



Self-regulatory Processes in Problematic Pornography Use

Kjell Büsche^{1,2} · Rudolf Stark^{3,4,5,6} · Matthias Brand^{1,2} · Stephanie Antons^{1,2}

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Abstract

Purpose of Review A core symptom of problematic pornography use (PPU) is the repeated failure to control sexual impulses resulting in pornography use; however, the field of self-regulation research has rarely been applied to PPU.

Recent Findings Various goals can underly the use of online pornography. These goals can conflict with other self-regulatory goals a person holds, which leads to moments of self-control. The outcome of such self-control moments depends on multiple internal factors, including the strength of the desire to use pornography, whether a person perceives a conflict with their behaviour, and the motivation to resist their desire, as well as external, situational factors. Findings on the contribution of volition towards self-regulation in PPU are inconclusive.

Summary More research is needed to further explore what influences moments of self-control, specifically in PPU. The proposed model of self-control moments can be used to derive research questions for further studies as well as to develop prevention and intervention approaches.

Keywords Self-control · Impaired control · Online pornography · Compulsive sexual behavior disorder · Behavioural goals

Introduction

Compulsive sexual behaviour disorder (CSBD), included in the eleventh revision of the International Classification of Diseases (ICD-11) as an impulse control disorder, is characterized by a “*persistent pattern of failure to control intense repetitive sexual impulses or urges resulting in repetitive sexual behaviour*” [1]. The resulting sexual

behaviour causes significant distress or impairment in several areas of everyday life but is continued or even escalated despite experiencing negative consequences or gaining little satisfaction from it. The most commonly shown sexual behaviour in CSBD is the excessive use of pornography, often referred to as problematic pornography use (PPU) [2, 3]. For the purpose of this review, we will primarily focus on PPU as one expression of CSBD but occasionally generalize to CSBD when applicable. While PPU in principle encompasses both online and offline pornography, the problematic use of online pornography may be more prevalent because of the technological development that made online pornography highly accessible, affordable and anonymous [4]. As PPU shares features of addictions, some researchers consider PPU a disorder due to addictive behaviours, similar to gambling and gaming disorders [5]. Diminished control over impulses resulting in the behaviour is a central mechanism involved in the development and maintenance of PPU. This mechanism may manifest in the symptom of diminished control over the use of pornography that is assessed in most screening questionnaires with questions asking for unsuccessful efforts to control or significantly reduce the behaviour [6–9]. The current review aims at giving an overview on aspects contributing to diminished control in PPU through the lens of theories on self-control and self-regulation.

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✉ Stephanie Antons
stephanie.antons@uni-due.de

¹ General Psychology: Cognition and Center for Behavioral Addiction Research (CeBAR), University of Duisburg-Essen, Forsthausweg 2, 47057 Duisburg, Germany

² Erwin L. Hahn Institute for Magnetic Resonance Imaging, Essen, Germany

³ Department of Psychotherapy and Systems Neuroscience, Justus Liebig University, Giessen, Germany

⁴ Bender Institute for Neuroimaging (BION), Justus Liebig University, Giessen, Germany

⁵ Center for Mind, Brain and Behavior, Phillips University Marburg, Marburg, Germany

⁶ Center for Mind, Brain and Behavior, Justus Liebig University, Giessen, Germany

Self-control can be understood as one part of self-regulation processes and involves the ability to inhibit impulses in favour of long-term advantageous outcomes [10]. Some authors use the term self-control to describe the process of resolving conflicts between goals with short-term rewards and long-term rewards [11]. For example, in the context of pornography use, self-control means refraining from using pornography, even if short-term rewards are expected, when the use conflicts with other goals, such as being successful at work or avoiding problems in relationships. In accordance with this definition, self-control is needed in concrete situations of potential conflicts between goals. The broader concept of self-regulation, as defined by Inzlicht and colleagues [10], refers to a continuous process of identifying personal goals, working towards them, as well as monitoring the process while doing so. Reduced self-control and self-regulation may contribute to moments of self-control failures in specific situations and may therefore cause the development of the symptom/characteristic of diminished control over the consumption of pornography in PPU.

Conflicting Goals in PPU

Goals that can be achieved by using pornography can be manifold, as can the goals that conflict with them. Many studies have investigated motivations for pornography use [12–15]. The motivations differ between goals that can be primarily reached by using pornography (e.g. sexual pleasure, sexual curiosity, self-exploration), also called approach motivations, and goals of avoiding a negative state by the use of pornography (e.g. boredom avoidance, emotional distraction, stress reduction), also called avoidance motivations [16]. The frequency of pornography use and symptoms of PPU have been associated with both approach and avoidance motivations. The association with the frequency of pornography use is, however, stronger for approach motivations, and the symptom severity of PPU seems to be associated more strongly with avoidance motivations [12, 17]. This might indicate that diminished control over pornography use may especially be present if pornography is used with the aim to avoid negative states.

Studies identifying goals that conflict with the aim to engage in sexual behaviour are rare. Some studies simply assume conflicts because the behaviour in question is either unlawful (e.g. sexting among minors [18]) or because a moral objection to certain sexual behaviours is implied [19, 20]. There are studies that report that PPU is associated with increased levels of moral incongruency [20, 21]. Accordingly, it can be assumed that one common goal that conflicts with the aim of using pornography is the congruency with their own moral values. From reports of patients seeking treatment for PPU or CSBD in general, the negative

consequences they experienced were related to the disruption of family life, mental disorders (e.g. depressive symptoms), sleeplessness and reduced interest in other recreational activities as well as losing friends [2, 22]. This may imply that goals conflicting with engaging in sexual activities are related to harmonious and close relationships, being healthy or pursuing other recreational interests. However, this needs to be confirmed in future studies.

