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# Deconstructing the components model of addiction: an illustration through "addictive" use of social media

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ABSTRACT

The components model of addiction posits that all addictions share six components, namely salience, tolerance, mood modification, relapse, withdrawal, and conflict. This highly influential model has resulted in the development of numerous psychometric instruments that measure addictive behaviors according to these criteria. However, recent research suggests that, in the context of behavioral addictions, certain components constitute peripheral features that do not distinguish non-pathological from pathological behavior. Using "addictive" use of social media as a representative example, we examined this perspective by testing whether these six components actually assess central features of addiction, or whether some of them constitute peripheral features that are not indicative of a disorder.

Four independent samples totaling 4,256 participants from the general population completed the Bergen Social Media Addiction Scale, a six-item psychometric instrument derived from the components model of addiction to assess social media "addiction". By performing structural equation modeling and network analyses, we showed that the six components did not form a unitary construct and, crucially, that some components (i.e., salience, tolerance) were not associated with measures assessing psychopathological symptoms.

Taken together, these results suggest that psychometric instruments based on the components model conflate central and peripheral features of addiction when applied to behavioral addictions. This implies that such instruments pathologize involvement in appetitive behaviors. Our findings thus call for renewing the conceptualization and assessment of behavioral addictions.

## 1. Introduction

Over the past two decades, the research field of behavioral addictions has received increasing interest, accompanied by a flourishing number of scientific publications. Contributing to this efflorescence has been the inclusion of gambling disorder as an addictive disorder aligned to substance use disorders in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2013).

In parallel, researchers have conceptualized a wide range of behaviors as potential new addictions, many of which are part of daily life, such as working (Andreassen, Griffiths et al., 2012), using social media (Andreassen et al., 2016), shopping (Andreassen et al., 2015), being in love (Costa et al., 2021), having sex (Andreassen, Pallesen, Griffiths, et al., 2018), or tanning (Andreassen, Pallesen, Torsheim, et al., 2018).

At the root of the burgeoning proliferation of these "behavioral addictions" lies the so-called "confirmatory approach" to behavioral addictions (Billieux, Schimmenti, et al., 2015; Flayelle et al., 2022). The

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confirmatory approach refers to the process in which elevated involvement in appetitive behaviors is *a priori* conceptualized as an addictive disorder. Subsequently, psychometric instruments are developed to assess and diagnose these behavioral addictions by transposing substance addiction criteria. This has led to an abundance of diagnosable and diagnosed psychopathological conditions, despite their dubious theoretical and clinical relevance, ultimately resulting in pathologizing involvement in a large range of behaviors (Billieux, Maurage, et al., 2015; Billieux, Schimmenti, et al., 2015; Kardefelt-Winther et al., 2017; Mihordin, 2012; Ryan et al., 2014; Satchell et al., 2021; Starcevic et al., 2018).

Many of these newly proposed behavioral addictions, along with their respective psychometric instruments, are derived from the components model of addiction operationalized by Griffiths (2005). This model, which was adapted from the components model of substance addiction proposed by Brown (1993), postulates that all addictions – both substance-related and non-substance-related – display six core components: (1) *salience* (cognition, affect, and conation focusing on carrying out the behavior), (2) *tolerance* (increasing involvement in the behavior to maintain a comparable experience), (3) *mood modification* (involvement in the behavior to achieve a desired affective state), (4) *relapse* (resumption of involvement in the behavior following an attempt to reduce or discontinue it), (5) *withdrawal* (aversive psychological and/or physiological experience when discontinuing involvement in the behavior), and (6) *conflict* (intrapersonal and interpersonal conflict stemming from involvement in the behavior).

In recent years, several authors have criticized the use of substance addiction criteria to operationalize and assess behavioral addictions (Billieux, Schimmenti, et al., 2015; Flayelle et al., 2022; Starcevic, 2016a), arguing that some of these criteria (e.g., salience, tolerance) are not necessarily valid in the context of non-substance-related addictions. It has even been claimed that borrowing substance addiction criteria such as tolerance and withdrawal may have been driven by a need to "legitimize" behavioral addictions (Starcevic, 2016b).

For example, Charlton and Danforth (2007) challenged the structural validity of the six-component model in the context of online video gaming. By performing exploratory factor analyses on questionnaire items tapping the six components of addiction proposed by Brown (1993), they highlighted the existence of two factors which they labeled "engagement" (consisting of peripheral components that do not distinguish non-pathological from pathological behavior, namely salience, tolerance, and euphoria[1]) and "addiction" (consisting of central components, namely relapse, withdrawal, and conflict). This seminal work thus questioned the validity of recycling all substance addiction criteria to conceptualize and assess behavioral addictions. Following the work of Charlton and Danforth (2007), several studies have shown that elevated involvement in various appetitive behaviors is not necessarily pathological or indicative of an "addiction" (e.g., Calvo et al., 2018; Flayelle et al., 2019; Kraus et al., 2018; Whelan et al., 2021).

Consistent with the abovementioned evidence, it is critical to further test whether widely used psychometric instruments derived from the six-component model (e.g., Andreassen et al., 2012, 2015, 2016; Andreassen, Pallesen, Griffiths, et al., 2018; Andreassen, Pallesen, Torsheim, et al., 2018; Costa et al., 2021) are valid for assessing potential behavioral addictions. In the present study, we therefore probed the psychometric validity of the six-component model in the context of "addictive" social media use.

The notion of social media "addiction" has emerged alongside the growing popularity of social media and the increasing number of social media users (Brand et al., 2022). Yet, much research in this field relied on the confirmatory approach described above, conceptualizing elevated involvement in social media use in relation to addiction-like features and developing psychometric instruments to assess the latter features (Cataldo et al., 2022; Sun & Zhang, 2021). Although there is still no consensus on the conceptualization of social media use as a behavioral addiction, some consider it a *bona fide* addictive disorder that fulfills the category of other specified disorders due to addictive behaviors in the eleventh edition of the International Classification of Diseases (World Health Organization, 2019) despite major concerns about the subsequent potential pathologizing of social media use (Brand et al., 2022; Moretta et al., 2022). In the present study, we decided to focus on the six-item Bergen Social Media Addiction Scale (Andreassen et al., 2016), as it is one of the most influential psychometric instruments derived from the six-component model, and as it remains, to date, the most popular and cited psychometric instrument in screening for social media "addiction" (Cataldo et al., 2022).

This study adopts a multiverse methodological approach (Steegen et al., 2016) comprising two different psychometric frameworks: (1) structural equation modeling analysis, in which psychopathological disorders are represented by latent entities reflected by their symptoms, and (2) network analysis, in which psychopathological disorders are represented by the complex interrelationships among their symptoms (Borsboom & Cramer, 2013).

Thus, by performing structural equation modeling and network analyses within these six components in the context of "addictive" use of social media, we first aimed to determine whether the components cohered into a unitary construct (as postulated by the components model and assessed by psychometric instruments derived from this model) or emerged as multiple distinct constructs (combining, for example, central and peripheral components, consistent with Charlton and Danforth (2007)). Then, by performing network analysis within these components and a wide array of psychopathological symptoms, we also aimed to determine whether all components were associated with psychopathological symptoms – that is, whether all components were actually valid indicators of a disorder – or whether some of them were not.

## 2. Methods

### 2.1. Participants and procedure

The total sample consisted of an aggregation of four independent databases comprising participants recruited for previous research projects, all of which have received ethical clearance from local ethics committees and some of which have led, to date, to peer-reviewed journal articles (i.e., Boursier, Gioia, & Griffiths, 2020; Boursier, Gioia, Musetti, et al., 2020; Costanzo et al., 2021; Mariani et al., 2021). All participants were based in Italy and Italian-speaking. Their participation consisted in completing online self-administered psychometric instruments, five of which were included in the present study. All participants provided informed consent prior to participation and no compensation was provided.

