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Mood changes after watching pornography on the Internet are linked to tendencies towards Internet-pornography-viewing disorder

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ABSTRACT

Internet-pornography-viewing disorder (IPD) is considered one type of Internet-use disorder. For IPD's development, it was assumed theoretically that a dysfunctional use of Internet pornography to cope with depressive mood or stress might be considered to be a risk factor. To address the effect of Internet pornography use on mood, an online study with three measuring points with a sample of male participants was conducted. Participants were investigated regarding their tendencies towards IPD, personal use of Internet pornography, general mood, perceived stress, and their Internet pornography use motivation. Moreover, participants were asked regarding their current mood, sexual arousal, and need to masturbate before and after they watched Internet pornography self-determinedly in a private environment. Data showed that tendencies towards IPD were associated negatively with feeling generally good, awake, and calm and were correlated positively with perceived stress in daily life and using Internet pornography for excitation seeking and emotional avoidance. Self-determined use of Internet pornography in their private environment was accompanied by changes in mood and indicators of sexual arousal. Moreover, tendencies towards IPD were negatively related to mood before and after Internet-pornography use as well as an actual increase of good and calm mood. The results showed effects of watching Internet pornography on mood and sexual arousal which can be considered having reinforcing effects for the user. Thus, the results are in line with theoretical assumptions on IPD's development, in which the positive (and negative) reinforcement received by Internet-pornography use is related to cue-reactivity and craving reactions.

1. Introduction

The potential positive and negative effects of watching pornography on the Internet are discussed controversially (Campbell & Kohut, 2016; Grubbs, Exline, Pargament, Volk, & Lindberg, 2016; Hald & Malamuth, 2008; Harkness, Mullan, & Blaszczynski, 2015; Peter & Valkenburg, 2014; Shaughnessy, Byers, Clowater, & Kalinowski, 2014; Stanley et al., 2016). It has become obvious that some individuals report a loss of control regarding their pornography use, which is frequently accompanied by increasing using times and negative consequences in several life domains, such as school/academic/job functioning (Duffy, Dawson, & das Nair, 2016; Griffiths, 2012; Wéry & Billieux, 2015). The addictive nature of sexual behaviors is still debated (Potenza, 2014), but many researchers argue that both watching pornography and sexual behaviors in general might be considered addictive (Brand, Young, & Laier, 2014; Garcia & Thibaut, 2010; Kraus, Voon, & Potenza, 2016; Love, Laier, Brand, Hatch, & Hajela, 2015). While some argue that addictive viewing of Internet pornography may be a specific form of sex addiction or hypersexuality (Garcia & Thibaut, 2010; Kafka, 2015), others argue that it should be classified as a specific type of Internet addiction (Laier & Brand, 2014; Young, 2008). Indeed pornography was shown to be the Internet application at risk for developing an addictive usage pattern (Meerkerk, van den Eijnden, & Garretsen, 2006). Because of the ongoing discussion on its phenomenology we use the term Internet-pornography-viewing disorder (IPD) in analogy to Internet-gaming disorder as used in the DSM-5 (APA, 2013). Since there is no agreement on the diagnostic criteria of IPD, the prevalence of the phenomenon can only be estimated. One study examined a sample representative from Sweden and found 2% of the female and 5% of the male participants reporting symptoms of IPD (Ross, Månsson, & Daneback, 2012).

With respect to the development of IPD it was argued that characteristics of the medium (e.g., reinforcing effects, anonymity, accessibility) contribute to the motivation to watch pornography (Cooper, Delmonico, Griffin-Shelley, & Mathy, 2004). With respect to the characteristics of the users, it was argued that individuals might be predisposed for the development of IPD symptoms by personal characteristics (e.g., high sexual excitability) and that these characteristics

