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SPECIAL ARTICLE

Fear of missing out (FOMO): overview, theoretical underpinnings, and literature review on relations with severity of negative affectivity and problematic technology use

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This article discusses the fear of missing out (FOMO) on rewarding experiences, an important psychological construct in contemporary times. We present an overview of the FOMO construct and its operational definition and measurement. Then, we review recent empirical research on FOMO's relationship with levels of online social engagement, problematic technology and internet communication use, negative affectivity, and sociodemographic variables. Additionally, we discuss theoretical conceptualizations regarding possible causes of FOMO and how FOMO may drive problematic internet technology use. Finally, we discuss future directions for the empirical study of FOMO.

Keywords: Addictive behavior; anxiety; social anxiety; depression; smartphone

Introduction

The fear of missing out (FOMO) on rewarding experiences has received increasing empirical study in recent years. Central to FOMO is the perceived need to persistently stay connected with one's social network, resulting in frequent (and for some people, excessive) use of social networking sites (SNS) and messaging services.[1] The enhanced scientific focus on FOMO coincides with growing societal debate about whether too much digital "screen time" is harmful to children and adults.[2,3] However, the empirical literature on FOMO has not yet been synthesized into a review paper. Our focus in this paper is to define and discuss the FOMO construct and its theoretical underpinnings, as well as review the recent empirical literature on relationships between FOMO and levels of online social engagement, problematic internet use (PIU), negative affectivity, and sociodemographic characteristics.

Background, definition, and measurement of FOMO

FOMO was first introduced in media outlets in the early 2010s.[4,5] At that time, SNS use had grown exponentially around the world.[6,7] With the dissemination of means to check SNS, especially the increasing ubiquity of smartphones, it has become easy to learn about potentially rewarding experiences (online and offline) that one may be missing. Incidentally, from early on FOMO was characterized as an anxiety-provoking construct in popular media.[4,5]

FOMO has been defined in scientific literature as involving two specific primary components: a) apprehension that others are having rewarding experiences from which one is absent, and b) the persistent desire to stay connected with people in one's social network.[1] The first component maps onto the cognitive aspect of anxiety (e.g., worry, rumination, etc.). The latter component involves a behavioral strategy aimed at relieving such anxiety – analogous to how compulsions aim (though maladaptively) to relieve anxiety in obsessive compulsive disorder. Currently, this behavioral component of FOMO most often involves frequent checking of SNS and messaging services to maintain social connections and avoid missing out on rewarding experiences.[1]

The persistent online checking behavior inherent in FOMO is not only active, i.e. when people have time to proactively browse their internet-enabled devices such as smartphones, but is also frequently reactive (or perhaps passive) through the many social-related notifications received over the course of the day – to which there is a compulsion to respond. On one hand, social-related notifications are helpful for one's social life and are rated favourably[8,9] because they satisfy and alleviate FOMO.

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Online social interaction can also enhance social capital for many people.[10] On the other hand, interruptive smartphone and computer notifications (and associated checking behavior) are known to have adverse effects. Such notifications can result in a distracted and less focused daily experience, impairing attention[11] and interrupting work, school,[12,13] and other daily life activities[14] due to "switching costs," which make it difficult to return to and complete the task at hand.[15] Thus, FOMO can drive excessive checking for and responding to SNS notifications, making it difficult to remain productive in daily life.[16] In this context, we also mention growing discussion on the need to regulate the number of elements built in to social media apps that elicit FOMO[17,18] in an attempt to prolong usage time to harvest more personal data in the age of surveillance capitalism.[19,20]

Several self-report scales have been developed to measure FOMO, of which the most widely used is the 10-item Likert-type FOMO Scale developed by Przybylski et al.[1] This scale includes items such as "I fear others have more rewarding experiences than me," and "When I miss out on a planned get-together it bothers me." Another similar scale is Alt's FOMO Scale, with 17-item[21] and 10-item[22] versions. A third scale added items to the Przybylski FOMO Scale by incorporating state-based FOMO content to distinguish it from trait-based FOMO.[23] The authors used the two FOMO Scale items described above as examples of trait-based FOMO, and added state-based FOMO items such as "I am continuously online in order to not miss out on anything" and "I fear not to be up-to-date in my social networking sites." Additionally, some research has used behavioral measures to examine FOMO by assessing the physiological distress (e.g., heart rate and blood pressure) of being separated from a smartphone and SNS.[24,25]

Several studies have explored the latent dimensions of FOMO by using exploratory and/or confirmatory factor analysis to better understand this construct. Some work has tested and found support for a single latent dimension.[26-28] Wegmann et al.[23] added the previously described state-based content to the Przybylski et al.[1] FOMO Scale and refined it through exploratory factor analysis with a sample of German participants. They then validated the expanded scale with confirmatory factor analysis in a separate German sample, revealing a two-dimensional model involving trait- and state-based FOMO factors.[23,29] Another study revealed two FOMO factors involving missing out on the experiences of others, and the use of rumination strategies for controlling one's social experiences.[30] Finally, other research has discovered three FOMO factors in social, news, and commercial information.[21,22]