Within the goal-systems theory by Kruglanski et al. [23], it is assumed that goals and their associated ways to attain the goals (called means) make up a hierarchical interconnected goal system. Following this theory, the strength of these interconnections drives one's behaviours. In the context of PPU, experiencing sexual pleasure or avoiding boredom are goals that can be achieved by the means of pornography use. Notably, avoidance goals (e.g. boredom avoidance, stress reduction) are goals that could generally be achieved by other means as well (e.g. meeting a friend). The question remains why individuals with PPU keep using pornography to avoid negative feelings even though other potential means may also result in reaching the goal of avoidance. The goal-systems theory seems useful to answer this question theoretically. First, means that are very effective or most instrumental to reach a goal are preferentially selected. Individuals with PPU may have experienced that using pornography is most effective for achieving their goals, which may be consolidated on the basis of reinforcement learning and conditioning processes [24]. Second, a small number of alternative means to reach the goal is assumed to increase the likelihood to use one specific available means. Individuals at risk of developing PPU may have a reduced number of potential ways to achieve goals such as avoiding boredom or experiencing sexual pleasure. For example, it has been shown that individuals with PPU/CSBD score lower on extraversion [25] and higher on attachment-related avoidance than healthy controls [26]. Low extraversion and high attachment avoidance might be associated with greater difficulty to build relationships with others which may relate to reduced availability of alternative means to reach these goals. In addition, it has been shown that individuals with PPU/CSBD use more dysfunctional coping strategies and emotion regulation strategies (e.g. less reappraisal, more self-depreciation or blaming others) [26–29]. In contrast, active coping strategies (e.g. seeking social support, problem-focused coping) were related to a reduced risk of showing symptoms of CSBD, including PPU [30]. This may hint to the fact that the number of alternative means beyond engaging in sexual behaviour is reduced in individuals with PPU. Due to a lack of longitudinal studies, it is unclear whether individuals with PPU already have had a reduced number of alternative means before developing symptoms, whether the number of alternative means decreased during the course of the disorder, or both. The third explanation

given by the goal-systems theory is that the probability that a certain means is used may increase with the number of goals it serves. It is possible that individuals with PPU have multiple goals (both reward-related and avoidance-related) that can be effectively approached by using pornography.

In summary, it can be assumed that the use of pornography is one way of reaching specific approach and avoidance goals. The use of pornography may conflict with other goals of an individual; however, research on the concrete types of conflicting goals is scarce. Using pornography as means for other goals may manifest itself, if it is a highly effective means, if there are few alternative means or if the use of pornography serves multiple goals. Although research indicates that all three assumptions on the manifestation could be supported, more research is needed to fully understand the system of goals and means in PPU.

Moments of Self-control Failures

In moments of self-control failures, multiple mechanisms act in concert leading to the use of pornography despite experiencing negative consequences. The Preventive-Interventive Model of Self-Control (PI-Model) by Hofmann and Kotabe [31] is a theoretical framework summarizing six components of self-control situations (desire, conflict, control motivation, volition, opportunity constraints, and behaviour enactment) that allow the identification of types of self-control failures as well as preventive and interventive self-regulation strategies. In the following section, we will discuss the six components in the context of current research in the field of PPU and illustrate strategies that might be used to affect them.

Desire

Desire in general describes a strong motivation to behave in a specific manner. In the context of addiction research, the strong desire to consume a drug or execute an addictive behaviour is frequently referred to as craving [32]. A cognitive process that is assumed to be crucially involved in the emergence of cravings is desire thinking [33]. Desire thinking includes processes of imaginal prefiguration and verbal perseveration and is strongly associated with a craving for pornography [34]. Although desire thinking and craving can be understood as distinct but interrelated constructs [35], both can be subsumed under the *Desire* component included in the PI-Model. Various studies have shown that individuals with PPU show an increased general sexual motivation and baseline craving [29, 36, 37]. The subjectively perceived craving increases when individuals with PPU are confronted with cues related to sexual activity (cue-reactivity) [38, 39]. Negative mood and stress could also function as internal

triggers for craving [40]. Individuals with PPU may show an attentional bias towards these cues which could enhance cue-reactivity and craving responses [38]. Mediated by craving, attentional biases may contribute to the symptoms of PPU and diminished control over pornography use. Cue-reactivity and craving have been associated with increased activity of the brain's reward system [41–43], which is consistent with dual process models of addiction and self-control [44]. Furthermore, the process model of self-control by Duckworth et al. [11] describes three steps that may result in behaviour enactments which broadly overlap with the mechanisms described for PPU: situation (e.g. presence of a cue), attention (e.g. attentional bias towards the cue) and appraisal (e.g. experiencing craving).

Accordingly, research on PPU indicates that an increased desire to use pornography may be a core component leading to diminished control over the behaviour in a specific situation. Mechanisms of cue-reactivity and attentional biases may significantly contribute to the increased desire.

When considering strategies that may help individuals to reduce the desire to use pornography in a certain situation, avoiding such cues or situations in which they are expected to occur might be among the most effective preventive self-regulatory strategies [11, 31]. For example, software could restrict search results or hide advertisements to avoid stumbling across suggestive content while online. As an interventive strategy to reduce desire, a person might try to allocate their attention to other things or may try to mindfully accept desire as has been shown to be effective for other problematic behaviours on the internet, such as online gaming or gambling [45].

Conflict

Conflict, or rather the perception of a conflict, is the second component. Only when a desire conflicts with other goals of an individual, it turns into a temptation that needs to be controlled. To identify a conflict, the individual needs to perceive an inconsistency between anticipated consequences resulting from enacting in the desired behaviour and the goals or values the person is committed to. Accordingly, conflict monitoring and self-monitoring are needed [46].

A study by Schiebener et al. [47] showed that individuals with increased symptoms of PPU had more difficulties with balancing the work on two different tasks in parallel, of which one task included pornographic images. While it was expected that individuals with higher symptom severity worked more intensively on the task with the pornographic images and neglected the other task, results indicated that individuals with higher symptom severity either focused on one task or the other. Accordingly, they were less able to balance their efforts on both tasks. One reason for this result could be that individuals with increased PPU severity had

reduced monitoring capacities which could be an indicator that individuals with PPU have less abilities to recognize a conflict.