The aggregated sample included 4,256 participants from the general population. The age of the participants ranged between 13 and 78 years ($M = 28.012$; $SD = 11.321$), with 64.145% being males, 35.597% females, and 0.258% others. All 4,256 participants completed the 6-item Bergen Social Media Addiction Scale (Andreassen et al., 2016). The aggregated sample was divided into four subsamples based on the co-completion of online self-administered psychometric instruments. Among the 4,256 participants who completed the 6-item Bergen Social Media Addiction Scale, 2,572 participants (60.432%) also completed the 23-item Adult DSM-5 Self-Rated Level 1 Cross-Cutting Symptom

[1] In Griffiths' (2005) adaptation of Brown's (1993) six-component model, the original "euphoria" component was adapted into a "mood modification" component based on the assumption that addictive behaviors are performed to regulate both positive and negative affective states. Importantly, most psychometric instruments based on the components model specifically assess the regulation of negative affective states (e.g., "How often during the last year have you used social media to forget about personal problems?"; Andreassen et al., 2016).

Measure (Narrow et al., 2013), 715 (16.800%) also completed the 21-item Depression, Anxiety and Stress Scales (Lovibond & Lovibond, 1995), 578 (13.581%) also completed the 16-item Social Appearance Anxiety Scale (Hart et al., 2008), and 221 (5.193%) also completed the 90-item Symptom Checklist-90-Revised (Derogatis, 1994). All reported sample sizes and sociodemographic information were obtained after listwise deletion of missing data. Sociodemographic information for the aggregated sample and its four subsamples is shown in Table 1.

Detailed information regarding the data and the data itself are available from the Open Science Framework (https://osf.io/d39fa/).

### 2.2. Materials

Detailed information regarding the materials and the materials themselves are available from the Open Science Framework (https://osf.io/d39fa/).

#### 2.2.1. 6-item Bergen Social Media Addiction Scale

The Bergen Social Media Addiction Scale (original English version by Andreassen et al., 2016; Italian version by Monacis et al., 2017) is a 6-item self-administered psychometric instrument which was adapted from the Bergen Facebook Addiction Scale (Andreassen, Torsheim, et al., 2012) by replacing in its items the word "Facebook" with "social media". This instrument assesses the applicability of statements related to the six different components of addiction proposed by Griffiths (2005) (i.e., salience, tolerance, mood modification, relapse, withdrawal, and conflict) over the past year. Items are scored on a five-point Likert scale (from 1 = "Very rarely" to 5 = "Very often"). In the present study, internal consistency of the instrument's global score was good (Cronbach's alpha = 0.829).

#### 2.2.2. 23-item Adult DSM-5 Self-Rated Level 1 Cross-Cutting Symptom Measure

The Adult DSM-5 Self-Rated Level 1 Cross-Cutting Symptom Measure (original English version by Narrow et al., 2013; Italian version by Fossati et al., 2015) is a 23-item self-administered psychometric instrument. This instrument assesses the applicability of statements related to thirteen different psychopathological symptoms (i.e., depression, anger, mania, anxiety, somatic distress, suicidal ideation, psychotic experiences, sleep problems, memory problems, repetitive thoughts and behaviors, dissociative experiences, maladaptive personality functioning, and problematic substance use) over the past two weeks. Items are scored on a five-point Likert scale (from 0 = "Not at all" to 4 = "Nearly every day"). In the present study, internal consistency of the instrument's psychopathological symptoms' scores (except for the single-item psychopathological symptoms' scores) ranged from Cronbach's alpha = 0.738 to Cronbach's alpha = 0.809. The psychopathological symptoms' score of mania was omitted from subsequent analyses as its internal consistency was poor (Cronbach's alpha = 0.489).

#### 2.2.3. 21-item Depression, Anxiety and Stress Scales

The Depression, Anxiety and Stress Scales (original English version by Lovibond & Lovibond, 1995; Italian version by Bottesi et al., 2015) is a 21-item self-administered psychometric instrument. This instrument assesses the applicability of statements related to three different psychopathological symptoms (i.e., stress, anxiety, and depression) over the past week. Items are scored on a four-point Likert scale (from 0 = "Did not apply to me at all" to 3 = "Applied to me very much or most of the time"). In the present study, internal consistency of the instrument's psychopathological symptoms' scores ranged from Cronbach's alpha = 0.906 to Cronbach's alpha = 0.928.

#### 2.2.4. 16-item Social Appearance Anxiety Scale

The Social Appearance Anxiety Scale (original English version by Hart et al., 2008; Italian version by Dakanalis et al., 2016) is a 16-item self-administered psychometric instrument. This instrument assesses the applicability of statements related to social appearance anxiety (i.e., anxiety about overall appearance being negatively evaluated by others). Items are scored on a five-point Likert scale (from 1 = "Not at all" to 5 = "Extremely"). In the present study, internal consistency of the instrument's global score was excellent (Cronbach's alpha = 0.956).

#### 2.2.5. 90-item Symptom Checklist-90-Revised

The Symptom Checklist-90-Revised (original English version by Derogatis, 1994; Italian version by Prunas et al., 2012) is a 90-item self-administered psychometric instrument. This instrument assesses the applicability of statements related to nine different psychopathological symptoms (i.e., somatization, obsessive–compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism) over the past two weeks. Items are scored on a five-point Likert scale (from 0 = "Not at all" to 4 = "Nearly every day"). In the present study, internal consistency of the instrument's psychopathological symptoms' scores ranged from Cronbach's alpha = 0.858 to Cronbach's alpha = 0.922.

### 2.3. Data analytic plan

All analyses were performed using *R* version 4.2.1 (R Core Team, 2022).

The factorial structure of the 6-item Bergen Social Media Addiction Scale was analyzed after randomly splitting the aggregated sample of 4,256 participants into two independent subsamples of 2,128 participants each. Using the first subsample of 2,128 participants, exploratory analyses were performed within the frameworks of structural equation modeling analysis (i.e., exploratory factor analyses) and network analysis (i.e., exploratory graph analyses) to test unidimensional and bidimensional solutions. Using the second subsample of 2,128 participants, confirmatory analyses were performed within the framework of structural equation modeling analysis (i.e., confirmatory factor analyses) to test data-driven and theory-driven models. The associations between the 6-item Bergen Social Media Addiction Scale and the four available self-

**Table 1**
**Sociodemographic information.**

| (SUB-)SAMPLE | | AGE | | | GENDER | | |
|---|---|---|---|---|---|---|---|
| MATERIALS | *N / n* | *M* | *SD* | RANGE | MALE (%) | FEMALE (%) | OTHERS (%) |
| **BSMAS** | 4,256 | 28.012 | 11.321 | 13–78 | 64.145 | 35.597 | 0.258 |
| **BSMAS & CCSM** | 2,572 | 29.190 | 10.799 | 15–78 | 61.470 | 38.142 | 0.389 |
| **BSMAS & DASS** | 715 | 31.701 | 10.815 | 18–72 | 71.469 | 28.531 | N.D. |
| **BSMAS & SAAS** | 578 | 16.102 | 1.514 | 13–21 | 62.457 | 37.543 | N.D. |
| **BSMAS & SCL** | 221 | 30.629 | 12.511 | 18–66 | 66.516 | 33.484 | N.D. |

BSMAS = 6-item Bergen Social Media Addiction Scale (Andreassen et al., 2016); CCSM = 23-item Adult DSM-5 Self-Rated Level 1 Cross-Cutting Symptom Measure (Narrow et al., 2013); DASS = 21-item Depression, Anxiety and Stress Scales (Lovibond & Lovibond, 1995); SAAS = 16-item Social Appearance Anxiety Scale (Hart et al., 2008); SCL = 90-item Symptom Checklist-90-Revised (Derogatis, 1994). All reported (sub-)sample sizes and sociodemographic information were obtained after listwise deletion of missing data. N.D. indicates that the variable of interest was not recorded during data collection.

administered psychometric instruments measuring psychopathological symptoms were analyzed using each of the four subsamples of 2,572, 715, 578, and 221 participants, respectively, within the framework of network analysis.

Detailed information regarding the analyses – along with zero-order correlation analyses as supplementary material – and the code itself are available from the Open Science Framework (https://osf.io/d39fa/).

