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Implicit cognitions in problematic social network use

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VIEWPOINT



ABSTRACT

Implicit cognitions may be involved in the development and maintenance of specific Internet use disorders such as problematic social network use (PSNU). In more detail, implicit attitude, attentional biases, approach and avoidance tendencies as well as semantic memory associations are considered relevant in the context of PSNU. This viewpoint article summarizes the available literature on implicit cognitions in PSNU. We systematically reviewed articles of implicit cognitions in PSNU from PubMed, Scopus, Web of Science, and ProQuest databases based on a targeted search strategy and assessed using predefined inclusion and exclusion criteria. The present findings suggest that specific implicit cognitions are important in the context of PSNU and therefore show parallels to other addictive behaviors. However, the empirical evidence is limited to a few studies on this topic. Implicit cognitions in PSNU should be explored in more depth and in the context of other affective and cognitive mechanisms in future work.

KEYWORDS

problematic social network use, internet-use disorders, implicit cognitions

INTRODUCTION

Implicit cognitions play an important role in the development and maintenance of addictions and research on implicit cognitions helps to understand why individuals repeatedly engage in addictive behaviors despite being aware of negative consequences (Stacy & Wiers, 2010). Implicit cognitions may contribute to the difficulties in controlling automatically triggered impulses and defending against potential harmful behaviors (Cox, Fadardi, & Klinger, 2006; R. W. Wiers & Stacy, 2006). Beyond dual process theories of addiction that distinguish between impulsive/automatic and controlled/deliberative processes (e.g., Bechara, 2005), models such as that of R. W. Wiers and Stacy (2006) emphasize how automatic processing of addiction-related stimuli increases through sensitization processes. This can be influenced by controlled processes that can regulate behaviors. As addictive behaviors progress over time, it becomes more difficult to control the behaviors, which may become seemingly habitual (Brand et al., 2019). Based on these theories and implicit measures used in addiction research to date, several implicit cognitions can be named that change with the onset of addictive behaviors; these include implicit associations/attitudes, attentional biases, approach and avoidance tendencies and semantic memory associations (Breiner, Stritzke, & Lang, 1999; Stacy & Wiers, 2010; R. W. Wiers & Stacy, 2006). There are numerous findings in addiction research confirming the involvement of implicit cognitions in various substance-use disorders (e.g., Cox et al., 2006; Field & Cox, 2008; Reich, Below, & Goldman, 2010;

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Rooke, Hine, & Thorsteinsson, 2008; Stacy & Wiers, 2010). Additionally, in recent decades, there is a growing body of evidence that emphasizes the involvement of implicit cognitions in behavioral addictions as well (Chen et al., 2018; Snagowski & Brand, 2015; Trotzke, Müller, Brand, Starcke, & Steins-Loeber, 2020). Theoretical models on addictive behaviors, such as the I-PACE model of Brand et al. (2019, 2016), also consider implicit cognitions important in the development and maintenance of specific behavioral addictions. It has been argued by Brand and colleagues that implicit cognitive processes towards addiction-related stimuli develop based on conditioning processes and are linked to cue-reactivity and craving.

The inclusion of gambling disorder in the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2013) and of gambling disorder and gaming disorder the International Classification of Diseases (World Health Organization, 2019) as disorders due to addictive behaviors has been justified by, among other arguments, research showing parallels between gambling/gaming disorder and substance use disorders regarding psychological and neurobiological mechanisms (Vaccaro & Potenza, 2019). Many researchers and clinicians argue that in the context of rapidly increasing digitalization of societies, additional types of problematic usage of the internet exist that need public health considerations (Fineberg et al., 2022). One of the potential types of specific Internet-use disorders may be problematic social network use (PSNU), which manifests as strong desires to use social networks (SN) resulting in negative consequences for health, emotional well-being, life satisfaction or job performance (Andreassen, 2015; Hawi & Samaha, 2017; Kuss & Griffiths, 2011). PSNU has been considered a behavioral addiction due to parallels with officially recognized disorders due to addictive behaviors (e.g., Andreassen, Pallesen, & Griffiths, 2017; Brand, 2022; Müller et al., 2019; Zhou, Rau, Yang, & Zhou, 2021). It has, however, been argued that more systematic research on specific neurocognitive functions in PSNU (and other disorders due to addictive behaviors) is needed to justify inclusion of this diagnosis in upcoming revisions of the ICD and DSM (Brand, 2022). This systematic review examines the involvement of implicit cognitions in PSNU. Based on the theoretical conceptualizations of R. W. Wiers and Stacy (2006) and previous reviews, such as that of Rooke et al. (2008), several mechanisms of implicit cognition can be defined.

Implicit attitude

Individuals form certain attitudes during the development of addictions, which can be subconsciously influenced and usually lead to a positive attitude towards the addictive stimuli (Rudman, 2004). Furthermore, this may also increase the likelihood of approaching the use or behavior (Rooke et al., 2008). To measure the salience of implicit attitudes, the Implicit Association Test (IAT) is often used, originally developed by Greenwald, McGhee, and Schwartz (1998) to measure attitudes outside the context of addiction. To date,

studies have found positive implicit attitudes in alcohol use disorders (Lindgren et al., 2013), tobacco use disorders (Dal Cin, Gibson, Zanna, Shumate, & Fong, 2007), and behavioral addictions such as gambling disorder (Flórez et al., 2016) and buying-shopping disorder (Trotzke et al., 2020).

