openness → OSN OCD	-0.0208	-0.0007	No	Yes
OSN FOMO * Agreeable → OSN OCD	-0.0135	0.0046	Yes	No
OSN FOMO * Conscientiousness → OSN OCD	-0.0168	0.0017	Yes	No
OSN FOMO * Neuroticism → OSN OCD	-0.0142	0.0049	Yes	No
OSN FOMO * Openness → OSN OCD	-0.0324	-0.0088	No	Yes
OSN anxiety * Agreeable → OSN OCD	-0.0223	0.0068	Yes	No
OSN anxiety * Conscientiousness → OSN OCD	-0.0251	0.0032	Yes	No
OSN anxiety * Neuroticism → OSN OCD	-0.0236	0.0069	Yes	No
OSN anxiety * Openness → OSN OCD	-0.0488	-0.0181	No	Yes

Second-Order Factor Model Details

Figure B.2. Post-Hoc Second-Order Factor Models

*p < 0.05, **p < 0.01, ***p < 0.001, and n/s = not significant.

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[i] *Convergent validity* is the basic idea that measurement items that should be related are related. It is established "when items thought to reflect a construct converge, or show significant, high correlations with one another, particularly when compared to the convergence of items relevant to other constructs, irrespective of method" [22, 391].

[ii] *Discriminant validity* is the idea that items that should not be related are in fact not related. it can be established when items thought to diverge show insignificantly low correlations with one another, particularly when compared to items in other constructs [22].

[iii] Reliability refers to the degree to which a scale yields consistent and stable measures over time [21].