#### 2.3.1. Structural equation modeling analysis

The framework of structural equation modeling analysis was called upon to analyze the factorial structure of the 6-item Bergen Social Media Addiction Scale. Structural equation modeling analyses were computed using the *R* packages *lavaan* version 0.6–12 (Rosseel et al., 2022) and *semPlot* version 1.1.6 (Epskamp, Stuber, et al., 2022).

To fit the structural equation models, oblimin oblique rotation methods (Schmitt & Sass, 2011) and weighted least squares mean and variance adjusted robust estimation methods (Flora & Curran, 2004) were employed.

To assess the quality of the structural equation models' adjustment to the data, four conventional model fit indices were employed (Hu & Bentler, 1999): the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). Good fit was determined by a CFI $\geq$ 0.950, a TLI $\geq$ 0.950, an RMSEA $\leq$ 0.050, and an SRMR $\leq$ 0.050, while acceptable fit was determined by a CFI $\geq$ 0.900, a TLI $\geq$ 0.900, an RMSEA $\leq$ 0.080, and an SRMR $\leq$ 0.100 (Kline, 2016).

#### 2.3.2. Network analysis

The framework of network analysis was called upon to analyze the factorial structure of the 6-item Bergen Social Media Addiction Scale and to examine its associations with the four available self-administered psychometric instruments measuring psychopathological symptoms. Network analyses were computed using the *R* packages *bootnet* version 1.5 (Epskamp & Fried, 2021), *glasso* version 1.11 (Friedman & Tibshirani, 2019), *huge* version 1.3.5 (Jiang et al., 2021), *igraph* version 1.3.4 (Nepusz et al., 2022), *networktools* version 1.5.0 (Jones, 2022), and *qgraph* version 1.9.2 (Epskamp, Costantini, et al., 2022).

In the network perspective, variables of interest are represented by nodes, and their pairwise relationships are represented by edges (Epskamp et al., 2018). Three statistical advantages of modeling (unregularized) partial correlation networks were of major interest in the present study: (1) each edge controls for the spurious influence of other nodes included in the model (Epskamp & Fried, 2018), (2) false positive edges are likely to be excluded from the model (Isvoranu & Epskamp, 2021), and (3) community detection algorithms can be used to evaluate the dimensional structure within the model (Golino & Epskamp, 2017).

To fit the network models, partial correlation networks (i.e., Gaussian Graphical Models) were employed. They are composed of nodes, which represent variables of interest, and of edges, which represent partial correlations between pairs of variables (Epskamp et al., 2018). Beforehand, the Hittner method (Hittner et al., 2003) was implemented to check whether some pairs of variables were highly collinear and thus needed to be combined through principal component analysis. As all variable scores were non-normally distributed, non-paranormal transformation was applied prior to estimating the networks to relax the assumption of normality (Liu et al., 2009). Stepwise generation of unregularized Gaussian Graphical Models using the ggmModSelect algorithm (Isvoranu & Epskamp, 2021) was conducted to select the optimal model based on the Bayesian Information Criterion (Foygel & Drton, 2010) by iteratively adding and removing edges. The walktrap community detection algorithm (Pons & Latapy, 2005) was implemented to estimate dimensionality in exploratory graph analyses (Golino & Epskamp, 2017).

To assess the stability of the network models' estimated parameters, 1,000 case-dropping subset bootstrapped samples per Gaussian Graphical Model were estimated to yield CS-coefficients (Epskamp et al., 2018). To assess the accuracy of the network models' estimated parameters, 1,000 non-parametrically bootstrapped samples per Gaussian Graphical Model were estimated to yield 95% non-parametrically bootstrapped confidence intervals (Epskamp et al., 2018). Network stability and accuracy analyses are available as supplementary material from the Open Science Framework (https://osf.io/d39fa/).

## 3. Results

### 3.1. Factorial structure of the 6-item Bergen Social Media Addiction Scale

Exploratory factor analyses and exploratory graph analyses conducted on the item scores of the 6-item Bergen Social Media Addiction Scale both yielded identical unidimensional and bidimensional configurations shown in Fig. 1.

The first exploratory model described a unidimensional construct of "addictive" social media use comprising the six components of addiction proposed by Griffiths (2005) (i.e., salience, tolerance, mood modification, relapse, withdrawal, and conflict; see Fig. 1, models A and B).

The second exploratory model described a bidimensional construct of "addictive" social media use, with one dimension comprising the two components of salience and tolerance, and one dimension comprising the four components of mood modification, relapse, withdrawal, and conflict (see Fig. 1, models C and D).

Confirmatory factor analyses conducted on three different data-driven and theory-driven models of the 6-item Bergen Social Media Addiction Scale yielded the fit indices shown in Table 2 and the configurations shown in Fig. 2.

The first confirmatory model described a unidimensional construct of "addictive" social media use comprising the six components of addiction proposed by Griffiths (2005) (i.e., salience, tolerance, mood modification, relapse, withdrawal, and conflict; see Fig. 2, model A). The model's root mean square error of approximation (RMSEA = 0.137) showed a poor adjustment to the data (see Table 2, model A).

The second confirmatory model described a bidimensional construct of "addictive" social media use derived from the distinction of Charlton and Danforth (2007) between central and peripheral criteria in behavioral addiction. The model described one dimension comprising the peripheral components of salience, tolerance, and mood modification, and one dimension comprising the central components of relapse, withdrawal, and conflict (see Fig. 2, model B). The model's root mean square error of approximation (RMSEA = 0.104) showed a poor adjustment to the data (see Table 2, model B).

The third confirmatory model described a bidimensional construct of "addictive" social media use derived from the exploratory factor and graph analyses, with one dimension comprising the two components of tolerance and salience, and one dimension comprising the four components of mood modification, relapse, withdrawal, and conflict (see Fig. 2, model C). The model's mean and variance adjusted robust model fit indices showed a good to excellent adjustment to the data (see Table 2, model C). The internal consistency for the model's dimension scores corresponded to McDonald's omega = 0.764 for the first dimension and to McDonald's omega = 0.722 for the second dimension.

### 3.2. Associations between the 6-item Bergen Social Media Addiction Scale and psychopathological symptoms

Network analyses conducted on the four subsamples yielded the four partial correlation networks shown in Fig. 3.

In the four yielded Gaussian Graphical Models, the factor score of the 6-item Bergen Social Media Addiction Scale comprising the two components of salience and tolerance showed no association (i.e., null edges) with any of the psychopathological symptoms' scores included in the present study (see Fig. 3, models A, B, C, and D). In contrast, the factor score of the 6-item Bergen Social Media Addiction Scale