Attentional bias

In addition to the associative link to the addictive object (e.g., the drug), research has long been concerned with the question of whether individuals with a particular addictive behavior exhibit a tendency by which attention is drawn to the addictive object/behavior. Once attention to the addictive object is gained, cues can have a tremendous impact on subsequent behavior (Rooke et al., 2008). Paradigms such as the dot probe or visual probe have been used in research to measure this attentional bias (MacLeod, Mathews, & Tata, 1986). Increased attentional biases have already been found in various substance-use disorders, for example related to alcohol (Loeber et al., 2009), cocaine (Smith, N'Diaye, Fortias, Mallet, & Vorspan, 2020) and tobacco (Cane, Sharma, & Albery, 2009). Similarly, an attentional bias has been found in individuals with gambling disorder (van Holst et al., 2012) and symptoms of buying-shopping disorder (Trotzke et al., 2020; Vogel et al., 2019).

Approach-avoidance tendencies

Addiction-related cues can cause competing action tendencies that trigger approach or avoidance to the addictive object through subconscious evaluation (Breiner et al., 1999). While the positive evaluation is accompanied by approach tendencies, negative evaluation, on the other hand, is more likely to lead to avoidance of the behavior (Rooke et al., 2008). One paradigm that can be used to make these action tendencies measurable is the approach-avoidance task (AAT) (Rinck & Becker, 2007). Approach and avoidance tendencies have been found in substance-use disorders related to alcohol (e.g., Field & Cox, 2008), cannabis (Cousijn et al., 2012), and tobacco (C. E. Wiers et al., 2014). There are also findings of approach tendencies in pornography use (Stark et al., 2017) as well as both approach and avoidance tendencies related to symptoms of pornography-use disorder (Snagowski & Brand, 2015).

Semantic memory associations

Semantic memory association is thought to be able to determine whether individuals with an addictive behavior can subconsciously recall something more quickly in memory if it is related to the addictive object (Stacy & Wiers, 2010). McCusker (2001) postulated that memory stores expectations relevant to motivating behavioral execution and is the origin of cognitive biases. Thus, implicit attitudes, attentional biases, and approach/avoidance tendencies may depend on how accessible specific information is and how quickly addiction-related constructs are available (Stacy, Leigh, & Weingardt, 1994). To measure semantic memory associations, for example, word association tests or semantic



priming can be used. Findings support the link between semantic memory associations and substance-use disorders such as alcohol-use disorder (e.g., Cox et al., 2006; Reich & Goldman, 2005) and behavioral addictions such as gambling disorder (Russell, Williams, & Sanders, 2019).

Given the evidence for the involvement of implicit cognitions in substance-use disorders and behavioral addictions, we systematically reviewed studies of implicit cognitions in PSNU.

METHODS AND RESULTS OF A SYSTEMATIC REVIEW

The approach to the literature search and further methodology was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method

(Moher, Liberati, Tetzlaff, & Altman, 2010). For this purpose, the publications of the last 11 years of the databases PubMed, Scopus, Web of Science, and ProQuest were reviewed (see Fig. 1). The literature search was conducted between March 2022 and March 2023. Detailed information on methods (eligibility criteria and keywords) can be found in Table S1 in the supplementary material.

Details regarding the included studies, such as sample size, operationalization of implicit cognitions, and results, are presented in Table 1. Looking at the articles included, it can first be summarized that there is a balanced distribution of the focused implicit cognitive mechanisms, except the semantic memory associations. Accordingly, we found two eligible studies for implicit attitudes and approach tendencies and three for attentional bias. No studies were identified that investigated the role of semantic memory associations in PSNU. Given the complexity of the analysis, this viewpoint