A fundamental question is whether individuals with PPU in a state of craving perceive a conflict at all. Addiction theories argue that especially in later stages of the disorder, the behaviour becomes habitualized and mainly automatic [48, 49]. These automatic processes may bypass cognition; and therefore, individuals might not recognize a conflict. First, indicators for increased automatized processes are implicit approach tendencies as measured with the approach-avoidance task. Higher approach tendencies towards pornography-related cues in individuals with higher symptom severity have been found [36, 50, 51]. However, Snagowski et al. [50] not only found higher approach tendencies to be associated with symptom severity but also avoidance tendencies, which could be an indicator for an implicit conflict between goals. Although research supports that individuals with PPU experience a loss of control over their behaviour, experience negative consequences due to the pornography use and often report negative emotions after indulging in the behaviour [40], it is not clear if individuals with PPU actually do perceive a conflict in an acute state of craving. It should be mentioned that some individuals might experience a conflict entirely due to an incongruity with moral values although the pornography use itself is neither excessive nor resulting from overwhelming desires. An individual might experience these situations as dysregulated although the behavioural pattern is inconspicuous. As considered in the diagnostic criteria for CSBD within the ICD-11, this form of dysregulation needs to be differentiated from the behavioural patterns shown in the context of PPU and CSBD as it may underly different mechanisms [52]. Thus, identifying whether and why individuals experience a conflict may be important to understand diminished control in PPU.

Up to now, no final statement can be given on whether individuals with PPU experience a conflict during a state of craving. Increasing monitoring competencies would help individuals to regain control over their behaviour [53]. As proposed by Hofmann and Kotabe [31], the installation of reminders of conflict as a preventive strategy could also help individuals to identify potential conflict situations. Pictures of one's spouse or a wedding ring might serve as reminders of an agreement or an interpersonal conflict with the partner about one's pornography use.

Control Motivation

The presence of a conflict and the priority of the goal to regulate the behaviour are central factors that contribute to the strength of control motivation, the third component of the PI-Model. It describes the formation of an intent to resist temptation. The motivation to control the behaviour

in a certain situation might be especially high when it is an intrinsic (want-to) motivation [54]. However, in a moment of temptation, a re-evaluation of either the negative consequences or the benefits of indulging in the behaviour may reduce the control motivation. Individuals may still be aware that they shouldn't engage in a certain behaviour; however, the underlying reason such as the competing goal can be downplayed to a degree, where indulging seems like a reasonable decision. Cognitive biases such as increased pornography-related use expectancies [52] may be relevant in this context, as it has been shown for other addictive behaviours, such as online gaming [55–57]. Similarly, the anticipated rewards for indulging can be exaggerated to a point where they outweigh the negative consequences. In this context, it has been shown that reward anticipation for sexual rewards is increased in individuals with PPU [58, 59]. Besides these more implicit processes, explicit justifications could also result in motivational self-control failures. De Witt Huberts et al. [60] describe how individuals use justifications to temporarily abandon their self-regulatory goals. Incidentally, the most common justifications generally justify indulgence either as a reward for desirable behaviour, or as compensation for unpleasant experiences [60], which mirrors the previously discussed approach and avoidance goals of sexual behaviour. A person who holds the goal of remaining abstinent from watching pornography might, for example, justify the use of pornography as compensation for an especially stressful week, or as a well-deserved reward for academic achievement, or even for prolonged successful abstinence. Another reason for motivational self-control failure might be a person's poor self-efficacy expectations in a certain situation, as self-efficacy has been found to, at least partially, mediate the effect of impulse control on substance use behaviour [61] and is assumed to also play a role in PPU [62]. Hofmann and Kotabe [31] suggest that the anticipation of a potentially effortful act of volitional self-control combined with doubt in one's ability to successfully resist temptation might dissuade a person from even attempting to resist.

Anticipating such motivational self-control failures, a person might pre-emptively take measures to reaffirm their commitment, such as self-contracts or public declarations of intent as suggested by Hofmann and Kotabe [31]. Such commitments are commonly used in interventions for PPU and CSBD [63–65]. Being aware and reminded of the negative consequences of using pornography as well as of cognitive biases and common justifications may help individuals to increase their want-to-regulate motivation. Increasing the motivation to regulate the behaviour is another method often used in treatments for PPU and CSBD [66–70]. In addition, increasing the level of self-efficacy by training or cognitive-behaviour interventions may help individuals with PPU to regain control over their behaviour [70].

Volition

Once a person is aware of a conflict and is motivated to resist the temptation, abstaining from that action becomes a question of willpower or *volition*, the fourth interventive component of the model. Volition includes both the control capacity and persistence, and, together with the motivational component, constitutes the core of in-the-moment self-control. Willpower has been defined as the ability to inhibit unwanted impulses [71]. In theories on ego depletion [71], it is assumed that self-control is predominantly a result of effortful inhibition. It is reported that individuals with PPU may experience abstinence as hard work that requires immense effort and willpower to maintain [72]. The ego-depletion theory has been widely discussed, [73] and more current works assume that willpower and inhibitory control is one component of self-regulation and self-control but probably not the most important component [10, 74].

Research on inhibitory control in PPU has been reviewed by Castro-Calvo et al. [75]. Overall, symptoms of PPU seem to be associated with performance in inhibitory control tasks. While Seok and Sohn [76] reported the expected decrease in inhibition in participants with PPU, the results from Antons and Brand [77] unexpectedly indicated a better inhibitory control performance in participants with higher symptom severity; another study by Antons and Brand [78] found no relation between severity of PPU and inhibitory control. Within the model by Jones et al. [79] it is assumed that despite a stable ability to control impulses, the strength of inhibitory control in a certain situation may highly depend on situational factors such as the presence of addiction-related cues, motivational biases or effects of ego-depletion. The inconsistent results of inhibitory control studies in the context of PPU may be explained by these situational influences. However, more research is needed to understand whether individuals with PPU have difficulties with inhibiting their impulses. If individuals with PPU show reduced inhibitory control abilities in situations of temptation, inhibitory control training might be a useful tool to decrease the risk of self-control failures [80].