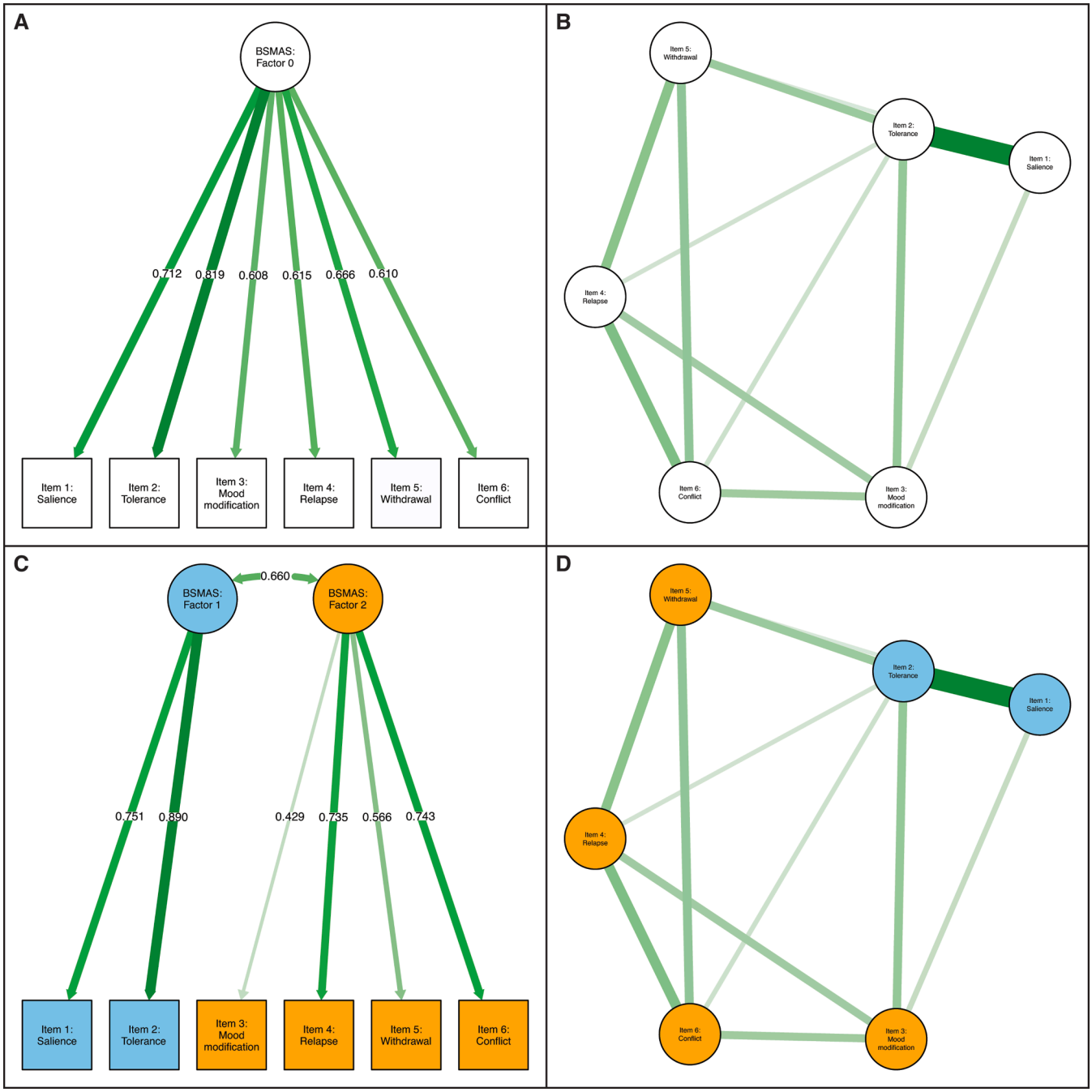


**Fig. 1. Exploratory factorial structure analyses' models of the 6-item Bergen Social Media Addiction Scale.** $n = 2{,}128$. BSMAS = 6-item Bergen Social Media Addiction Scale (Andreassen et al., 2016); A = Unidimensional exploratory factor analyses; B = Unidimensional exploratory graph analyses; C = Bidimensional exploratory factor analyses; D = Bidimensional exploratory graph analyses. In exploratory factor analyses, circles denote latent variables (i.e., factors), while squares denote manifest variables (i.e., items). In exploratory graph analyses, circles denote manifest variables (i.e., items). In exploratory factor analyses, green double-headed arrows indicate positive zero-order inter-factor correlations, while green single-headed arrows indicate positive factor loadings. In exploratory graph analyses, green edges indicate positive partial inter-item correlations. Arrow and edge thickness represents the magnitude of relationships between objects. White-colored shapes reflect "BSMAS: Factor 0" in the unidimensional factorial structure of the construct of interest. Sky blue-colored shapes reflect "BSMAS: Factor 1" and orange-colored shapes reflect "BSMAS: Factor 2" in the bidimensional factorial structure of the construct of interest.

comprising the four components of mood modification, relapse, withdrawal, and conflict showed positive associations (i.e., positive edges) with twelve of the psychopathological symptoms' scores included in the present study (see Fig. 3, models A, B, C, and D).

## 4. Discussion

While behavioral addictions have received increasing interest over the past two decades, there is growing evidence that many criteria sets involved in their operationalization fail to distinguish non-pathological from pathological behavior adequately. Therefore, the present psychometric study aimed to test, using "addictive" social media use as a representative example, whether the six-component model of addiction essentially assesses central features of addiction or whether it conflates central and peripheral features of addiction. To this end, the present study adopted a multiverse methodological approach relying on

**Table 2**
**Confirmatory factorial structure analyses' models of the 6-item Bergen Social Media Addiction Scale.**

| MODEL | $\chi^2$ | *df* | *p* | CFI | TLI | RMSEA | SRMR |
|---|---|---|---|---|---|---|---|
| **A** | 370.064 | 9 | < 0.001 | 0.945 | 0.909 | 0.137 | 0.062 |
| **B** | 193.525 | 8 | < 0.001 | 0.972 | 0.947 | 0.104 | 0.044 |
| **C** | 98.729 | 8 | < 0.001 | 0.986 | 0.974 | 0.073 | 0.033 |

$n$ = 2,128. CFI = Comparative fit index; TLI = Tucker-Lewis index; RMSEA = Root mean square error of approximation; SRMR = Standardized root mean square residual; A = Confirmatory factor analyses' unidimensional model with one dimension comprising the six components of addiction (Griffiths, 2005) of salience, tolerance, mood modification, relapse, withdrawal, and conflict of the 6-item Bergen Social Media Addiction Scale (Andreassen et al., 2016); B = Confirmatory factor analyses' theory-driven bidimensional model with one dimension comprising the three components of addiction (Griffiths, 2005) of salience, tolerance, and mood modification of the 6-item Bergen Social Media Addiction Scale (Andreassen et al., 2016), and another dimension comprising the three components of addiction (Griffiths, 2005) of relapse, withdrawal, and conflict of the 6-item Bergen Social Media Addiction Scale (Andreassen et al., 2016); C = Confirmatory factor analyses' data-driven bidimensional model with one dimension comprising the two components of addiction (Griffiths, 2005) of salience and tolerance of the 6-item Bergen Social Media Addiction Scale (Andreassen et al., 2016), and another dimension comprising the four components of addiction (Griffiths, 2005) of mood modification, relapse, withdrawal, and conflict of the 6-item Bergen Social Media Addiction Scale (Andreassen et al., 2016). All reported statistics are mean and variance adjusted robust model fit indices.

structural equation modeling and network analyses.

Our results showed that the six components of addiction – as measured by the six-item Bergen Social Media Addiction Scale – did not cohere into a unitary construct, but rather into a bidimensional construct. Furthermore, the first identified dimension – comprising the two components of tolerance and salience – showed no association with any measures of psychopathological symptoms included in the present study. In contrast, the second dimension – comprising the four components of mood modification, relapse, withdrawal, and conflict – was positively associated with several measures of psychopathological symptoms included in the present study.

Our findings yield important implications concerning the conceptualization and assessment of behavioral addictions. By including criteria reflecting peripheral features – such as the components of salience or tolerance – yet assumed to be indicators of addictive disorders *stricto sensu*, screening for behavioral addictions according to the components model leads to pathologizing involvement in appetitive behaviors. This is crucial as a growing body of research argues that the components model fails to distinguish non-pathological from pathological behavior, for example in the context of video gaming (Billieux et al., 2019) or physical exercise (Brevers et al., 2022). Overall, the findings of the present study confirm such claims through a data-driven multiverse psychometric approach.

In contrast to the findings of the seminal work of Charlton and Danforth (2007) in the context of "addictive" video gaming, however, our results in the context of "addictive" social media use did not support that the component of mood modification constitutes a peripheral criterion. This nuance is likely to be accounted for by Griffiths' (2005) adaptation of Brown's (1993) original "euphoria" component into a "mood modification" component based on the assumption that addictive behaviors are performed to regulate both positive and negative affective states. In fact, Charlton and Danforth (2007) adopted the original "euphoria" component for their psychometric instrument, hence tapping a positive affective state (i.e., "I often experience a buzz of excitement while playing"). Conversely, the 6-item Bergen Social Media Addiction Scale is tapping a negative affective state (i.e., "How often during the last year have you used social media to forget about personal problems?") that may primarily capture compensatory social media use in response to negative life events or affective states (Kardefelt-Winther, 2014). It is thus likely that, in individuals endorsing the latter item, social media use reflects a maladaptive coping strategy or is symptomatic of underlying issues rather than an "addiction" to social media (Kardefelt-Winther et al., 2017). Furthermore, from a psychometric point of view, assessing the component of mood modification with a single item only tapping a negative affective state implies incomplete construct coverage – since the component of mood modification regards both positive and negative affective states – and therefore low content validity.