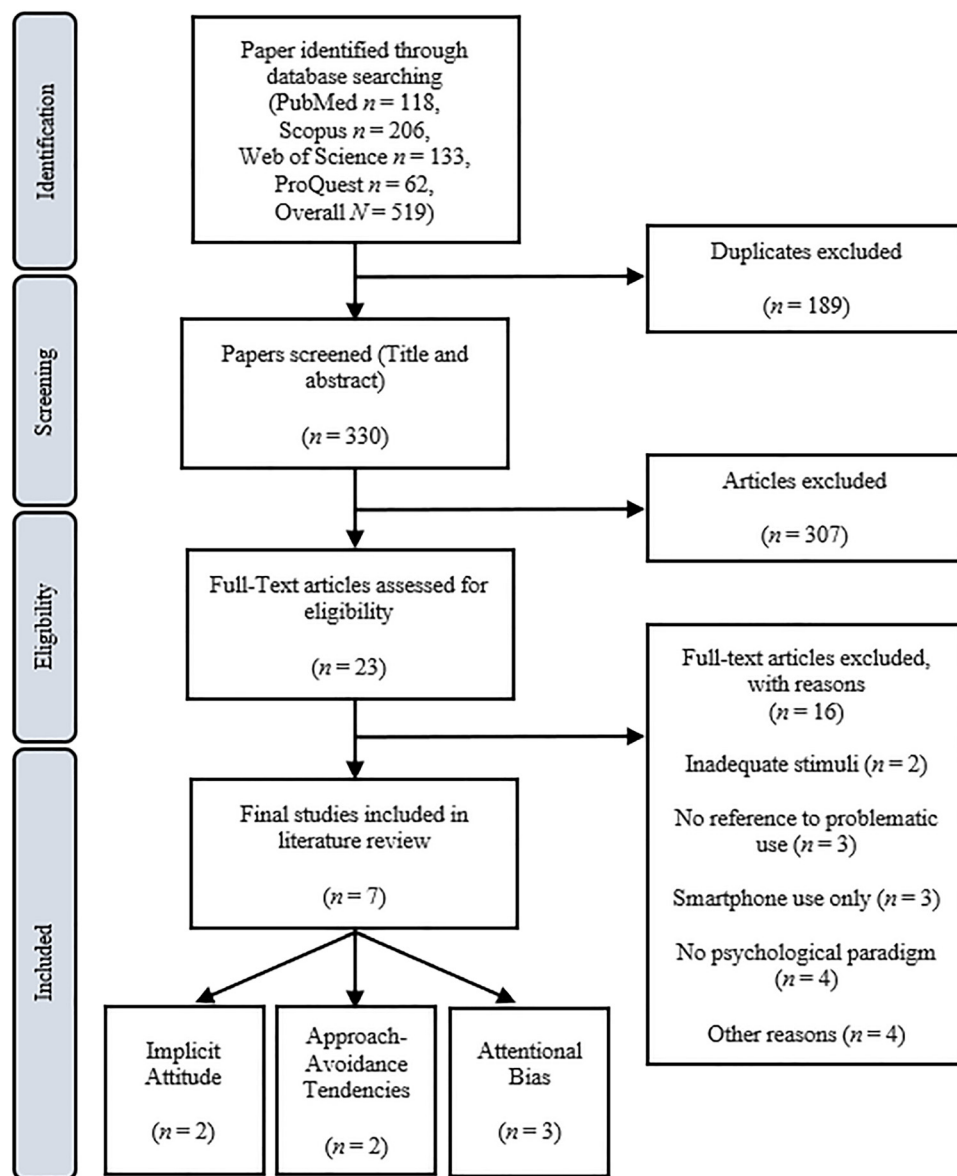


Fig. 1. Flowchart of identified articles and exclusions

Table 1. Studies reviewed

Author	Title	Journal	Study Variables				Results
			N	Mean Age $\pm$ SD	ICM measure	PNSU measure	
Turel and Serenko (2020)	Cognitive biases and excessive use of social media: The Facebook implicit associations test (FIAT)	Addictive Behaviors	220	22.90 $\pm$ 4.60	F-IAT	Nine-item technology-addiction scale (Charlton & Danforth, 2007), adapted to the social media use context (Serenko & Turel, 2015)	Implicit attitudes were significantly correlated with excessive social media use, $r = 0.20$, $p < 0.05$
Brailovskaia and Teichert (2020)	“I like it” and “I need it”: Relationship between implicit associations, flow, and addictive social media use	Computers in Human Behavior	145	21.50 $\pm$ 4.99	IAT	BSMAS	Implicit attitudes were significantly correlated with social media addiction, $r = 0.18$, $p < 0.05$
Nikolaidou et al. (2019)	Attentional bias in Internet users with problematic use of social networking sites	Journal of Behavioral Addictions	65	20.10 $\pm$ 2.70	Dot probe Task & Pleasantness Rating Tasks	AEQ	PSNU showed an attentional bias for SN-related images compared to control images, $t(15) = 2.82$, $p = 0.013$
Thomson et al., (2021)	Social media ‘addiction’: The absence of an attentional bias to social media stimuli	Journal of Behavioral Addiction	100	20.00 $\pm$ 2.00	Attentional capture task	BSNAS; SMAQ; SMES	findings do not provide support for a social media specific attentional bias
Wadsley and Ihssen (2022)	The roles of implicit approach motivation and explicit reward in excessive and problematic use of social networking sites	Plos One 2022	411	22.90 $\pm$ 3.55	VAAST	SMDS	No significant relationship between approach motivation and problematic Internet usage
Juergensen and Leckfor (2019)	Stop pushing me away: Relative level of Facebook addiction is associated with implicit approach motivation for Facebook stimuli	Psychological Reports	47	20.77 $\pm$ 5.47	AAT	BFAS	Participants with higher self-reported tendencies of Facebook addiction tended to approach Facebook-related stimuli faster, $r = 0.28$, $p < .05$ (continued)

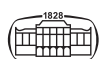


Table 1. Continued

Author	Title	Journal	Study Variables				Results
			N	Mean Age $\pm$ SD	ICM measure	PNSU measure	
Zhao et al. (2022)	Attentional Bias Is Associated with Negative Emotions in Problematic Users of Social Media as Measured by a Dot-Probe Task	International Journal of Environmental Research and Public Health	60 (PSNU = 30; Control = 30)	PSNU: 20.07 $\pm$ 1.70 Controls: 19.33 $\pm$ 1.40	Dot probe task, Addiction Stroop Task	Chinese Version of the BMSAS (Leung et al., 2020)	PSNU subjects showed attentional bias toward social network cues in the dot probe task, $F(1, 58) = 26.77, p < 0.001$. No significant relationships with the Addiction Stroop Task

Note. BSMAS = Bergen Social Media Addiction Scale (Andreassen, Torsheim, Brunborg, & Pallesen, 2012); AEQ = Addiction-Engagement Questionnaire (Charlton & Danforth, 2010); BSNAS = Bergen Social Networking Addiction Scale (Andreassen et al., 2016); SMAQ = Social Media Addiction Questionnaire (Hawi & Samaha, 2017); SMES = Social Media Engagement Scale (Przybylski, Murayama, DeHaan, & Gladwell, 2013); VAAST = Visual Approach/Avoidance by the Self Task (Rougier et al., 2018); SMDS = Social Media Disorder Scale (van den Eijnden, Lemmens, & Valkenburg, 2016); BFAS = Bergen Facebook Addiction Scale (Andreassen et al., 2012).

can only summarize the main findings. Further information can be found in the [supplementary material](#).