FOMO appears to be a universal phenomenon, having been investigated and supported as a valid construct in numerous countries and languages. For example, FOMO has been studied in samples from Israel,[22] Turkey,[29] Belgium,[31] Poland,[32] the United Kingdom,[33] New Zealand,[34] Germany,[35] Italy,[30] China,[36] Bosnia,[37] India,[38] Latin America,[39] and various regions within the United States.[27,40,41] One paper compared the FOMO scores of German and Spanish samples, finding that Germans scored significantly higher on trait-based FOMO, with a small effect ($\eta_p^2 = 0.031$).[23]

FOMO's relationships with relevant variables

We now review recent empirical research on bivariate relationships between FOMO and relevant variables, including PIU, psychopathology and sociodemographic characteristics. Ours is not a comprehensive systematic review, since we focused on findings from the past couple of years. Specifically, when reviewing FOMO's relations with relevant constructs, we only included studies published since 2018. Nevertheless, we also reviewed earlier studies when discussing FOMO's relations with sociodemographic variables, since few papers have reported such findings. We organized the discussed references in an Endnote database.

Frequency and problematic use of internet technology

First, we will discuss research investigating FOMO in relation to greater frequency of, but not necessarily maladaptive, SNS use. The majority of these studies investigated only Facebook use or overall SNS use, employing self-report methodology with a correlational, cross-sectional survey design. Moderate to large relationships have been discovered in several such studies involving samples of children and youth, college students, and adults.[35,37,42-45] For example, Dempsey et al.[43] analyzed data from 289 American college students using a cross-sectional web survey design with standardized, self-report scales. The authors reported a bivariate Pearson correlation of -0.19 between the Przybylski et al.[1] 10-item FOMO Scale and a five-item Facebook use frequency scale (computed such that lower scores indicate greater Facebook frequency).

We should provide a caveat at this juncture about healthy vs. maladaptive internet technology (including SNS) use. A higher level of social networking is not necessarily maladaptive, but it can be if it becomes excessive or "problematic." In fact, PIU is defined as when overuse results in adverse effects.[46] Such adverse effects are typically categorized as those observed in addictive disorders involving drug and alcohol use, including withdrawal when denied access, tolerance (requiring increasing periods of use to feel the same level of emotional relief), and functional impairment such as work or social problems, hazardous use, etc.[47,48] For recent discussion on this topic and a taxonomy of internet-related use disorders, including SNS use disorder or problematic SNS use, see work by Montag et al.[49] We should also point out that only problematic use of internet gaming is currently an official medical/mental health diagnosis[50]; for preliminary empirical findings, see recent work.[51,52]

Nonetheless, problematic use of other forms of internet technology, such as smartphones and SNS, are important because of the adverse health and functional consequences that can result from overuse.[53-55] Since the smartphone itself is only a vehicle for accessing social

media apps etc., the construct of problematic smartphone use (PSU) (alternatively, smartphone addiction or smartphone use disorder) is frequently debated.[49,56] Recent reviews of PIU have included smartphone[57-59] and SNS use,[60,61] including relations between problematic use and psychological (including psychopathological) constructs. The relationships between unspecified PIU and PSU have also been investigated, showing overlap (correlations) of around 0.50 in recent research.[62-64] The psychological scales in the aforementioned reviews have frequently used diagnostic criteria for drug and alcohol use that have been modified to assess use of a specific technology medium.

FOMO has been empirically studied in relation to problematic SNS use in numerous studies. These studies have almost exclusively used self-report methodology with a correlational, cross-sectional survey design. Moderate to large positive associations between FOMO and levels of problematic SNS use have been found in several studies of school-aged adolescents, college students, and adults.[29,30,37,38,43,65-69] Dempsey et al.[43] discovered a bivariate Pearson correlation of 0.32 between the Przybylski et al.[1] FOMO Scale and the six-item Bergen Facebook Addiction Scale.[70] Thus, FOMO has been linked not only to greater frequency of SNS use, but also to higher levels of problematic SNS use.