The present study contains limitations that ought to be acknowledged. First, within the framework of network analysis, sampling variability poses a challenge of reproducibility. To address the latter, we assessed both the stability and the accuracy of the estimated network models' parameters (Borsboom et al., 2021; McNally, 2021). Second,

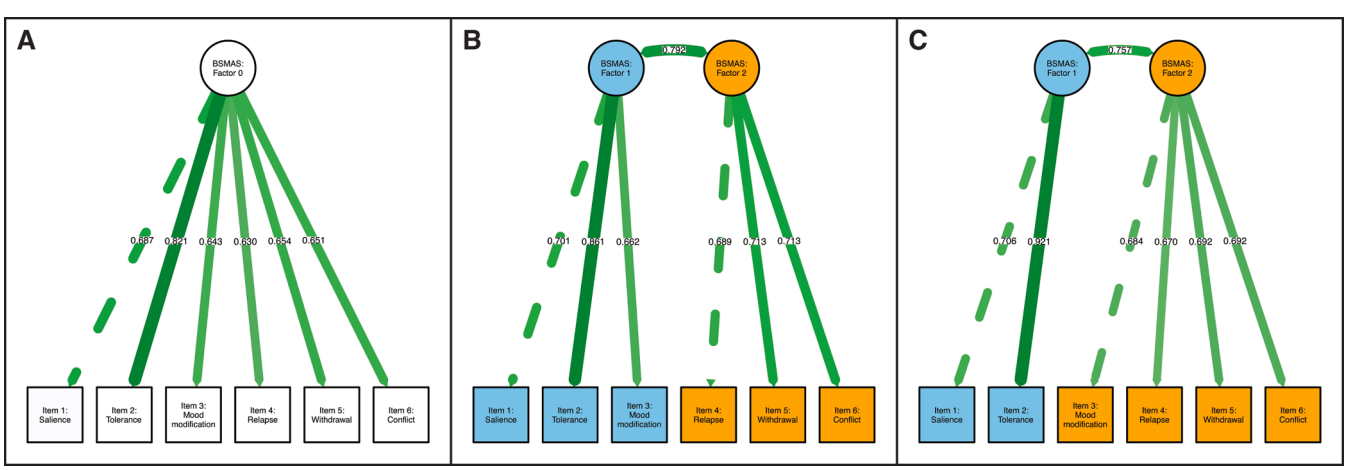


**Fig. 2. Confirmatory factorial structure analyses' models of the 6-item Bergen Social Media Addiction Scale.** $n$ = 2,128. BSMAS = 6-item Bergen Social Media Addiction Scale (Andreassen et al., 2016); A = Confirmatory factor analyses' unidimensional model; B = Confirmatory factor analyses' theory-driven bidimensional model; C = Confirmatory factor analyses' data-driven bidimensional model. In confirmatory factor analyses, circles denote latent variables (i.e., factors), while squares denote manifest variables (i.e., items). In confirmatory factor analyses, green double-headed arrows indicate positive zero-order inter-factor correlations, while green single-headed arrows indicate positive factor loadings. In confirmatory factor analyses, green single-headed dashed arrows indicate positive factor loadings which were standardized to one as a constraint. Arrow thickness represents the magnitude of relationships between objects. White-colored shapes reflect "BSMAS: Factor 0" in the unidimensional factorial structure of the construct of interest. Sky blue-colored shapes reflect "BSMAS: Factor 1" and orange-colored shapes reflect "BSMAS: Factor 2" in the data-driven and theory-driven bidimensional factorial structure of the construct of interest.