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interact with cognitions related to pornography usage (e.g., positive use expectancies) (Laier & Brand, 2014). Due to the reinforcing effects in terms of sexual gratification by watching pornography, processes of conditioning should lead to the development of cue-reactivity and resulting craving reactions to internal or external addiction-related cues. Evidence for the important role of sexual arousal and craving reactions for IPD has been shown in several studies (Brand et al., 2011; Laier, Pawlikowski, Pekal, Schulte, & Brand, 2013; Laier, Pekal, & Brand, 2014, 2015; Rosenberg & Kraus, 2014; Snagowski, Wegmann, Pekal, Laier, & Brand, 2015). These findings are consistent with the assumption that particularly those individuals are prone to develop IPD who functionalize pornography consumption to cope with depressive mood or stress (Cooper, Putnam, Planchon, & Boies, 1999). This assumption has also been suggested in the I-PACE model of specific Internet-use disorders (I-PACE stands for Interaction of Person-Affect-Cognition-Execution) (Brand, Young, Laier, Wolfling, & Potenza, 2016). One hypothesis of the model is that current mood might influence the decision to use a specific Internet application (e.g., Internet pornography) and that the effects received by using the specific application should reinforce Internet-related cognitions. In addition, the idea and expectancy that the use of the Internet application is helpful to cope with stress or abnormal mood is also considered to be reinforced and a general dysfunctional coping style, as well. Personality characteristics and also psychopathological symptoms may be stabilized or intensified by the experiences during the addiction process. Although dysfunctional coping has been shown to be associated to IPD (Laier & Brand, 2014), the role of current mood and mood changes after watching pornography on the Internet for symptoms of IPD has not been investigated, so far. The aim of the study was to contribute to filling this research gap by addressing the following hypotheses in a sample of regular Internet-pornography users: 1.) Tendencies towards IPD are related with general mood and with perceived stress, 2.) Tendencies towards IPD are associated with current mood and with sexual arousal before and after Internet pornography use, 3.) Tendencies towards IPD are associated with changes in mood and sexual arousal due to Internet pornography use, and 4.) The relationship between tendencies towards IPD and the motivation to use Internet pornography is moderated by sexual arousal gained due to watching pornography. To address these hypotheses, an online field study with three measuring points was conducted.

2. Material and methods

2.1. Procedure

Participants were recruited through e-mail lists, social network sites, and advertisements at the University of Duisburg-Essen (Germany). The description indicated explicitly that the online study investigates Internet-pornography use and that only male individuals were invited to participate. Individuals interested in participation were asked to answer the invitation by e-mail and were then briefed via a detailed description of the study. The study was introduced as a survey with three measuring points. In the first part, participants gave information about sociodemographic variables, the personal use of the Internet for sexually motivated behaviors, subjectively perceived stress, and symptoms of IPD ($t1$). It was explained to the participants that if they should self-determinedly watch Internet pornography in their private environment for the next time, they were asked to answer questions regarding their current mood and sexual arousal before (second measuring point, $t2$) and after (third measuring point, $t3$) viewing Internet pornography. After the participants gave written informed consent they received tokens to match their data from the measuring points. All volunteers were invited to participate in a lottery to win one voucher from BestChoice (3 vouchers á 50€, 5 vouchers á 20€, 5 vouchers á 10 €). The data was checked for plausibility and no noticeable problems were observed. The study was approved by the local ethics committee.

2.2. Participants

The sample comprised 80 male individuals (M_{age} = 26.41 years, SD = 6.23, range: 18–55). Mean education was 12.90 years (SD = 0.45), 43 individuals (53.8%) indicated to have a partner. Forty-nine individuals described themselves as “heterosexual”, 12 as “rather heterosexual”, 5 as “bisexual”, 2 as “rather homosexual”, and 12 as “homosexual”. The number of participants using specific Internet applications and the mean time spent for these specific applications are shown in Table 1. Sixty-six participants of the sample completed the survey at $t2$ and $t3$. Mean age of this subsample was 25.91 (SD = 5.43). All individuals of the subsample indicated to use cybersex applications on a regular basis.