The two studies that examined implicit attitudes related to PSNU both suggest that symptom severity of PSNU correlates with positive implicit attitudes (Brailovskaia & Teichert, 2020; Turel & Serenko, 2020). Both studies used the Implicit Association Task as their paradigm. The studies that investigated attentional bias showed different results: the study of Nikolaidou, Fraser, and Hinest (2019) found significantly increased attentional bias with higher symptom severity of PSNU. Similarly, Zhao et al. (2022) report that subjects with PSNU display attentional bias toward social network cues. No significant correlation between increased attentional bias and symptom severity of PSNU were found by Thomson, Hunter, Butler, and Robertson (2021). For approach and avoidance tendencies, significant relationships between approach tendency and symptom severity of problematic Facebook use were reported by Juergensen and Leckfor (2019). However, there was no difference in approach tendencies towards social networks stimuli and neutral control stimuli. Similarly, Wadsley and Ihssen (2022) found no significant relationship between increased approach tendencies and symptoms of problematic use of SN using an online Visual Approach/Avoidance by the Self Task (VAAST).

DISCUSSION

The aim of this systematic review was to define the current knowledge about the involvement of specific implicit cognitions in PSNU based on the empirical evidence. The results suggest, at least to a small extent, significant associations between PSNU and implicit cognitions, which is

consistent with what is known on implicit cognitions in substance-use disorders (e.g., Cox et al., 2006; Field & Cox, 2008; Lindgren et al., 2013; Loeber et al., 2009; Reich et al., 2010; Reich & Goldman, 2005; Rooke et al., 2008; Stacy & Wiers, 2010; C. E. Wiers et al., 2014) and behavioral addictions (e.g., Chen et al., 2018; Trotzke et al., 2020; Yen et al., 2011). It is important to note here that the data base in this research area is still very limited, with a total of only seven studies identified according to our predefined inclusion criteria. In addition, the available evidence suggests that not all implicit cognitions may be equally relevant in PSNU and the correlations between symptoms of PSNU and specific implicit cognitions are relatively weak. Different methodological approaches and operationalizations in the studies, including the measurement of PSNU symptoms, further limit the generalizability of the conclusions.

Recent theoretical models of substance-use disorders and behavioral addictions consider implicit cognitions important in the maintenance of the addictive behaviors (Brand, Young, Laier, Wölfling, & Potenza, 2016; Breiner et al., 1999; Dong & Potenza, 2014; R. W. Wiers & Stacy, 2006). The decision to use social networks in the context of PSNU may be influenced by the individual's fast associative "impulsive" system, in which social-networks-related stimuli are automatically evaluated and may then trigger seemingly habitual responses, which is also consistent with Bechara's (2005) dual process model of decision making in addictions. There is preliminary evidence that social networks stimuli become more salient in PSNU and that incentive sensitization occurs, which is known to be an important mechanism for the emergence of implicit cognitions (Robinson & Berridge, 1993) and, according to Breiner et al. (1999), can also trigger approach tendencies as well as cue-reactivity and craving (e.g., Brand et al., 2019). Especially in the earlier stages of the



development of online addictive behaviors, the use of an application (such as social networks) may be reinforced positively and negatively, resulting in “feels-better” motivations for the usage (Brand, 2022). The ubiquity of social networks may also contribute to difficulties in controlling the use, as the urges and impulses related to the “feels-better” driving motivation may override self-control. The relationship between availability/ubiquity, the frequency of use, the specific reinforcement experiences may foster the development of implicit cognitions resulting in reduced control over the use of social networks. Given the prominent role that implicit cognitions play in theories of addictive behaviors and the fact that multiple authors consider PSNU as a potential addictive behavior (e.g., Paschke, Austermann, & Thomasius, 2021) it is surprising that the number of empirical studies on this topic is so small. More research on implicit cognitions and other affective and cognitive mechanisms in PSNU is urgently needed to explore whether or not the theoretical considerations of addictive behaviors are also valid for PSNU.