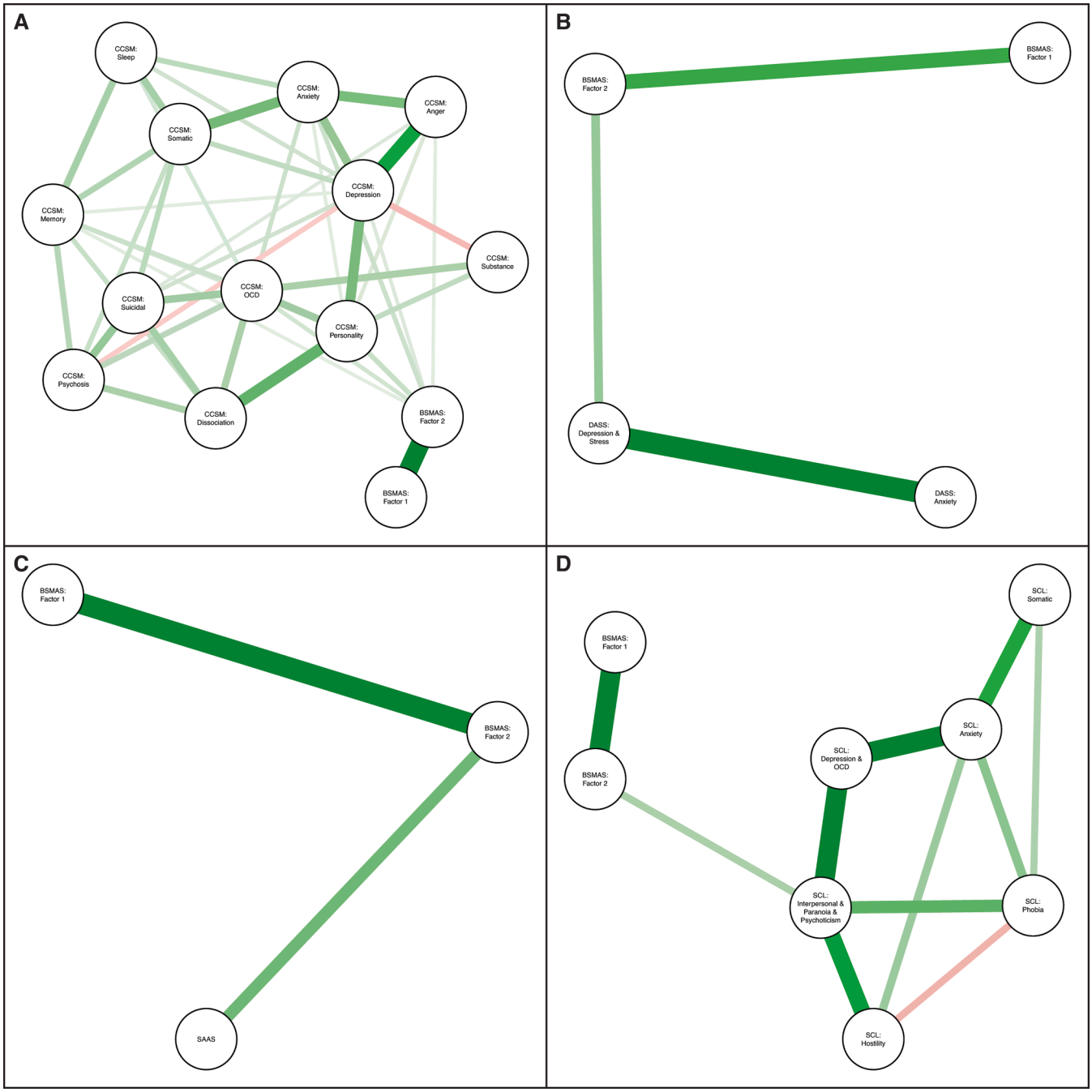


**Fig. 3. Associations between the 6-item Bergen Social Media Addiction Scale and psychopathological symptoms.** BSMAS = 6-item Bergen Social Media Addiction Scale (Andreassen et al., 2016); CCSM = 23-item Adult DSM-5 Self-Rated Level 1 Cross-Cutting Symptom Measure (Narrow et al., 2013); DASS = 21-item Depression, Anxiety and Stress Scales (Lovibond & Lovibond, 1995); SAAS = 16-item Social Appearance Anxiety Scale (Hart et al., 2008); SCL = 90-item Symptom Checklist-90-Revised (Derogatis, 1994); BSMAS: Factor 1 = Factor score comprising the two components of addiction (Griffiths, 2005) of salience and tolerance of the 6-item Bergen Social Media Addiction Scale (Andreassen et al., 2016); BSMAS: Factor 2 = Factor score comprising the four components of addiction (Griffiths, 2005) of mood modification, relapse, withdrawal, and conflict of the 6-item Bergen Social Media Addiction Scale (Andreassen et al., 2016); A = BSMAS & CCSM network analyses ($n$ = 2,572); B = BSMAS & DASS network analyses ($n$ = 715); C = BSMAS & SAAS network analyses ($n$ = 578); D = BSMAS & SCL network analyses ($n$ = 221). Circles denote factors or psychopathological symptoms. Green edges indicate positive partial inter-factor or inter-psychopathological symptoms' scores correlations, while red edges indicate negative partial inter-factor or inter-psychopathological symptoms' scores correlations. Edge thickness represents the magnitude of relationships between objects. All reported (sub-)sample sizes and zero-order correlation coefficients were obtained after listwise deletion of missing data.

still within the framework of network analysis, variables are treated as observed variables, which does not account for measurement error. To address the latter, we combined information from multiple indicators per node by examining factor scores (rather than item scores) to substantially improve the reliability and performance of the estimated network models (Borsboom et al., 2021; de Ron et al., 2022). Moreover, to address both aforementioned challenges in the factorial structure analyses, we adopted a multiverse methodological approach relying on structural equation modeling and network analyses to reinforce the robustness of our results. Third, we aggregated four independent databases comprising participants who were recruited in the context of different previous research projects. Yet, we do not consider this a

critical limitation, as this approach has allowed us to take advantage of a large sample size. Fourth, due to high collinearity, some psychopathological symptoms' scores had to be combined through principal component analysis before performing the network analyses to preserve the overall accuracy of our results.

Taken together, the results of the present study support the notion that psychometric instruments based on the components model conflate central and peripheral features of addiction when applied to behavioral addictions. Our results substantiate several previous claims that, due to an over-reliance on the "confirmatory approach", many psychometric instruments assessing "behavioral addictions" were developed on questionable theoretical and methodological grounds and led to pathologizing involvement in various appetitive behaviors (Aarseth et al., 2017; Billieux, Schimmenti, et al., 2015; Satchell et al., 2021; van Rooij et al., 2018). Critically, such an approach risks increasing false positives and inflating prevalence rates, misusing clinical diagnoses and treatments, and stigmatizing individuals with non-pathological involvement in appetitive behaviors (Flayelle et al., 2022). The findings of the present study further emphasize the necessity to renew the conceptualization and assessment of behavioral addictions.

## CRediT authorship contribution statement

**Loïs Fournier:** Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Writing – original draft, Visualization, Project administration. **Adriano Schimmenti:** Investigation, Resources, Writing – review & editing. **Alessandro Musetti:** Investigation, Resources, Writing – review & editing. **Valentina Boursier:** Investigation, Resources, Writing – review & editing. **Maèva Flayelle:** Writing – review & editing. **Ilaria Cataldo:** Writing – review & editing. **Vladan Starcevic:** Writing – review & editing. **Joël Billieux:** Conceptualization, Methodology, Writing – original draft, Supervision, Project administration.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

All analyses, code, data, and materials are available from the Open Science Framework (https://osf.io/d39fa/).

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## References

Aarseth, E., Bean, A. M., Boonen, H., Colder Carras, M., Coulson, M., Das, D., et al. (2017). Scholars' open debate paper on the World Health Organization ICD-11 Gaming Disorder proposal. *Journal of Behavioral Addictions, 6*(3), 267–270. https://doi.org/10.1556/2006.5.2016.088

American Psychiatric Association. (2013). Diagnostic and Statistical Manual of Mental Disorders. *American Psychiatric Association*. https://doi.org/10.1176/appi.books.9780890425596

Andreassen, C. S., Billieux, J., Griffiths, M. D., Kuss, D. J., Demetrovics, Z., Mazzoni, E., et al. (2016). The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: A large-scale cross-sectional study. *Psychology of Addictive Behaviors, 30*(2), 252–262. https://doi.org/10.1037/adb0000160

Andreassen, C. S., Griffiths, M. D., Hetland, J., & Pallesen, S. (2012). Development of a work addiction scale: Development of a work addiction scale. *Scandinavian Journal of Psychology, 53*(3), 265–272. https://doi.org/10.1111/j.1467-9450.2012.00947.x

Andreassen, C. S., Griffiths, M. D., Pallesen, S., Bilder, R. M., Torsheim, T., & Aboujaoude, E. (2015). The Bergen Shopping Addiction Scale: Reliability and validity of a brief screening test. *Frontiers in Psychology, 6*. https://doi.org/10.3389/fpsyg.2015.01374

Andreassen, C. S., Pallesen, S., Griffiths, M. D., Torsheim, T., & Sinha, R. (2018). The Development and Validation of the Bergen-Yale Sex Addiction Scale with a Large National Sample. *Frontiers in Psychology, 9*, 144. https://doi.org/10.3389/fpsyg.2018.00144

Andreassen, C. S., Pallesen, S., Torsheim, T., Demetrovics, Z., & Griffiths, M. D. (2018). Tanning addiction: Conceptualization, assessment and correlates. *British Journal of Dermatology*. https://doi.org/10.1111/bjd.16480

Andreassen, C. S., Torsheim, T., Brunborg, G. S., & Pallesen, S. (2012). Development of a Facebook Addiction Scale. *Psychological Reports, 110*(2), 501–517. https://doi.org/10.2466/02.09.18.PR0.110.2.501-517

Billieux, J., Flayelle, M., Rumpf, H.-J., & Stein, D. J. (2019). High Involvement Versus Pathological Involvement in Video Games: A Crucial Distinction for Ensuring the Validity and Utility of Gaming Disorder. *Current Addiction Reports, 6*(3), 323–330. https://doi.org/10.1007/s40429-019-00259-x

Billieux, J., Maurage, P., Lopez-Fernandez, O., Kuss, D. J., & Griffiths, M. D. (2015). Can Disordered Mobile Phone Use Be Considered a Behavioral Addiction? An Update on Current Evidence and a Comprehensive Model for Future Research. *Current Addiction Reports, 2*(2), 156–162. https://doi.org/10.1007/s40429-015-0054-y

Billieux, J., Schimmenti, A., Khazaal, Y., Maurage, P., & Heeren, A. (2015). Are we overpathologizing everyday life? A tenable blueprint for behavioral addiction research. *Journal of Behavioral Addictions, 4*(3), 119–123. https://doi.org/10.1556/2006.4.2015.009

Borsboom, D., & Cramer, A. O. J. (2013). Network Analysis: An Integrative Approach to the Structure of Psychopathology. *Annual Review of Clinical Psychology, 9*(1), 91–121. https://doi.org/10.1146/annurev-clinpsy-050212-185608

Borsboom, D., Deserno, M. K., Rhemtulla, M., Epskamp, S., Fried, E. I., McNally, R. J., et al. (2021). Network analysis of multivariate data in psychological science. *Nature Reviews Methods Primers, 1*(1), 58. https://doi.org/10.1038/s43586-021-00055-w

Bottesi, G., Ghisi, M., Altoè, G., Conforti, E., Melli, G., & Sica, C. (2015). The Italian version of the Depression Anxiety Stress Scales-21: Factor structure and psychometric properties on community and clinical samples. *Comprehensive Psychiatry, 60*, 170–181. https://doi.org/10.1016/j.comppsych.2015.04.005