2.3. Questionnaires

At $t1$, symptoms of IPD, general mood, perceived stress, and Internet-pornography use motivation were assessed. Tendencies towards IPD were measured with the short-version of the Internet Addiction Test modified for sex (s-IATsex, Cronbach's α = 0.83) (Laier et al., 2013; Wéry, Burnay, Karila, & Billieux, 2015), which consists of the two subscales “loss of control/time management” (s-IATsex-1) and “social problems/craving” (s-IATsex-2). Twelve items were answered on a scale from 1 (=never) to 5 (=very often), which are summed up for the total score with high scores representing high tendencies towards or high symptoms of IPD, respectively. General mood was assessed with the Multidimensional Mood State Questionnaire (MDMQ, Cronbach's α = 0.94) (Steyer, Schwenkmezger, Notz, & Eid, 1997). Twenty-four items were answered on a scale from 1 (=not at all) 5 (=very), and mean scores of the subscales “good-bad” (MDMQ-good), “awake-tired” (MDMQ-awake), and “calm-nervous” (MDMQ-calm) were calculated. High scores represent rather good than bad, rather awake than tired, and rather calm than nervous mood. The Pornography Consumption Inventory (PCI, Cronbach's α = 0.83) was used to measure the four motivational dimensions of Internet-pornography use (Reid, Li, Gilliland, Stein, & Fong, 2011). Fifteen items were answered on a scale from 1 (=never like me) to 5 (=very often like me), and mean scores for the subscales “emotional avoidance” (PCI-EA), “sexual curiosity” (PCI-SC), “excitement seeking” (PCI-ES), and “sexual pleasure” (PCI-SP) were calculated. High scores represent high motivational relevance for Internet-pornography use. To indicate stress vulnerability, the screening version of the Trier Inventory for Chronic Stress (TICS, Cronbach's α = 0.92) was applied (Schulz, Schlotz, & Becker, 2004). The questionnaire asks for perceived stress exposure in the last three months with twelve items which have to be answered on a scale from 0 (=never) to 4 (=very often). A sum score was computed. High scores represent high perceived stress. Consistent with previous studies (Laier et al., 2014, 2015), individuals were asked whether or not they use specific Internet applications with a response format “yes/no”. If so, we asked how often (“less than once a year”, “at least once in a year and less than once each month”, “at least once a month

Table 1
Description of the sample's cybersexual activities. Mean scores and standard deviations refer to the time (min/week) spend to use a specific cybersex application.

	n	*M*	*SD*
Softcore pictures	55	28.96	45.04
Softcore videos	26	20.03	30.81
Hardcore pictures	55	46.01	61.89
Hardcore videos	75	116.15	171.66
Sex chats	12	71.96	131.38
Sex via Webcam	4	185.45	154.08
Live sex Shows	7	32.20	37.35

Note. Please note the number of participants using one (n = 8), two (n = 14), three (n = 8), four (n = 25), five (n = 12), six (n = 10), or seven (n = 3) of the inquired specific cybersex applications. All mean scores and standard deviations only refer to individuals who used a specific cybersex application weekly.

and less than each week", "at least once a week and less than once a day", "at least once a day") and for how long ("minutes per use") they use the cybersex application. Mean scores of the weekly spent time in minutes per each cybersex application were computed.

At *t*2 and *t*3, we assessed current mood and sexual arousal before and after watching Internet pornography. Therefore, we modified the instruction of the MDMQ from "Generally I feel…" into "Right now, I feel…" and asked the participants to answer the questionnaire at *t*2 (Cronbach's $\alpha = 0.91$) and at *t*3 (Cronbach's $\alpha = 0.93$). We computed mean scores of the MDMQ-good, MDMQ-awake, and the MDMQ-calm at *t*2 and *t*3. Moreover, delta scores ("*t*3" − "*t*2") were calculated to represent increase in good mood (Δ-good), awake mood (Δ-awake), and calm mood (Δ-calm). High scores represent strong increases in good, awake, or calm mood. As indicators of sexual arousal, participants indicated both their current sexual arousal on a scale from 0 = "not sexually aroused" to 100 = "very sexually aroused" as well as their need to masturbate from 0 = "no need to masturbate" to 100 = "very strong need to masturbate" at *t*2 and *t*3. Mean scores at *t*2 and *t*3 were calculated, high scores represent strong sexual arousal or need to masturbate. Two mean delta scores ("*t*2" − "*t*3") were calculated to represent the decrease of sexual arousal (Δ-Sexual arousal) and the decrease in the need to masturbate (Δ-Need to masturbate). High scores represent a strong decrease of sexual arousal and the need to masturbate. Moreover, participants were asked whether they experienced one or more orgasms and how satisfying they perceived the orgasm/s (scale from 0 = "not at all satisfying" to 100 = "very satisfying"). The perceived satisfaction with the orgasm/s was used as an indicator of gratification ("Sexual gratification").