Opportunity Constraints

Even if all interventive self-control components fail, behaviour enactment can still be prevented by *opportunity constraints*. Opportunity constraints are situational factors out of a person's immediate control that prevent certain behaviours. These include most prominently the unavailability of the object of someone's desire but also "weaker" constraints such as monetary restrictions, time restrictions and social barriers [31]. A strip club might be closed, or no sexual partner might be available which would prevent the specific sexual behaviour from occurring. Online pornography,

however, poses a special case in that it is easily available almost anytime and anywhere. Not only, does the internet provide almost unlimited access to sexual material, but it also does so with a high degree of affordability and anonymity [4]. As online pornography is often accessible for free, financial restrictions might play less of a role than in other behaviours, and the anonymity of the internet can reduce the fear of judgement that might have dissuaded someone from accessing pornographic material offline. While there are few barriers to access online pornography, time constraints and being in a situation where it would be inappropriate, such as at work, might still discourage pornography consumption. However, especially in addiction, these might not suffice to prevent behaviour but rather contribute to the adverse financial, social or professional consequences that are often associated with uncontrolled behaviours. For example, Wéry et al. [2] reported that 8.5% of a sample of self-identified sexual addicts admitted to engaging in sexual behaviour at work, and 6.4% reported losing a job as a consequence of their behaviour.

Besides them simply constraining behaviour, we also suggest the possibility that the awareness of the opportunity constraints might influence other components of the PI-Model. An awareness of the ease of access might make the consumption of online pornography a more salient means according to the goal systems theory by Kruglanski et al. [23] and thus give rise to desire. Similarly, the awareness of strong opportunity constraints might increase one's self-efficacy beliefs and thus reduce the likelihood of a motivational self-control-failure.

While opportunity constraints are outside of a person's immediate control, they can also result from a person's preventive self-control strategies. We already addressed stimulus and situation control as strategies to prevent desire from arising, but taken further, they can also be used to limit a person's options of behaviour enactment, an approach that is of course much more difficult to apply to something as widely available as online pornography.

Behaviour Enactment

Behaviour enactment is the last component of the PI-Model and the cumulation of all the previous components. It indicates whether self-control was successful and no sexual behaviour occurred, or whether a self-control-failure led to the use of pornography or some other sexual behaviour. Together with previous components, it further allows the distinction between different types of self-control-failures, based on whether the behaviour resulted from a failure to identify a conflict (self-monitoring failure), a lack of intent to resist the temptation (motivational self-control failure) or a lack of capacity to resist (volitional self-control failure) [31]. True resistance to temptation occurs only if a person correctly

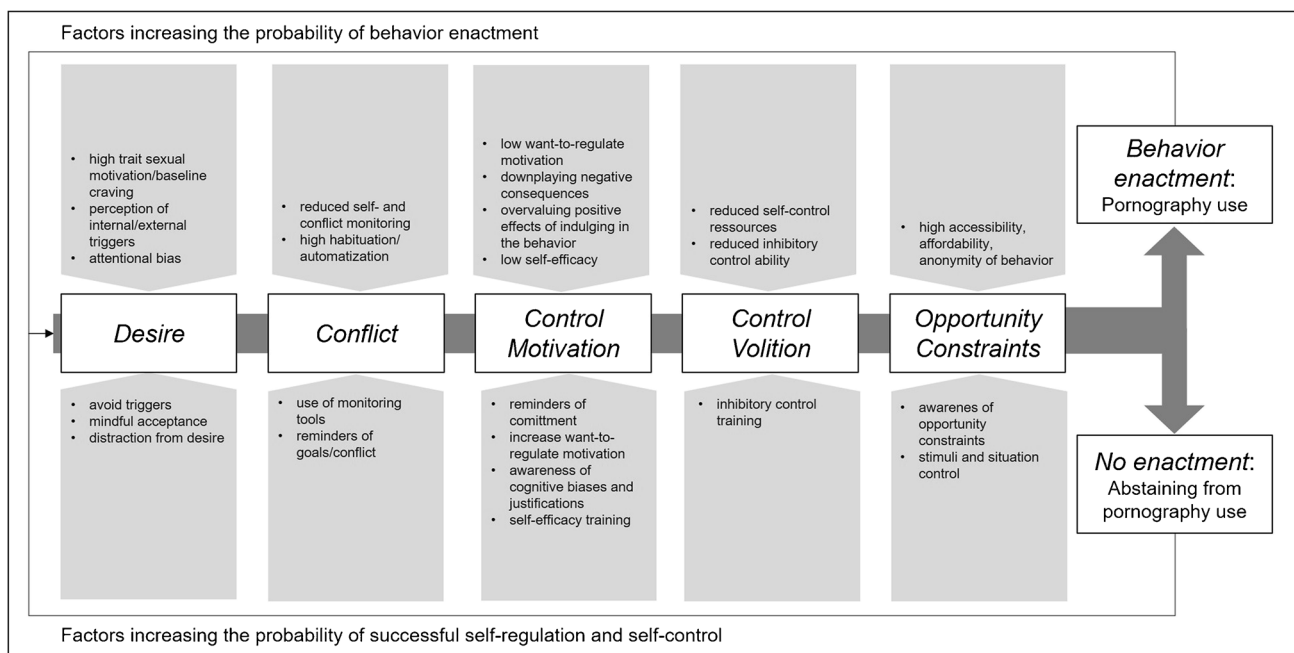


Fig. 1 Theoretical model explaining moments of self-control over pornography use, based on the Preventive-Interventive Model of self-control [31]

identifies a conflict, decides to resist it, and successfully does so. However, situational constraints might prevent enactment even if the person does not truly manage to resist temptation.