Many studies have also examined FOMO in relation to levels of problematic smartphone use. These investigations have exclusively used self-report methods and a correlational, cross-sectional research design. Numerous studies with samples from all age groups have found moderate to large positive associations between FOMO and problematic smartphone use.[27,28,36,45,65,66,69,71-75] For example, Elhai, Yang, Fang et al.[36] analyzed data from 1,034 Chinese university students, using a cross-sectional, online self-report survey design with standardized psychological scales. They reported a bivariate Pearson correlation of 0.29 between the Chinese versions of the Przybylski et al.[1] FOMO Scale and the 10-item Smartphone Addiction Scale.[76] Associations between FOMO and other adverse effects from smartphones have also been investigated. FOMO has been positively correlated with disrupted daily life activities due to smartphone notifications,[16] as well as to distracted pedestrian behavior due to smartphone use.[77]

Negative affectivity and demographics

FOMO has been conceptualized as a construct that primarily involves anxiety-related psychopathology,[1] and anxiety disorders are conceptualized as an important aspect of underlying negative affectivity.[78] As such, FOMO has been examined in relation to anxiety symptom severity, including social anxiety, in studies with adolescent and adult samples that used correlational, cross-sectional designs. Across studies, FOMO has revealed moderate to large positive relationships with anxiety severity.[27,29,30,32,35,36,38,43,68,72,75,79] For instance, in the previously mentioned study by Elhai, Yang, Fang et al.,[36] a bivariate Pearson correlation of 0.33 was reported between the Przybylski et al.[1] FOMO Scale and the seven-item anxiety subscale of the Depression Anxiety Stress Scale-21.[80]

Anxiety highly correlates (and is comorbid) with depression,[81,82] which is also a fundamental aspect of underlying negative affectivity.[78] FOMO has also been examined in relation to depression severity from adolescence through adulthood using correlational, cross-sectional methodology. Specifically, mild to moderate positive associations have been found between FOMO and depression symptom severity.[27,35,36,38,43,72,74,79,83] Elhai, Yang, Fang et al.[36] reported a bivariate Pearson correlation of 0.29 between the Przybylski et al.[1] FOMO Scale and seven-item depression subscale of the Depression Anxiety Stress Scale-21.[80]

Other indices of negative affectivity have been supported in connection with FOMO through correlational, cross-sectional methodology. Moderate to large positive associations have been found for FOMO with rumination,[27,43] as well as for FOMO with negative affect and mood.[72,75,79] Additionally, a moderate positive correlation has been found between FOMO and proneness to experience boredom[27,74]; in fact, boredom proneness is conceptualized as a negative affectivity construct that additionally involves impaired attention.[84]

FOMO has also been investigated for relations with variables involving the opposite of negative affectivity – namely, perceived quality of life. These studies have used cross-sectional methods similar to those of most of the previously mentioned studies. Specifically, FOMO has shown mild to moderate inverse correlations with life satisfaction.[26,66,69] Furthermore, mild to moderate inverse associations have been found between FOMO and emotional well-being.[42,85]

Finally, FOMO has been associated with particular demographic characteristics in a small number of studies with correlational, cross-sectional designs. FOMO has been correlated with younger age in some studies,[27,32,86] and others have found it to be more related to females than males.[27,31,87] One study of North Americans found that FOMO was more related to Caucasians than racial minorities.[27]

Theoretical underpinnings of FOMO

FOMO was first conceptualized using self-determination theory (SDT), which was developed by Ryan & Deci[88] and applied by Przybylski et al. to understanding what drives FOMO.[1] SDT attempts to explain how personality is formed and the psychological needs that drive personality formation. SDT proposes that intrinsic (rather than extrinsic) motivation for reward is essential in promoting mental health, and that intrinsic motivation is best promoted when one feels socially connected to others. Therefore, in SDT, social relatedness can drive intrinsic motivation, which in turn can encourage positive mental health.[89] Przybylski et al. applied SDT to FOMO, proposing that FOMO is a negative emotional state resulting from unmet social relatedness needs.[1] The conceptualization that FOMO involves negative affect from unmet social needs is similar to theories about the negative emotional effects of social ostracism.[90]

In this context, research involving personality psychology should also be mentioned. FOMO has been linked to the personality trait of neuroticism,[29,86] one of the most well-known risk factors for developing a mood disorder.[91] Furthermore, narcissism likely plays a role in FOMO. Vulnerable narcissists in particular have unmet social relatedness needs (similar to those with severe FOMO) and more often engage in problematic SNS use.[92] Therefore, FOMO may have a mediational role between narcissism and problematic SNS use.

Subsequent investigations have assessed whether FOMO influences negative affectivity, such as depression and anxiety, or whether negative affectivity influences FOMO. For instance, several papers have conceptualized FOMO as a driving factor for negative affectivity.[31,79,93] However, other papers have conceptualized negative affectivity as an antecedent of FOMO.[23,39,94] It is not yet clear whether FOMO causes negative affectivity, whether negative affectivity causes FOMO, or whether there is a bidirectional effect. Repeated measures, longitudinal designs, and experiments may eventually provide answers to this question. Studies with repeated measures designs have found some initial support that FOMO drives negative affect over short (1-week) periods of time.[79,93]