3. Results

Descriptive results of the questionnaires are presented in Table 2. The mean sum score of the s-IATsex was 21.09 ($SD = 0.69$, range: 12–42). The s-IATsex correlated significantly with the MDMQ-good ($r = -0.32$, $p = 0.004$), MDMQ-awake ($r = -0.29$, $p = 0.009$), MDMQ-calm ($r = -0.30$, $p = 0.007$), the PCI-EA ($r = 0.48$, $p < 0.001$), the PCI-ES ($r = 0.40$, $p < 0.001$), and the TICS ($r = 0.36$, $p \leq 0.001$). The s-IATsex was not significantly correlated to the PCI-SC ($r = 0.01$, $p = 0.91$) and the PCI-SP ($r = 0.02$, $p = 0.85$).

From the subsample of 66 participants who completed also the survey at *t*2 and *t*3, 65 indicated that watching pornography online was accompanied by masturbation. Moreover, 61 of the participants experienced at least one orgasm while watching pornography and masturbating. Three individuals indicated to have experienced two, and two individuals indicated to have experienced three orgasms ($M = 1.11$, $SD = 0.41$). The four individuals who reported not to have experienced an orgasm were excluded from further analyses. In the remaining sample of 61 participants, the mean score of the overall s-IATsex score was $M = 20.59$, $SD = 6.59$. The mean score of the s-IATsex-1 was $M = 11.12$ ($SD = 4.70$), the mean score of the s-IATsex-2 was $M = 9.39$ ($SD = 2.79$). Mean scores of the MDMQ-good, MDMQ-awake, MDMQ-calm, the sexual arousal and the need to masturbate at *t*2 and *t*3 as well as the results of *t*-tests for dependent samples are presented in Table 3.

Table 2
Descriptive values of questionnaires assessed at *t*1.

$N = 80$	*M*	*SD*
s-IATsex-1	11.47	4.69
s-IATsex-2	9.61	3.21
MDMQ-good	3.89	0.88
MDMQ-awake	3.43	0.80
MDMQ-calm	3.56	0.78
PCI-EA	2.19	1.08
PCI-SC	2.52	0.94
PCI-ES	2.62	0.95
PCI-SP	4.08	0.71
TICS	1.41	0.87

Table 3
Descriptive results of the questionnaires measured at *t*2 and *t*3 as well as the results of *t*-tests for dependent variables.

$N = 61$	*t*2		*t*3		*t*	*p*	*d*[a]
	M	*SD*	*M*	*SD*			
MDMQ-good	3.91	0.90	4.14	0.77	3.22	**0.002****	0.18
MDMQ-awake	3.06	0.12	3.19	0.93	1.61	0.11	0.13
MDMQ-calm	3.74	0.85	4.20	0.56	5.23	<**0.001****	0.60
Sexual arousal	51.69	26.19	27.69	27.44	4.88	<**0.001****	0.89
Need to masturbate	75.67	23.24	7.61	17.35	20.38	<**0.001****	3.30

Significant *p*-values ($p < 0.05$) are presented in bold.
[a] Cohen's *d* for dependent samples.
** $p \leq 0.01$.

On average, the decrease in sexual arousal (Δ-Sexual arousal) was $M = 24.00$ ($SD = 38.42$), the decrease of the need to masturbate (Δ-Need to masturbate) was $M = 68.06$ ($SD = 26.08$). When subtracting *t*2 from *t*3, the increase in good mood (Δ-good) was $M = 0.23$ ($SD = 0.54$), the increase in awake mood (Δ-awake) was $M = 0.12$ ($SD = 0.59$), and the increase in calm mood (Δ-calm) was $M = 0.45$ ($SD = 0.68$). Pearson-correlations between the s-IATsex scores and the indicators of sexual arousal and mood at *t*2 and *t*3 are shown in Table 4.