Even in the case of self-control failure, the use of pornography might initially be associated with experiences of gratification or compensation [81], that is, the fulfilment of approach or avoidance goals. These generally pleasant consequences reinforce pornography use, while negative reinforcement (e.g. avoiding negative mood through pornography use) may form coping mechanisms and thus affect future self-control situations [49]. However, with increasing compulsivity of pornography use, self-control failures might be increasingly associated with negative emotional reactions and thoughts [40], which might trigger the desire for further, compensatory pornography use.

Conclusion

Although most processes summarized in the current review have been described in previous models on the development and maintenance of addictive behaviours including PPU [e.g. 49], the current review adds to these models by focusing on concrete situations of self-control failures in the context of PPU and how these could be avoided. Based on these findings, we modified and extended the model by Hofmann and Kotabe [31] in Fig. 1.

The model should be used to derive hypotheses for future studies and approaches to develop preventive and interventive self-regulation strategies. Ambulatory assessments and new data-tracking technologies could be informative methods to get a better understanding of momentary processes involved in moments of impaired control in PPU. Overall, the review could show that despite many factors that increase the risk of diminished control over pornography use, there are also considerable preventive and interventive strategies that could help individuals with PPU to regain control.

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Declarations

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References

- World Health Organization: International statistical classification of diseases and related health problems (11th Revision). 2020. <https://icd.who.int/browse11/l-m/en>. Accessed 09.04.2021.
- Wéry A, Vogelaere K, Challet-Bouju G, Poudat FX, Caillon J, Lever D, et al. Characteristics of self-identified sexual addicts in a behavioral addiction outpatient clinic. *J Behav Addict*. 2016;5(4):623–30. <https://doi.org/10.1556/2006.5.2016.071>.
- Reid RC, Carpenter BN, Hook JN, Garos S, Manning JC, Gilliland R, et al. Report of findings in a DSM-5 field trial for hypersexual disorder. *J Sex Med*. 2012;9(11):2868–77. <https://doi.org/10.1111/j.1743-6109.2012.02936.x>.
- Cooper A. Sexuality and the internet: surfing into the new millennium. *Cyberpsychol Behav*. 1998;1(2):187–93. <https://doi.org/10.1089/cpb.1998.1.187>.
- Brand M, Rumpf H-J, Demetrovics Z, Müller A, Stark R, King DL, et al. Which conditions should be considered as disorders in the International Classification of Diseases (ICD-11) designation of “other specified disorders due to addictive behaviors”? *J Behav Addict*. 2020; Online ahead of print. <https://doi.org/10.1556/2006.2020.00035>.
- Grubbs JB, Sessoms J, Wheeler DM, Volk F. The cyber-pornography use inventory: the development of a new assessment instrument. *Sex Addict Compuls*. 2010;17(2):106–26.
- Reid RC, Li DS, Gilliland R, Stein JA, Fong T. Reliability, validity, and psychometric development of the pornography consumption inventory in a sample of hypersexual men. *J Sex Marital Ther*. 2011;37(5):359–85. <https://doi.org/10.1080/0092623X.2011.607047>.
- Bóthe B, Tóth-Király I, Zsila Á, Griffiths MD, Demetrovics Z, Orosz G. The development of the problematic pornography consumption scale (PPCS). *J Sex Res*. 2018;55(3):395–406.
- Kraus SW, Gola M, Grubbs JB, Kowalewska E, Hoff RA, Lew-Starowicz M, et al. Validation of a brief pornography screen across multiple samples. *J Behav Addict*. 2020;9(2):259–71. <https://doi.org/10.1556/2006.2020.00038>.
- Inzlicht M, Werner KM, Briskin JL, Roberts BW. Integrating models of self-regulation. *Annu Rev Psychol*. 2021;72:319–45. <https://doi.org/10.1146/annurev-psych-061020-105721>. **Overview over self-regulation theories as well as terminology.**
- Duckworth AL, Gendler TS, Gross JJ. Situational strategies for self-control. *Perspect Psychol Sci*. 2016;11(1):35–55. <https://doi.org/10.1177/1745691615623247>.
- Bóthe B, Tóth-Király I, Bella N, Potenza MN, Demetrovics Z, Orosz G. Why do people watch pornography? The motivational basis of pornography use. *Psychol Addict Behav*. 2021;35(2):172–86. <https://doi.org/10.1037/adb0000603>. **Explores goals and motivations underlying pornography use.**
- de Oliveira L, Carvalho J. The link between boredom and hypersexuality: a systematic review. *J Sex Med*. 2020;17(5):994–1004. <https://doi.org/10.1016/j.jsxm.2020.02.007>.
- Levin ME, Lee EB, Twohig MP. The role of experiential avoidance in problematic pornography viewing. *Psychol Rec*. 2019;69(1):1–12. <https://doi.org/10.1007/s40732-018-0302-3>.
- Brahim FB, Rothen S, Bianchi-Demicheli F, Courtois R, Khazaal Y. Contribution of sexual desire and motives to the compulsive use of cybersex. *J Behav Addict*. 2019;8(3):442–50. <https://doi.org/10.1556/2006.8.2019.47>.
- Elliot AJ. Approach and avoidance motivation and achievement goals. *Educ Psychol*. 1999;34(3):169–89. https://doi.org/10.1207/s15326985ep3403_3.
- Grubbs JB, Wright PJ, Braden AL, Wilt JA, Kraus SW. Internet pornography use and sexual motivation: a systematic review and integration. *Ann Int Commun Assoc*. 2019;43(2):117–55.
- Lee C-H, Moak S, Walker JT. Effects of self-control, social control, and social learning on sexting behavior among South Korean youths. *Youth Soc*. 2013;48(2):242–64. <https://doi.org/10.1177/0044118x13490762>.
- Grubbs JB, Kraus SW, Perry SL. Self-reported addiction to pornography in a nationally representative sample: the roles of use habits, religiousness, and moral incongruence. *J Behav Addict*. 2019;8(1):88–93. <https://doi.org/10.1556/2006.7.2018.134>.
- Lewczuk K, Glica A, Nowakowska I, Gola M, Grubbs JB. Evaluating pornography problems due to moral incongruence model. *J Sex Med*. 2020;17(2):300–11. <https://doi.org/10.1016/j.jsxm.2019.11.259>.
- Grubbs JB, Perry SL. Moral incongruence and pornography use: a critical review and integration. *J Sex Res*. 2019;56(1):29–37. <https://doi.org/10.1080/00224499.2018.1427204>.
- Wéry A, Schimmenti A, Karila L, Billieux J. Where the mind cannot dare: a case of addictive use of online pornography and its relationship with childhood trauma. *J Sex Marital Ther*. 2018;45(2):1–35. <https://doi.org/10.1080/0092623x.2018.1488324>.
- Kruglanski AW, Shah JY, Fishbach A, Friedman R, Chun WY, Sleeth-Keppler D. A theory of goal systems. In: Zanna MP, editor. *Advances in experimental social psychology*, vol. 2. San Diego: London Elsevier; 2002. p. 331–78.
- Hogarth L. Controlled and automatic learning processes in addiction. In: Pickard H, Ahmed SH, editors. *The Routledge handbook of philosophy and science of addiction*. London, New York: Routledge; 2018. p. 325–38.
- Zilberman N, Yadid G, Efrati Y, Rassovsky Y. Who becomes addicted and to what? Psychosocial predictors of substance and behavioral addictive disorders. *Psychiatry Res*. 2020;291:113221. <https://doi.org/10.1016/j.psychres.2020.113221>.
- Engel J, Veit M, Sinke C, Heitland I, Kneer J, Hillemacher T, et al. Same same but different: a clinical characterization of men with hypersexual disorder in the Sex@Brain Study. *J Clin Med*. 2019;8(2):157. <https://doi.org/10.3390/jcm8020157>.
- Tonioni F, Mazza M, Autullo G, Pellicano GR, Aceto P, Catalano V, et al. Socio-emotional ability, temperament and coping strategies associated with different use of internet in internet addiction. *Eur Rev Med Pharmacol Sci*. 2018;22(11):3461–6. https://doi.org/10.26355/eurrev_201806_15171.
- Studer J, Marmet S, Wicki M, Gmel G. Cybersex use and problematic cybersex use among young Swiss men: associations with sociodemographic, sexual, and psychological factors. *J Behav Addict*. 2019;8(4):794–803. <https://doi.org/10.1556/2006.8.2019.69>.