Boursier, V., Gioia, F., & Griffiths, M. D. (2020). Do selfie-expectancies and social appearance anxiety predict adolescents' problematic social media use? *Computers in Human Behavior, 110*, 106395. https://doi.org/10.1016/j.chb.2020.106395

Boursier, V., Gioia, F., Musetti, A., & Schimmenti, A. (2020). Facing Loneliness and Anxiety During the COVID-19 Isolation: The Role of Excessive Social Media Use in a Sample of Italian Adults. *Frontiers in Psychiatry, 11*, 586222. https://doi.org/10.3389/fpsyt.2020.586222

Brand, M., Rumpf, H.-J., Demetrovics, Z., Müller, A., Stark, R., King, D. L., et al. (2022). Which conditions should be considered as disorders in the International Classification of Diseases (ICD-11) designation of "other specified disorders due to addictive behaviors"? *Journal of Behavioral Addictions, 11*(2), 150–159. https://doi.org/10.1556/2006.2020.00035

Brevers, D., Maurage, P., Kohut, T., Perales, J. C., & Billieux, J. (2022). On the pitfalls of conceptualizing excessive physical exercise as an addictive disorder: Commentary on Dinardi et al. (2021). *Journal of Behavioral Addictions, 11*(2), 234–239. https://doi.org/10.1556/2006.2022.00001.

Brown, R. I. F. (1993). Some contributions of the study of gambling to the study of other addictions. In W. R. Eadington, & J. Cornelius (Eds.), *Gambling behavior and problem gambling* (pp. 241–272). College of Business Administration, University of Nevada Press, Reno: Institute for the Study of Gambling and Commercial Gaming.

Calvo, F., Carbonell, X., Oberst, U., & Fuster, H. (2018). May the passion be with you: The addictive potential of collectible card games, miniatures, and dice of the Star Wars universe. *Journal of Behavioral Addictions, 7*(3), 727–736. https://doi.org/10.1556/2006.7.2018.73

Cataldo, I., Billieux, J., Esposito, G., & Corazza, O. (2022). Assessing problematic use of social media: Where do we stand and what can be improved? *Current Opinion in Behavioral Sciences, 45*, 101145. https://doi.org/10.1016/j.cobeha.2022.101145

Charlton, J. P., & Danforth, I. D. W. (2007). Distinguishing addiction and high engagement in the context of online game playing. *Computers in Human Behavior, 23*(3), 1531–1548. https://doi.org/10.1016/j.chb.2005.07.002

Costa, S., Barberis, N., Griffiths, M. D., Benedetto, L., & Ingrassia, M. (2021). The Love Addiction Inventory: Preliminary Findings of the Development Process and Psychometric Characteristics. *International Journal of Mental Health and Addiction, 19*(3), 651–668. https://doi.org/10.1007/s11469-019-00097-y

Costanzo, A., Santoro, G., Russo, S., Cassarà, M. S., Midolo, L. R., Billieux, J., et al. (2021). Attached to Virtual Dreams: The Mediating Role of Maladaptive Daydreaming in the Relationship Between Attachment Styles and Problematic Social

Media Use. *Journal of Nervous & Mental Disease, 209*(9), 656–664. https://doi.org/10.1097/NMD.0000000000001356

Dakanalis, A., Carrà, G., Calogero, R., Zanetti, M. A., Volpato, C., Riva, G., et al. (2016). The Social Appearance Anxiety Scale in Italian Adolescent Populations: Construct Validation and Group Discrimination in Community and Clinical Eating Disorders Samples. *Child Psychiatry & Human Development, 47*(1), 133–150. https://doi.org/10.1007/s10578-015-0551-1

Derogatis, L. R. (1994). *SCL-90-R: Administration*. Scoring and Procedures Manual (Third Edition): NCS Pearson.

de Ron, J., Robinaugh, D. J., Fried, E. I., Pedrelli, P., Jain, F. A., Mischoulon, D., et al. (2022). Quantifying and addressing the impact of measurement error in network models. *Behaviour Research and Therapy, 157*, Article 104163. https://doi.org/10.1016/j.brat.2022.104163

Epskamp, S., Borsboom, D., & Fried, E. I. (2018). Estimating psychological networks and their accuracy: A tutorial paper. *Behavior Research Methods, 50*(1), 195–212. https://doi.org/10.3758/s13428-017-0862-1

Epskamp, S., Costantini, G., Haslbeck, J., Isvoranu, A., Cramer, A. O. J., Waldorp, L. J., et al. (2022). qgraph: Graph Plotting Methods. *Psychometric Data Visualization and Graphical Model Estimation, 1.9.2*. https://CRAN.R-project.org/package=qgraph.

Epskamp, S., & Fried, E. I. (2018). A tutorial on regularized partial correlation networks. *Psychological Methods, 23*(4), 617–634. https://doi.org/10.1037/met0000167

Epskamp, S., & Fried, E. I. (2021). *bootnet: Bootstrap Methods for Various Network Estimation Routines* (1.5). https://CRAN.R-project.org/package=bootnet.

Epskamp, S., Stuber, S., Nak, J., Veenman, M., & Jorgensen, T. D. (2022). *semPlot: Path Diagrams and Visual Analysis of Various SEM Packages' Output* (1.1.6). https://CRAN.R-project.org/package=semPlot.

Flayelle, M., Maurage, P., Karila, L., Vögele, C., & Billieux, J. (2019). Overcoming the unitary exploration of binge-watching: A cluster analytical approach. *Journal of Behavioral Addictions, 8*(3), 586–602. https://doi.org/10.1556/2006.8.2019.53

Flayelle, M., Schimmenti, A., Starcevic, V., & Billieux, J. (2022). The Pitfalls of Recycling Substance-Use Disorder Criteria to Diagnose Behavioral Addictions. In N. Heather, M. Field, A. C. Moss, & S. Satel (Eds.), *Evaluating the Brain Disease Model of Addiction* (pp. 339–349). Routledge.

Flora, D. B., & Curran, P. J. (2004). An Empirical Evaluation of Alternative Methods of Estimation for Confirmatory Factor Analysis with Ordinal Data. *Psychological Methods, 9*(4), 466–491. https://doi.org/10.1037/1082-989X.9.4.466

Fossati, A., Borroni, S., & Del Corno, F. (2015). *Scala di valutazione dei sintomi trasversali di livello 1 autosomministrata – Adulto*. Raffaello Cortina Editore.

Foygel, R., & Drton, M. (2010). Extended Bayesian Information Criteria for Gaussian Graphical Models. *Advances in Neural Information Processing Systems, 23*, 2020–2028.

Friedman, J., & Tibshirani, T. H. (2019). *glasso: Graphical Lasso: Estimation of Gaussian Graphical Models* (1.11). https://CRAN.R-project.org/package=glasso.

Golino, H. F., & Epskamp, S. (2017). Exploratory graph analysis: A new approach for estimating the number of dimensions in psychological research. *PLOS ONE, 12*(6), e0174035.

Griffiths, M. D. (2005). A 'components' model of addiction within a biopsychosocial framework. *Journal of Substance Use, 10*(4), 191–197. https://doi.org/10.1080/14659890500114359

Hart, T. A., Flora, D. B., Palyo, S. A., Fresco, D. M., Holle, C., & Heimberg, R. G. (2008). Development and Examination of the Social Appearance Anxiety Scale. *Assessment, 15*(1), 48–59. https://doi.org/10.1177/1073191107306673

Hittner, J. B., May, K., & Silver, N. C. (2003). A Monte Carlo Evaluation of Tests for Comparing Dependent Correlations. *The Journal of General Psychology, 130*(2), 149–168. https://doi.org/10.1080/00221300309601282

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Isvoranu, A.-M., & Epskamp, S. (2021). Which estimation method to choose in network psychometrics? Deriving guidelines for applied researchers. *Psychological Methods*. https://doi.org/10.1037/met0000439.

Jiang, H., Fei, X., Liu, H., Roeder, K., Lafferty, J., Wasserman, L., Li, X., & Zhao, and T. (2021). *huge: High-Dimensional Undirected Graph Estimation* (1.3.5). https://CRAN.R-project.org/package=huge.