To test interaction effects between motivational factors and the changes in indicators of sexual arousal and mood due to Internet pornography use in predicting tendencies towards IPD, we calculated a moderated regression analysis with centralized predictor variables (Cohen, Cohen, West, & Aiken, 2003). The s-IATsex sum score was the dependent variable. In the first step, PCI-ES explained 8.90% of the s-IATsex, $F(1, 59) = 5.79$, $p = 0.02$. Adding "Sexual gratification" (perceived satisfaction with orgasm) in the second step, variance explanation did not significantly increase, changes in $R^2 = 0.006$, changes in $F(1, 58) = 0.36$, $p = 0.55$. When entering the interaction of PCI-ES and "Sexual gratification", the explanation of the s-IATsex increased significantly, changes in $R^2 = 0.075$, changes in $F(1, 57) = 5.14$, $p = 0.03$. The overall explanation of the s-IATsex by the three predictors remained significant ($R^2 = 0.17$, $F(3, 57) = 3.89$, $p = 0.01$). For further values, see Table 5.

Given the significant interaction effect of PCI-ES and "Sexual gratification", we analyzed the simple slopes to address the moderating effect

Table 4
Pearson-correlations of the indicators of Internet-pornography-viewing disorder with the indicators of sexual arousal and mood before (*t*2) and following (*t*3) watching Internet in private environment.

$N = 61$	s-IATsex	s-IATsex-1	s-IATsex-2
*t*2			
Sexual arousal	0.13	0.16	0.02
Need to masturbate	−0.01	−0.03	0.02
*t*3			
Sexual arousal	−0.11	−0.12	−0.06
Need to masturbate	−0.06	0.06	−**0.25***
Δ-Sexual arousal	0.16	0.19	0.06
Δ-Need to masturbate	0.03	−0.07	0.19
*t*2			
MDMQ-good	−**0.40***	−**0.40****	−**0.27***
MDMQ-awake	−0.23	−0.23	−0.17
MDMQ-calm	−**0.41****	−**0.44****	−0.23
*t*3			
MDMQ-good	−**0.32***	−**0.28***	−**0.29***
MDMQ-awake	−0.14	−0.07	−0.22
MDMQ-calm	−**0.35****	−**0.30***	−**0.33****
Δ-good	0.21	**0.27***	0.04
Δ-awake	0.14	0.24	−0.09
Δ-calm	0.22	**0.31***	0.02

* $p \leq 0.05$ (correlation is significantly different from zero with alpha = 5%, two-tailed).
** $p \leq 0.01$ (correlation is significantly different from zero with alpha = 1%, two-tailed).

Table 5
Hierarchical regression analysis with s-IATsex sum score as dependent variable.

	β	T	p
Main effects "PCI-ES"	0.32	2.61	0.01
"Sexual gratification"	0.16	1.26	0.21
"PCI-ES × sexual gratification"	0.29	−2.27	0.02

in more detail. The slope of the regression line representing "low sexual gratification" (regression-based estimation for subjects one *SD* below the group's mean) was significantly different from zero ($t = 3.67$, $p = 0.001$). The slope of the regression line representing "high sexual gratification" (regression-based estimation for subjects one *SD* above the group's mean) was not significantly different from zero ($t = 0.48$, $p = 0.64$). This indicates that the sum score of the s-IATsex was higher if individuals had a high motivation to watch pornography online to seek for excitation independently from whether or not their perceived sexual gratification was high or low (see Fig. 1).

4. Discussion

4.1. General conclusions

The main results of the study are that tendencies towards IPD were associated negatively with feeling generally good, awake, and calm. They also correlated positively with perceived stress in daily life and the motivation to use Internet pornography in terms of excitation seeking and emotional avoidance. Moreover, it has been shown that watching Internet pornography self-determinedly in private environment was - unsurprisingly - accompanied by strong reductions of sexual arousal and the need to masturbate, but also by an increase of mood in terms of feeling better, more awake and calmer. Furthermore, tendencies towards IPD were negatively related to mood before and after watching Internet pornography as well as an actual increase of good and calm mood. The relationship between tendencies towards IPD and excitement seeking due to Internet-pornography use was moderated by the evaluation of the experienced orgasm's satisfaction. Generally, the results of the study are in line with the hypothesis that IPD is linked to the motivation to find sexual gratification and to avoid or to cope with aversive emotions as well as with the assumption that mood changes following pornography consumption are linked to IPD (Cooper et al., 1999; Laier & Brand, 2014).