29. Antons S, Müller SM, Wegmann E, Trotzke P, Schulte MM, Brand M. Facets of impulsivity and related aspects differentiate among recreational and unregulated use of Internet pornography. *J Behav Addict*. 2019;8(2):1–11. <https://doi.org/10.1556/2006.8.2019.22>.
30. Park JW, Kim DJ, Shin MH. The effect of stress on compulsive sexual behavior disorder: active coping strategy and self-control as mediators. *Psychiatry Investig*. 2021;18(10):997–1005. <https://doi.org/10.30773/pi.2021.0010>.
31. Hofmann W, Kotabe H. A general model of preventive and interventive self-control. *Soc Pers Psychol Compass*. 2012;6(10):707–22. <https://doi.org/10.1111/j.1751-9004.2012.00461.x>.
32. Tiffany ST, Wray JM. The clinical significance of drug craving. *Ann N Y Acad Sci*. 2012;1248(1):1–17. <https://doi.org/10.1111/j.1749-6632.2011.06298.x>.
33. Kavanagh DJ, Andrade J, May J. Imaginary relish and exquisite torture: the elaborated intrusion theory of desire. *Psychol Rev*. 2005;112(2):446.
34. Allen A, Kannis-Dymand L, Katsikitis M. Problematic internet pornography use: the role of craving, desire thinking, and metacognition. *Addict Behav*. 2017;70:65–71. <https://doi.org/10.1016/j.addbeh.2017.02.001>.
35. Brandtner A, Antons S, Cornil A, Brand M. Integrating desire thinking into the I-PACE model: a special focus on internet-use disorders. *Curr Addict Rep*. 2021;8(4):459–68. <https://doi.org/10.1007/s40429-021-00400-9>.
36. Stark R, Kruse O, Snagowski J, Brand M, Walter B, Klucken T, et al. Predictors for (problematic) use of Internet sexually explicit material: role of trait sexual motivation and implicit approach tendencies towards sexually explicit material. *Sex Addict Compuls*. 2017;24(3):180–202. <https://doi.org/10.1080/10720162.2017.1329042>.
37. Chen L, Ding C, Jiang X, Potenza MN. Frequency and duration of use, craving and negative emotions in problematic online sexual activities. *Sex Addict Compuls*. 2018;26(1):396–414. <https://doi.org/10.1080/10720162.2018.1547234>.
38. Pekal J, Laier C, Snagowski J, Stark R, Brand M. Tendencies toward internet pornography use disorder: differences in men and women regarding attentional biases to pornographic stimuli. *J Behav Addict*. 2018;7(3):574–83. <https://doi.org/10.1556/2006.7.2018.70>.
39. Snagowski J, Laier C, Duka T, Brand M. Subjective craving for pornography and associative learning predict tendencies towards cybersex addiction in a sample of regular cybersex users. *Sex Addict Compuls*. 2016;23(4):342–60. <https://doi.org/10.1080/10720162.2016.1151390>.
40. Wordecha M, Wilk M, Kowalewska E, Skorko M, Łapiński A, Gola M. “Pornographic binges” as a key characteristic of males seeking treatment for compulsive sexual behaviors: qualitative and quantitative 10-week-long diary assessment. *J Behav Addict*. 2018;7(2):433–44. <https://doi.org/10.1556/2006.7.2018.33>.
41. Brand M, Snagowski J, Laier C, Maderwald S. Ventral striatum activity when watching preferred pornographic pictures is correlated with symptoms of Internet pornography addiction. *Neuroimage*. 2016;129:224–32. <https://doi.org/10.1016/j.neuroimage.2016.01.033>.
42. Gola M, Draps M. Ventral striatal reactivity in compulsive sexual behaviors. *Front Psychiatry*. 2018;9:546. <https://doi.org/10.3389/fpsy.2018.00546>.
43. Voon V, Mole TB, Banca P, Porter L, Morris L, Mitchell S, et al. Neural correlates of sexual cue reactivity in individuals with and without compulsive sexual behaviours. *PLoS ONE*. 2014;9(7):e102419. <https://doi.org/10.1371/journal.pone.0102419>.
44. Bechara A. Decision making, impulse control and loss of will-power to resist drugs: a neurocognitive perspective. *Nat Neurosci*. 2005;8(11):1458–63. <https://doi.org/10.1038/nn1584>.