For future research, some practical/methodological implications can be derived from the reported studies. One very important aspect is the operationalization and measurement of symptom severity of PSNU. In the seven studies reviewed in this viewpoint, six different measures for PSNU have been used which limits the comparability of the findings. Improving the standardized measurement of problematic usage of social networks is a major challenge for future research. For approach and avoidance tendencies, the relationship between smartphone use and PSNU could have important implications, as a certain automatism is learned with smartphone use, which may be associated with tendencies to approach the smartphone in many situations of daily life. This could provide an explanation for the partially unconfirmed results on approach and avoidance tendencies and suggest that smartphone-based AATs, as already used in other research areas (e.g., Zech, Gable, van Dijk, & van Dillen, 2022), might better represent relevant motor movements related to PSNU than joystick-based AATs. Overall, in the current state of research, there is no consensus on which applications are considered social networks. In the studies reviewed, implicit cognitions have been associated with both problematic use of individual platforms such as Facebook and problematic use of social networks more broadly (different platforms). The different addictive potential of the applications should be taken into account when interpreting the results (Rozgonjuk, Sindermann, Elhai, & Montag, 2021). As new applications are constantly added and preferences change, there could be variations that make it difficult to define or narrow down social networks in a uniform way. Furthermore, there also seems to be no consistency in the assessment of implicit cognitions. Here, the recommendation can be made that the same paradigms need to be tested much more in the context of a PSNU in order to make statements about the reproducibility and validity deemed necessary (e.g., Stacy & Wiers, 2010; Teige-Mocigemba, Klauer, & Sherman, 2010). Other methodological issues are related to sample sizes and study characteristics

(e.g., measures of symptom severity), as these vary considerably (see Table 1). In addition, predominantly nonclinical samples were used. It also is important to distinguish more precisely between the types of (problematic) smartphone and social networks use and to consider the corresponding stimuli. As our literature search for the review showed, there is no consensus in examining the two types of use and the most appropriate stimuli when studying affective and cognitive mechanisms of PSNU. However, it is necessary to distinguish between the two types of potential problematic behaviors because the smartphone is the device and many other applications can be used beyond social networks meaning that assessing problematic smartphone use is more generic than assessing problematic use of social networks. More studies including important potential moderating variables are required to better understand interactions between implicit cognitions, type and design of the task, number of trials, and stimuli used, but also person-related variables (e.g., gender, age, personality). Future research should also investigate potential interactions between implicit cognitions and explicit cognitions (e.g., explicit expectancies, desire thinking and beliefs, but also executive functions and general attention) in PSNU in order to test the incremental validity of implicit cognitions in explaining PSNU symptoms.

PSNU is a rapidly evolving phenomenon and research on affective and cognitive mechanisms of PSNU has only just begun, which is reflected by the fact that the oldest publication included in this review is only from about four years ago (Juergensen & Leckfor, 2019). Considering all the limitations and challenges for future research, the results of our review provide preliminary support for the view that implicit cognitions may play a role in the context of PSNU. At least, it can be concluded from the previous studies and theoretical considerations that implicit cognitions in the context of PSNU are worthy of a more detailed and systematic investigation, which we would like to motivate with this viewpoint.

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SUPPLEMENTARY MATERIAL

Supplementary data to this article can be found online at <https://doi.org/10.1556/2006.2023.00035>.