FOMO is also widely considered a driving mechanism for PIU, as discussed above. As such, FOMO has been theorized for its role in PIU. The Interaction of Person-Affect-Cognition-Execution (I-PACE) model of PIU conceptualizes risk factors for PIU, both in early[95] and later stages of excessive technology use.[96] I-PACE proposes that background personal variables, such as psychopathology, personality, and biology (including genetics), can influence problematic use. I-PACE additionally suggests that responses to background variables also play a role in PIU as mediating mechanisms between background variables and problematic use. Such response variables include coping strategies, cognitive bias, ability to inhibit impulsive behavior, craving and expectations about internet use.[96]

FOMO has been conceptualized as an internet-related maladaptive cognitive bias within the I-PACE model's response variables.[23,94] Elhai et al. suggested that because depression and anxiety involve social isolation, FOMO can be a natural consequence, in turn driving PIU.[94] In fact, consistent with I-PACE, several papers have found FOMO to mediate relations between psychopathological symptoms (i.e., depression and anxiety) and PIU levels.[27,28,36,39,43,73,74] Thus, FOMO may be a mechanism that explains how some depressed/anxious people develop PIU.

Conclusions and future directions

FOMO is an important psychological construct in the digital age. FOMO has been examined and validated globally with several self-report psychological scales, as well as with physiological monitoring. Support has been established for FOMO in relation to greater frequency of SNS use, higher levels of problematic SNS and smartphone use, more severe anxiety, depression and negative affectivity, and lower levels of perceived quality of life. Preliminary evidence indicates that FOMO is more related to younger age and female sex.

Future research could explore unanswered questions regarding the FOMO construct. Nearly all work assessing the relations between FOMO and high or problematic levels of technology use has involved self-reported behavior as the dependent variable. However, self-reported rates of internet use differ from objective measures of use (e.g. device logs).[97-99] In particular, digital phenotyping could help the psychological sciences overcome some of the problems arising from self-report methods, such as problems self-assessing a construct such as FOMO and the tendency to answer questions in socially desirable ways.[100] We are aware of only one FOMO study that has objectively measured internet technology use (smartphone), finding that FOMO was related to higher level of use.[83] More work in this area is needed. Furthermore, the vast majority of research on FOMO has used cross-sectional research methodology. We encourage researchers to use repeated measures, longitudinal, daily diary and/or experience sampling designs to further assess FOMO. Such designs can attempt to answer whether FOMO drives negative affectivity or vice-versa, which has been done thus far in only two papers,[79,93] and whether FOMO drives problematic smartphone/SNS use or vice-versa, which is as yet unexplored.

Additionally, the research on FOMO has been exclusively variable-centered. No studies have used person-centered analyses to examine possible heterogeneity in the experiences/symptoms of FOMO across individuals with mixture modeling such as cluster, latent class, or latent profile analysis. Furthermore, FOMO and other negative affectivity variables are all correlated with PIU and with each other. Therefore, statistical methods, such as machine learning algorithms that can address collinearity and relative variable importance and can shrink regression coefficients among collinear predictors to realistic levels, are advisable for further FOMO investigation.[72]

When writing the present paper, we were also surprised that FOMO has not yet been investigated with neuroscientific tools to better understand which neural processes underlie the relevant construct. This is a glaring omission, since studies have increasingly used such tools to investigate the effects of excessive social network use/smartphone use[101-103] or the power of likes on platforms such as Instagram.[104-106] This less-traveled path will be of tremendous importance for gaining deeper insights into the actual nature of FOMO. It will also be important to disentangle more state/trait effects of FOMO, given that Balta et al.[29] found that associations with neuroticism are stronger for trait FOMO ($r = 0.29$) than state FOMO ($r = 0.15$). See also Wegmann et al.[23] on the distinction between state vs. trait FOMO.

Finally, other psychological constructs that have preliminary associations with FOMO should be further examined in subsequent studies, including behavioral activation, which is important for treating major depressive disorder,[107] as well as the need for physical touch.[108] Another important area to study is app design that

reduces FOMO by batching interruptive smartphone notifications.[109] We hope that advances in methodological design will further our understanding of FOMO and its relationship with relevant psychological variables.

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JDE receives royalties for several books published on post-traumatic stress disorder (PTSD); occasionally serves as a paid, expert witness on PTSD legal cases. CM has performed grant reviews for several agencies; has edited journal sections and articles; has given academic lectures in clinical or scientific venues or companies; has generated books or book chapters for publishers of mental health texts (for some of these activities he received royalties, but never from the gaming or social media industry); is part of a discussion circle (Digitalität und Verantwortung: https://about.fb.com/de/news/h/gespraechskreis-digitalitaet-und-verantwortung/) debating ethical questions linked to social media, digitalization and society/democracy at Facebook (no salary); and is currently on the scientific advisory board of the Nymphenburg Group (nymphenburg.de; for this activity he is financially compensated). The other author reports no conflicts of interest.

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