45. Brandtner A, Antons S, King DL, Potenza MN, Tang Y-Y, Blycker GR, et al. A preregistered, systematic review considering mindfulness-based interventions and neurofeedback for targeting affective and cognitive processes in behavioral addictions. *Clin Psychol*. 2022. <https://doi.org/10.1037/cps0000075>.
46. Carver CS, Scheier MF. Cybernetic control processes and the self-regulation of behavior. In: Ryan RM, editor. *The Oxford handbook of human motivation*. New York: Oxford University Press; 2012. p. 28–42.
47. Schiebener J, Laier C, Brand M. Getting stuck with pornography? Overuse or neglect of cybersex cues in a multitasking situation is related to symptoms of cybersex addiction. *J Behav Addict*. 2015;4(1):14–21. <https://doi.org/10.1556/JBA.4.2015.1.5>.
48. Everitt BJ, Robbins TW. Neural systems of reinforcement for drug addiction: from actions to habits to compulsion. *Nat Neurosci*. 2005;8(11):1481–9. <https://doi.org/10.1038/nn1579>.
49. Brand M, Wegmann E, Stark R, Müller A, Wöllfling K, Robbins TW, et al. 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. *Neurosci Biobehav Rev*. 2019;104:1–10. <https://doi.org/10.1016/j.neubiorev.2019.06.032>.
50. Snagowski J, Brand M. Symptoms of cybersex addiction can be linked to both approaching and avoiding pornographic stimuli: results from an analog sample of regular cybersex users. *Front Psychol*. 2015;6:653. <https://doi.org/10.3389/fpsyg.2015.00653>.
51. Sklenarik S, Potenza MN, Gola M, Kor A, Kraus SW, Astur RS. Approach bias for erotic stimuli in heterosexual male college students who use pornography. *J Behav Addict*. 2019;8(2):234–41. <https://doi.org/10.1556/2006.8.2019.31>.
52. Brand M, Antons S, Wegmann E, Potenza MN. Theoretical assumptions on pornography problems due to moral incongruence and mechanisms of addictive or compulsive use of pornography: are the two “conditions” as theoretically distinct as suggested? *Arch Sex Behav*. 2018;48(2):1–7. <https://doi.org/10.1007/s10508-018-1293-5>.
53. Gass JC, Funderburk JS, Shepardson R, Kosiba JD, Rodriguez L, Maisto SA. The use and impact of self-monitoring on substance use outcomes: a descriptive systematic review. *Subst Abus*. 2021;42(4):512–26. <https://doi.org/10.1080/08897077.2021.1874595>.
54. Milyavskaya M, Inzlicht M, Hope N, Koestner R. Saying, “no” to temptation: want-to motivation improves self-regulation by reducing temptation rather than by increasing self-control. *J Pers Soc Psychol*. 2015;109(4):677–93. <https://doi.org/10.1037/pspp0000045>.
55. Brand M, Laier C, Young KS. Internet addiction: coping styles, expectancies, and treatment implications. *Front Psychol*. 2014;5:1256. <https://doi.org/10.3389/fpsyg.2014.01256>.
56. Laier C, Wegmann E, Brand M. Personality and cognition in gamers: avoidance expectancies mediate the relationship between maladaptive personality traits and symptoms of internet-gaming disorder. *Front Psychiatry*. 2018;9:304. <https://doi.org/10.3389/fpsy.2018.00304>.
57. Wegmann E, Brand M. Internet-communication disorder: it’s a matter of social aspects, coping, and internet-use expectancies. *Front Psychol*. 2016;7:1747. <https://doi.org/10.3389/fpsyg.2016.01747>.
58. Draps M, Sescousse G, Wilk M, Obarska K, Szumska I, Żukrowska W, et al. An empirical study of affective and cognitive functions in compulsive sexual behavior disorder. *J Behav Addict*. 2021;10(3):657–74. <https://doi.org/10.1556/2006.2021.00056>.
59. Gola M, Wordecha M, Sescousse G, Lew-Starowicz M, Kossowski B, Wypych M, et al. Can pornography be addictive? An fMRI study of men seeking treatment for problematic pornography use. *Neuropsychopharmacology*. 2017;42(10):2021–31. <https://doi.org/10.1038/npp.2017.78>.