REFERENCES

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5* (Vol. 5, No. 5).
- Andreassen, C. S. (2015). Online social network site addiction: A comprehensive review. *Current Addiction Reports*, 2(2), 175–184. <https://doi.org/10.1007/s40429-015-0056-9>.
- Andreassen, C. S., Billieux, J., Griffiths, M. D., Kuss, D. J., Demetrovics, Z., Mazzoni, E., & Pallesen, S. (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., Pallesen, S., & Griffiths, M. D. (2017). The relationship between addictive use of social media, narcissism, and self-esteem: Findings from a large national survey. *Addictive Behaviors*, 64, 287–293. <https://doi.org/10.1016/j.addbeh.2016.03.006>.
- 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>.
- Bechara, A. (2005). Decision making, impulse control and loss of willpower to resist drugs: A neurocognitive perspective. *Nature Neuroscience*, 8(11), 1458–1463. <https://doi.org/10.1038/nn1584>.
- Brailovskaia, J., & Teichert, T. (2020). “I like it” and “I need it”: Relationship between implicit associations, flow, and addictive social media use. *Computers in Human Behavior*, 113, 106509. <https://doi.org/10.1016/j.chb.2020.106509>.
- Brand, M. (2022). Can internet use become addictive? *Science*, 376(6595), 798–799. <https://doi.org/10.1126/science.abn4189>.
- Brand, M., Wegmann, E., Stark, R., Müller, A., Wölfling, K., Robbins, T. W., & Potenza, M. N. (2019). The Interaction of Person-Affect-Cognition-Execution (I-PACE) model for addictive behaviors: Update, generalization to addictive behaviors beyond internet-use disorders, and specification of the process character of addictive behaviors. *Neuroscience and Biobehavioral Reviews*, 104, 1–10. <https://doi.org/10.1016/j.neubiorev.2019.06.032>.
- Brand, M., Young, K. S., Laier, C., Wölfling, K., & Potenza, M. N. (2016). Integrating psychological and neurobiological considerations regarding the development and maintenance of specific Internet-use disorders: An Interaction of Person-Affect-Cognition-Execution (I-PACE) model. *Neuroscience and Biobehavioral Reviews*, 71, 252–266. <https://doi.org/10.1016/j.neubiorev.2016.08.033>.
- Breiner, M. J., Stritzke, W. G. K., & Lang, A. R. (1999). Approaching avoidance: A step essential to the understanding of craving. *Alcohol Research & Health*, 23(3), 197. <https://www.ncbi.nlm.nih.gov/pmc/articles/pmc6760377/>.
- Cane, J. E., Sharma, D., & Albery, I. P. (2009). The addiction Stroop task: Examining the fast and slow effects of smoking and marijuana-related cues. *Journal of Psychopharmacology*, 23(5), 510–519. <https://doi.org/10.1177/0269881108091253>.
- Charlton, J. P., & Danforth, I. D. (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>.
- Charlton, J. P., & Danforth, I. D. (2010). Validating the distinction between computer addiction and engagement: Online game playing and personality. *Behaviour & Information Technology*, 29(6), 601–613. <https://doi.org/10.1080/01449290903401978>.
- Chen, L., Zhou, H., Gu, Y., Wang, S., Wang, J., Tian, L., ... Zhou, Z. (2018). The neural correlates of implicit cognitive bias toward internet-related cues in internet addiction: An ERP study. *Frontiers in Psychiatry*, 9, 421. <https://doi.org/10.3389/fpsy.2018.00421>.
- Cousijn, J., Goudriaan, A. E., Ridderinkhof, K. R., van den Brink, W., Veltman, D. J., & Wiers, R. W. (2012). Approach-bias predicts development of cannabis problem severity in heavy cannabis users: Results from a prospective fMRI study. *Plos One*, 7(9), e42394. <https://doi.org/10.1371/journal.pone.0042394>.
- Cox, M., Fadardi, J. S., & Klinger, E. (2006). Motivational processes underlying implicit cognition in addiction. *Handbook of Implicit Cognition and Addiction*, 253–266. <https://journals.sagepub.com/doi/pdf/10.1111/j.1467-8721.2006.00455.x>.
- Dal Cin, S., Gibson, B., Zanna, M. P., Shumate, R., & Fong, G. T. (2007). Smoking in movies, implicit associations of smoking with the self, and intentions to smoke. *Psychological Science*, 18(7), 559–563. <https://doi.org/10.1111/j.1467-9280.2007.01939.x>.
- Dong, G., & Potenza, M. N. (2014). A cognitive-behavioral model of Internet gaming disorder: Theoretical underpinnings and clinical implications. *Journal of Psychiatric Research*, 58, 7–11. <https://doi.org/10.1016/j.jpsychires.2014.07.005>.
- Field, M., & Cox, W. M. (2008). Attentional bias in addictive behaviors: A review of its development, causes, and consequences. *Drug and Alcohol Dependence*, 97(1–2), 1–20. <https://doi.org/10.1016/j.drugalcdep.2008.03.030>.
- Fineberg, N. A., Menchón, J. M., Hall, N., Dell’Osso, B., Brand, M., Potenza, M. N., ... Zohar, J. (2022). Advances in problematic usage of the internet research - a narrative review by experts from the European network for problematic usage of the internet. *Comprehensive Psychiatry*, 118, 152346. <https://doi.org/10.1016/j.comppsy.2022.152346>.
- Flórez, G., Saiz, P. A., Santamaría, E. M., Álvarez, S., Nogueiras, L., & Arrojo, M. (2016). Impulsivity, implicit attitudes and explicit cognitions, and alcohol dependence as predictors of pathological gambling. *Psychiatry Research*, 245, 392–397. <https://doi.org/10.1016/j.psychres.2016.08.039>.
- Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, 74(6), 1464–1480. <https://doi.org/10.1037/0022-3514.74.6.1464>.
- Hawi, N. S., & Samaha, M. (2017). The relations among social media addiction, self-esteem, and life satisfaction in university