Jones, P. (2022). *networktools: Tools for Identifying Important Nodes in Networks* (1.5.0). https://CRAN.R-project.org/package=networktools.

Kardefelt-Winther, D. (2014). A conceptual and methodological critique of internet addiction research: Towards a model of compensatory internet use. *Computers in Human Behavior, 31*, 351–354. https://doi.org/10.1016/j.chb.2013.10.059

Kardefelt-Winther, D., Heeren, A., Schimmenti, A., van Rooij, A., Maurage, P., Carras, M., et al. (2017). How can we conceptualize behavioural addiction without pathologizing common behaviours? *How to conceptualize behavioral addiction Addiction, 112*(10), 1709–1715. https://doi.org/10.1111/add.13763

Kline, R. B. (2016). *Principles and practice of structural equation modeling (Fourth Edition)*. The Guilford Press.

Kraus, S. W., Sturgeon, J. A., & Potenza, M. N. (2018). Specific Forms of Passionate Attachment Differentially Mediate Relationships Between Pornography Use and Sexual Compulsivity in Young Adult Men. *Sexual Addiction & Compulsivity, 25*(4), 380–395. https://doi.org/10.1080/10720162.2018.1532362

Liu, H., Lafferty, J., & Wasserman, L. (2009). The Nonparanormal: Semiparametric Estimation of High Dimensional Undirected Graphs. *Journal of Machine Learning Research, 10*(80), 2295–2328.

Lovibond, S. H., & Lovibond, P. F. (1995). *Manual for the Depression Anxiety Stress Scales (Second Edition)*. Psychology Foundation of Australia.

Mariani, R., Musetti, A., Di Monte, C., Danskin, K., Franceschini, C., & Christian, C. (2021). Maladaptive Daydreaming in Relation to Linguistic Features and Attachment Style. *International Journal of Environmental Research and Public Health, 19*(1), 386. https://doi.org/10.3390/ijerph19010386

McNally, R. J. (2021). Network Analysis of Psychopathology: Controversies and Challenges. *Annual Review of Clinical Psychology, 17*(1), 31–53. https://doi.org/10.1146/annurev-clinpsy-081219-092850

Mihordin, R. (2012). Behavioral Addiction—Quo Vadis? *The Journal of Nervous and Mental Disease, 200*(6), 489–491. https://doi.org/10.1097/NMD.0b013e318257c503

Monacis, L., de Palo, V., Griffiths, M. D., & Sinatra, M. (2017). Social networking addiction, attachment style, and validation of the Italian version of the Bergen Social Media Addiction Scale. *Journal of Behavioral Addictions, 6*(2), 178–186. https://doi.org/10.1556/2006.6.2017.023

Moretta, T., Buodo, G., Demetrovics, Z., & Potenza, M. N. (2022). Tracing 20 years of research on problematic use of the internet and social media: Theoretical models, assessment tools, and an agenda for future work. *Comprehensive Psychiatry, 112*, 152286. https://doi.org/10.1016/j.comppsych.2021.152286

Narrow, W. E., Clarke, D. E., Kuramoto, S. J., Kraemer, H. C., Kupfer, D. J., Greiner, L., et al. (2013). DSM-5 Field Trials in the United States and Canada, Part III: Development and Reliability Testing of a Cross-Cutting Symptom Assessment for DSM-5. *American Journal of Psychiatry, 170*(1), 71–82. https://doi.org/10.1176/appi.ajp.2012.12071000

Nepusz, T., Amestoy, P. R., Azzalini, A., Badics, T., Benison, G., Bowman, A., Böhm, W., Briggs, K., Bruggeman, J., Buchmueller, J., Butts, C. T., Clauset, A., Conklin, J. T., Cooper, T., Csardi, G., Croft, T., Dalgaard, P., Davis, T. A., Deniau, L., … Zanini, F. (2022). *igraph: Network Analysis and Visualization* (1.3.4). https://CRAN.R-project.org/package=igraph.

Pons, P., & Latapy, M. (2005). Computing Communities in Large Networks Using Random Walks. In P. Yolum, T. Güngör, F. Gürgen, & C. Özturan (Eds.), *Computer and Information Sciences* – (pp. 284–293). Berlin Heidelberg: Springer. https://doi.org/10.1007/11569596_31. ISCIS 2005.

Prunas, A., Sarno, I., Preti, E., Madeddu, F., & Perugini, M. (2012). Psychometric properties of the Italian version of the SCL-90-R: A study on a large community sample. *European Psychiatry, 27*(8), 591–597. https://doi.org/10.1016/j.eurpsy.2010.12.006

R Core Team. (2022). *R: A language and environment for statistical computing* (4.2.1). R Foundation for Statistical Computing. https://www.R-project.org/.

Rosseel, Y., Jorgensen, T. D., Rockwood, N., Oberski, D., Byrnes, J., Vanbrabant, L., Savalei, V., Merkle, E., Hallquist, M., Rhemtulla, M., Katsikatsou, M., Barendse, M., Scharf, F., & Du, H. (2022). *lavaan: Latent Variable Analysis* (0.6-12). https://CRAN.R-project.org/package=lavaan.

Ryan, T., Chester, A., Reece, J., & Xenos, S. (2014). The uses and abuses of Facebook: A review of Facebook addiction. *Journal of Behavioral Addictions, 3*(3), 133–148. https://doi.org/10.1556/JBA.3.2014.016

Satchell, L. P., Fido, D., Harper, C. A., Shaw, H., Davidson, B., Ellis, D. A., et al. (2021). Development of an Offline-Friend Addiction Questionnaire (O-FAQ): Are most people really social addicts? *Behavior Research Methods, 53*(3), 1097–1106. https://doi.org/10.3758/s13428-020-01462-9

Schmitt, T. A., & Sass, D. A. (2011). Rotation Criteria and Hypothesis Testing for Exploratory Factor Analysis: Implications for Factor Pattern Loadings and Interfactor Correlations. *Educational and Psychological Measurement, 71*(1), 95–113. https://doi.org/10.1177/0013164410387348

Starcevic, V. (2016a). Behavioural addictions: A challenge for psychopathology and psychiatric nosology. *Australian & New Zealand Journal of Psychiatry, 50*(8), 721–725. https://doi.org/10.1177/0004867416654009

Starcevic, V. (2016b). Tolerance and withdrawal symptoms may not be helpful to enhance understanding of behavioural addictions: Letter to the Editor. *Addiction, 111*(7), 1307–1308. https://doi.org/10.1111/add.13381

Starcevic, V., Billieux, J., & Schimmenti, A. (2018). Selfitis and behavioural addiction: A plea for terminological and conceptual rigour. *Australian & New Zealand Journal of Psychiatry, 52*(10), 919–920. https://doi.org/10.1177/0004867418797442

Steegen, S., Tuerlinckx, F., Gelman, A., & Vanpaemel, W. (2016). Increasing Transparency Through a Multiverse Analysis. *Perspectives on Psychological Science, 11*(5), 702–712. https://doi.org/10.1177/1745691616658637

Sun, Y., & Zhang, Y. (2021). A review of theories and models applied in studies of social media addiction and implications for future research. *Addictive Behaviors, 114*, 106699. https://doi.org/10.1016/j.addbeh.2020.106699

van Rooij, A. J., Ferguson, C. J., Colder Carras, M., Kardefelt-Winther, D., Shi, J., Aarseth, E., et al. (2018). A weak scientific basis for gaming disorder: Let us err on the side of caution. *Journal of Behavioral Addictions, 7*(1), 1–9. https://doi.org/10.1556/2006.7.2018.19

Whelan, E., Laato, S., Islam, A. K. M. N., & Billieux, J. (2021). A casino in my pocket: Gratifications associated with obsessive and harmonious passion for mobile gambling. *PLOS ONE, 16*(2), e0246432.

World Health Organization. (2019). *International Statistical Classification of Diseases and Related Health Problems* (Eleventh Edition). World Health Organization. https://icd.who.int/.