60. De Witt Huberts JC, Evers C, De Ridder DTD. “Because I am worth it”: a theoretical framework and empirical review of a justification-based account of self-regulation failure. *Pers Soc Psychol Rev.* 2013;18(2):119–38. <https://doi.org/10.1177/1088868313507533>.
61. Hayaki J, Herman DS, Hagerty CE, de Dios MA, Anderson BJ, Stein MD. Expectancies and self-efficacy mediate the effects of impulsivity on marijuana use outcomes: an application of the acquired preparedness model. *Addict Behav.* 2011;36(4):389–96. <https://doi.org/10.1016/j.addbeh.2010.12.018>.
62. Kraus SW, Rosenberg H, Martino S, Nich C, Potenza MN. The development and initial evaluation of the Pornography-Use Avoidance Self-Efficacy Scale. *J Behav Addict.* 2017;6(3):354–63. <https://doi.org/10.1556/2006.6.2017.057>.
63. Crosby JM, Twohig MP. Acceptance and commitment therapy for problematic Internet pornography use: a randomized trial. *Behav Ther.* 2016;47(3):355–66. <https://doi.org/10.1016/j.beth.2016.02.001>.
64. Twohig MP, Crosby JM. Acceptance and commitment therapy as a treatment for problematic internet pornography viewing. *Behav Ther.* 2010;41(3):285–95. <https://doi.org/10.1016/j.beth.2009.06.002>.
65. Levin ME, Heninger ST, Pierce BG, Twohig MP. Examining the feasibility of acceptance and commitment therapy self-help for problematic pornography viewing: results from a pilot open trial. *Fam J.* 2017;25(4):306–12. <https://doi.org/10.1177/1066480717731242>.
66. Hallberg J, Kaldo V, Arver S, Dhejne C, Öberg KG. A cognitive-behavioral therapy group intervention for hypersexual disorder: a feasibility study. *J Sex Med.* 2017;14(7):950–8. <https://doi.org/10.1016/j.jsxm.2017.05.004>.
67. Hallberg J, Kaldo V, Arver S, Dhejne C, Jokinen J, Öberg KG. A randomized controlled study of group-administered cognitive behavioral therapy for hypersexual disorder in men. *J Sex Med.* 2019;16(5):733–45. <https://doi.org/10.1016/j.jsxm.2019.03.005>.
68. Hallberg J, Kaldo V, Arver S, Dhejne C, Piwowar M, Jokinen J, et al. Internet-administered cognitive behavioral therapy for hypersexual disorder, with or without paraphilia(s) or paraphilic disorder(s) in men: a pilot study. *J Sex Med.* 2020;17(10):2039–54. <https://doi.org/10.1016/j.jsxm.2020.07.018>.
69. Orzack MH, Voluse AC, Wolf D, Hennen J. An ongoing study of group treatment for men involved in problematic internet-enabled sexual behavior. *Cyberpsychol Behav.* 2006;9(3):348–60. <https://doi.org/10.1089/cpb.2006.9.348>.
70. Bøthe B, Baumgartner C, Schaub MP, Demetrovics Z, Orosz G. Hands-off: feasibility and preliminary results of a two-armed randomized controlled trial of a web-based self-help tool to reduce problematic pornography use. *J Behav Addict.* 2021;10(4):1015–35. <https://doi.org/10.1556/2006.2021.00070>.
71. Baumeister RF. Self-regulation, ego depletion, and inhibition. *Neuropsychologia.* 2014;65:313–9. <https://doi.org/10.1016/j.neuropsychologia.2014.08.012>.
72. Sniewski L, Farvid P. Abstinence or acceptance? A case series of men’s experiences with an intervention addressing self-perceived problematic pornography use. *Sex Addict Compuls.* 2019;26(3–4):191–210. <https://doi.org/10.1080/10720162.2019.1645058>.
73. Milyavskaya M, Inzlicht M. What’s so great about self-control? Examining the importance of effortful self-control and temptation in predicting real-life depletion and goal attainment. *Soc Psychol Pers Sci.* 2017;8(6):603–11. <https://doi.org/10.1177/1948550616679237>.
74. Fujita K. On conceptualizing self-control as more than the effortful inhibition of impulses. *Pers Soc Psychol Rev.* 2011;15(4):352–66. <https://doi.org/10.1177/1088868311411165>.
75. Castro-Calvo J, Cervigón-Carrasco V, Ballester-Arnal R, Giménez-García C. Cognitive processes related to problematic pornography use (PPU): a systematic review of experimental studies. *Addict Behav Rep.* 2021;13:100345. <https://doi.org/10.1016/j.abrep.2021.100345>. **Important review of executive functions, including inhibitory control, in PPU.**
76. Seok J-W, Sohn J-H. Response inhibition during processing of sexual stimuli in males with problematic hypersexual behavior. *J Behav Addict.* 2020;9(1):71–82. <https://doi.org/10.1556/2006.2020.00003>.
77. Antons S, Brand M. Inhibitory control and problematic internet-pornography use—the important balancing role of the insula. *J Behav Addict.* 2020;9(1):58–70. <https://doi.org/10.1556/2006.2020.00010>.
78. Antons S, Brand M. Trait and state impulsivity in males with tendency towards internet-pornography-use disorder. *Addict Behav.* 2018;79:171–7. <https://doi.org/10.1016/j.addbeh.2017.12.029>.
79. Jones A, Christiansen P, Nederkoorn C, Houben K, Field M. Fluctuating disinhibition: implications for the understanding and treatment of alcohol and other substance use disorders. *Front Psychiatry.* 2013;4:140. <https://doi.org/10.3389/fpsy.2013.00140>.
80. Jones A, Di Lemma LCG, Robinson E, Christiansen P, Nolan S, Tudur-Smith C, et al. Inhibitory control training for appetitive behaviour change: a meta-analytic investigation of mechanisms of action and moderators of effectiveness. *Appetite.* 2016;97:16–28. <https://doi.org/10.1016/j.appet.2015.11.013>.
81. Laier C, Brand M. Mood changes after watching pornography on the internet are linked to tendencies towards internet-pornography-viewing disorder. *Addict Behav Rep.* 2017;5:9–13. <https://doi.org/10.1016/j.abrep.2016.11.003>.

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