- students. *Social Science Computer Review*, 35(5), 576–586. <https://doi.org/10.1177/0894439316660340>.
- Juergensen, J., & Leckfor, C. (2019). Stop pushing me away: Relative level of facebook addiction is associated with implicit approach motivation for Facebook stimuli. *Psychological Reports*, 122(6), 2012–2025. <https://doi.org/10.1177/0033294118798624>.
- Kuss, D. J., & Griffiths, M. D. (2011). Online social networking and addiction—a review of the psychological literature. *International Journal of Environmental Research and Public Health*, 8(9), 3528–3552. <https://doi.org/10.3390/ijerph8093528>.
- Leung, H., Pakpour, A. H., Strong, C., Lin, Y.-C., Tsai, M.-C., Griffiths, M. D., ... Chen, I.-H. (2020). Measurement invariance across young adults from Hong Kong and Taiwan among three internet-related addiction scales: Bergen social media addiction scale (BSMAS), smartphone application-based addiction scale (SABAS), and internet gaming disorder scale-short form (IGDS-SF9) (study Part A). *Addictive Behaviors*, 101, 105969. <https://doi.org/10.1016/j.addbeh.2019.04.027>.
- Lindgren, K. P., Neighbors, C., Teachman, B. A., Wiers, R. W., Westgate, E., & Greenwald, A. G. (2013). I drink therefore I am: Validating alcohol-related implicit association tests. *Psychology of Addictive Behaviors*, 27(1), 1–13. <https://doi.org/10.1037/a0027640>.
- Loeber, S., Vollstädt-Klein, S., Goltz, C. von der, Flor, H., Mann, K., & Kiefer, F. (2009). Attentional bias in alcohol-dependent patients: The role of chronicity and executive functioning. *Addiction Biology*, 14(2), 194–203. <https://doi.org/10.1111/j.1369-1600.2009.00146.x>.
- MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. *Journal of Abnormal Psychology*, 95(1), 15–20. <https://doi.org/10.1037/0021-843x.95.1.15>.
- McCusker, C. G. (2001). Cognitive biases and addiction: An evolution in theory and method. *Addiction*, 96(1), 47–56. <https://doi.org/10.1046/j.1360-0443.2001.961474.x>.
- Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2010). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *International Journal of Surgery (London, England)*, 8(5), 336–341. <https://doi.org/10.1016/j.ijsu.2010.02.007>.
- Müller, A., Brand, M., Claes, L., Demetrovics, Z., Zwaan, M. de, Fernández-Aranda, F., ... Kyrios, M. (2019). Buying-shopping disorder-is there enough evidence to support its inclusion in ICD-11? *CNS Spectrums*, 24(4), 374–379. <https://doi.org/10.1017/s1092852918001323>.
- Nikolaidou, M., Fraser, D. S., & Hinest, N. (2019). Attentional bias in Internet users with problematic use of social networking sites. *Journal of Behavioral Addictions*, 8(4), 733–742. <https://doi.org/10.1556/2006.8.2019.60>.
- Paschke, K., Austermann, M. I., & Thomasius, R. (2021). Icd-11-Based assessment of social media use disorder in adolescents: Development and validation of the social media use disorder scale for adolescents. *Frontiers in Psychiatry*, 12, 661483. <https://doi.org/10.3389/fpsy.2021.661483>.
- Przybylski, A. K., Murayama, K., DeHaan, C. R., & Gladwell, V. (2013). Motivational, emotional, and behavioral correlates of fear of missing out. *Computers in Human Behavior*, 29(4), 1841–1848. <https://doi.org/10.1016/j.chb.2013.02.014>.
- Reich, R. R., Below, M. C., & Goldman, M. S. (2010). Explicit and implicit measures of expectancy and related alcohol cognitions: A meta-analytic comparison. *Psychology of Addictive Behaviors*, 24(1), 13–25. <https://doi.org/10.1037/a0016556>.
- Reich, R. R., & Goldman, M. S. (2005). Exploring the alcohol expectancy memory network: The utility of free associates. *Psychology of Addictive Behaviors: Journal of the Society of Psychologists in Addictive Behaviors*, 19(3), 317–325. <https://doi.org/10.1037/0893-164x.19.3.317>.
- Rinck, M., & Becker, E. S. (2007). Approach and avoidance in fear of spiders. *Journal of Behavior Therapy and Experimental Psychiatry*, 38(2), 105–120. <https://doi.org/10.1016/j.jbtep.2006.10.001>.
- Robinson, T. E., & Berridge, K. C. (1993). The neural basis of drug craving: An incentive-sensitization theory of addiction. *Brain Research. Brain Research Reviews*, 18(3), 247–291. [https://doi.org/10.1016/0165-0173\(93\)90013-P](https://doi.org/10.1016/0165-0173(93)90013-P).
- Rooke, S. E., Hine, D. W., & Thorsteinsson, E. B. (2008). Implicit cognition and substance use: A meta-analysis. *Addictive Behaviors*, 33(10), 1314–1328. <https://doi.org/10.1016/j.addbeh.2008.06.009>.
- Rougier, M., Muller, D., Ric, F., Alexopoulos, T., Batailler, C., Smeding, A., & Aubé, B. (2018). A new look at sensorimotor aspects in approach/avoidance tendencies: The role of visual whole-body movement information. *Journal of Experimental Social Psychology*, 76, 42–53. <https://doi.org/10.1016/j.jesp.2017.12.004>.
- Rozgonjuk, D., Sindermann, C., Elhai, J. D., & Montag, C. (2021). Comparing smartphone, WhatsApp, Facebook, Instagram, and Snapchat: Which platform elicits the greatest use disorder symptoms? *Cyberpsychology, Behavior and Social Networking*, 24(2), 129–134. <https://doi.org/10.1089/cyber.2020.0156>.
- Rudman, L. A. (2004). Sources of implicit attitudes. *Current Directions in Psychological Science*, 13(2), 79–82. <https://doi.org/10.1111/j.0963-7214.2004.00279.x>.
- Russell, G. E. H., Williams, R. J., & Sanders, J. L. (2019). The relationship between memory associations, gambling involvement, and problem gambling. *Addictive Behaviors*, 92, 47–52. <https://doi.org/10.1016/j.addbeh.2018.12.015>.
- Serenko, A., & Turel, O. (2015). Integrating technology addiction and use: An empirical investigation of Facebook users. *AIS Transactions on Replication Research*, 1, 1–18. <https://doi.org/10.17705/1attr.00002>.
- Smith, P., N'Diaye, K., Fortias, M., Mallet, L., & Vorspan, F. (2020). I can't get it off my mind: Attentional bias in former and current cocaine addiction. *Journal of Psychopharmacology*, 34(11), 1218–1225. <https://doi.org/10.1177/0269881120944161>.
- Snagowski, J., & Brand, M. (2015). Symptoms of cybersex addiction can be linked to both approaching and avoiding pornographic stimuli: Results from an analog sample of regular cybersex users. *Frontiers in Psychology*, 6, 653. <https://doi.org/10.3389/fpsyg.2015.00653>.
- Stacy, A. W., Leigh, B. C., & Weingardt, K. R. (1994). Memory accessibility and association of alcohol use and its positive outcomes. *Experimental and Clinical Psychopharmacology*, 2, 269–282. <https://doi.org/10.1037/1064-1297.2.3.269>.
- Stacy, A. W., & Wiers, R. W. (2010). Implicit cognition and addiction: A tool for explaining paradoxical behavior. *Annual*



- Review of Clinical Psychology*, 6, 551–575. <https://doi.org/10.1146/annurev.clinpsy.121208.131444>.
- Stark, R., Kruse, O., Snagowski, J., Brand, M., Walter, B., Klucken, T., & Wehrum-Osinsky, S. (2017). Predictors for (problematic) use of internet sexually explicit material: Role of trait sexual motivation and implicit approach tendencies towards sexually explicit material. *Sexual Addiction & Compulsivity*, 24(3), 180–202. <https://doi.org/10.1080/10720162.2017.1329042>.
- Teige-Mocigemba, S., Klauer, K. C., & Sherman, J. W. (2010). A practical guide to implicit association tests and related tasks. In *Handbook of implicit social cognition: Measurement, theory, and applications* (pp. 117–139). The Guilford Press.
- Thomson, K., Hunter, S. C., Butler, S. H., & Robertson, D. J. (2021). Social media 'addiction': The absence of an attentional bias to social media stimuli. *Journal of Behavioral Addictions*, 10(2), 302–313. <https://doi.org/10.1556/2006.2021.00011>.
- Trotzke, P., Müller, A., Brand, M., Starcke, K., & Steins-Loeber, S. (2020). Buying despite negative consequences: Interaction of craving, implicit cognitive processes, and inhibitory control in the context of buying-shopping disorder. *Addictive Behaviors*, 110, 106523. <https://doi.org/10.1016/j.addbeh.2020.106523>.
- Turel, O., & Serenko, A. (2020). Cognitive biases and excessive use of social media: The facebook implicit associations test (FIAT). *Addictive Behaviors*, 105, 106328. <https://doi.org/10.1016/j.addbeh.2020.106328>.
- Vaccaro, A. G., & Potenza, M. N. (2019). Diagnostic and classification considerations regarding gaming disorder: Neurocognitive and neurobiological features. *Frontiers in Psychiatry*, 10, 405. <https://doi.org/10.3389/fpsy.2019.00405>.
- van den Eijnden, R. J., Lemmens, J. S., & Valkenburg, P. M. (2016). The social media disorder scale. *Computers in Human Behavior*, 61, 478–487. <https://doi.org/10.1016/j.chb.2016.03.038>.
- van Holst, R. J., Lemmens, J. S., Valkenburg, P. M., Peter, J., Veltman, D. J., & Goudriaan, A. E. (2012). Attentional bias and disinhibition toward gaming cues are related to problem gaming in male adolescents. *The Journal of Adolescent Health : Official Publication of the Society for Adolescent Medicine*, 50(6), 541–546. <https://doi.org/10.1016/j.jadohealth.2011.07.006>.
- Vogel, B., Trotzke, P., Steins-Loeber, S., Schäfer, G., Stenger, J., Zwaan, M. de, ... Müller, A. (2019). An experimental examination of cognitive processes and response inhibition in patients seeking treatment for buying-shopping disorder. *PloS One*, 14(3), e0212415. <https://doi.org/10.1371/journal.pone.0212415>.
- Wadsley, M., & Ihssen, N. (2022). The roles of implicit approach motivation and explicit reward in excessive and problematic use of social networking sites. *PloS One*, 17(3), e0264738. <https://doi.org/10.1371/journal.pone.0264738>.
- Wiers, R. W., & Stacy, A. W. (2006). Implicit cognition and addiction. *Current Directions in Psychological Science*, 15(6), 292–296. <https://journals.sagepub.com/doi/pdf/10.1111/j.1467-8721.2006.00455.x>.
- Wiers, C. E., Stelzel, C., Park, S. Q., Gawron, C. K., Ludwig, V. U., Gutwinski, S., ... Bermpohl, F. (2014). Neural correlates of alcohol-approach bias in alcohol addiction: The spirit is willing but the flesh is weak for spirits. *Neuropsychopharmacology*, 39(3), 688–697. <https://doi.org/10.1038/npp.2013.252>.
- World Health Organization. (2019). *ICD-11 for mortality and morbidity statistics* (06/17).
- Yen, J.-Y., Yen, C.-F., Chen, C.-S., Tang, T.-C., Huang, T.-H., & Ko, C.-H. (2011). Cue-induced positive motivational implicit response in young adults with Internet gaming addiction. *Psychiatry Research*, 190(2–3), 282–286. <https://doi.org/10.1016/j.psychres.2011.07.003>.
- Zech, H. G., Gable, P., van Dijk, W. W., & van Dillen, L. F. (2022). Test-retest reliability of a smartphone-based approach-avoidance task: Effects of retest period, stimulus type, and demographics. *Behavior Research Methods*, 1–17. <https://doi.org/10.3758/s13428-022-01920-6>.
- Zhao, J., Zhou, Z., Sun, B., Zhang, X., Zhang, L., & Fu, S. (2022). Attentional bias is associated with negative emotions in problematic users of social media as measured by a dot-probe task. *International Journal of Environmental Research and Public Health*, 19(24), 16938. <https://doi.org/10.3390/ijerph192416938>.
- Zhou, X., Rau, P.-L. P., Yang, C.-L., & Zhou, X. (2021). Cognitive behavioral therapy-based short-term abstinence intervention for problematic social media use: Improved well-being and underlying mechanisms. *The Psychiatric Quarterly*, 92(2), 761–779. <https://doi.org/10.1007/s1126-020-09852-0>.