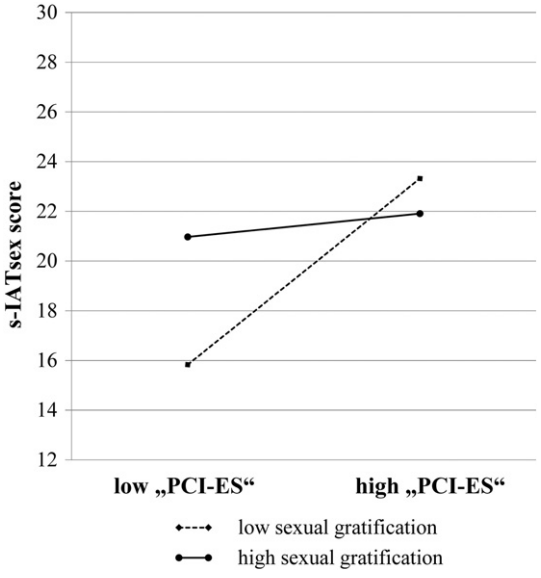

Fig. 1. Demonstration of the moderated regression analysis in which the sum score of the s-IATsex was the dependent variable. Individuals who experienced high sexual gratification when watching Internet pornography scored higher on the s-IATsex independently from their motivation to watch Internet pornography. Individuals who received low sexual arousal scored higher on the s-IATsex if they watch Internet pornography for excitement seeking.

It was postulated earlier that functionalizing Internet-pornography use to cope with depressive mood or stress might be considered to be a risk factor for developing IPD (Cooper et al., 1999). Since we investigated a non-clinical sample, the descriptive results indicate that these individuals report rather low scores of symptom severity of IPD, stress, and rather a good general mood. However, as expected, watching Internet pornography leads to an increase in mood and a decrease in sexual arousal, even in a non-clinical sample. The results that tendencies towards IPD were associated negatively with mood before and after Internet-pornography use and positively with the corresponding changes in mood are consistent with the hypothesized link of dysfunctional coping and IPD (Cooper et al., 1999). The relevance of dysfunctional coping for the development of IPD was also highlighted in the very recent I-PACE model (Brand, Young, Laier, Wolfing, et al., 2016). The I-PACE model assumes that individuals with several predisposing core characteristics might find themselves in a situation in which they feel stressed, have personal conflicts, or feel abnormal mood. This should lead to affective and cognitive responses, e.g. in the need for mood regulation and the decision to use a certain Internet application such as Internet pornography. The assumption is that the gratification received by Internet-pornography use reinforces the used coping style, but moreover specific motives for watching pornography and Internet-pornography-related cognitive biases. The interplay of a specific motivation for watching Internet pornography and the perceived gratification for explaining symptoms of IPD is represented in the moderated regression, in which the relationship between the motivation of Internet-pornography use because of excitement seeking and symptoms of IPD was moderated by the evaluation of the experienced orgasm's satisfaction. Individuals with low excitement seeking due to Internet pornography use and low perceived sexual gratification reported lowest tendencies towards IPD. However, individuals scored higher on IPD's symptom severity if they had a high motivation for Internet pornography use in terms of excitement seeking independently from whether or not they actually perceived watching Internet pornography as gratifying or not. This result might be related to another assumption of the I-PACE model, namely that Internet-pornography addiction should lead to gratification in the short-run, but that some individuals are at-risk to experience a shift from gratification to compensation as the addictive circle goes on leading to the development of cue-reactivity and craving as well as to an increasing diminished control over the pornography use and negative consequences in daily life (Brand, Young, Laier, Wolfing, et al., 2016). Since sexual arousal can be understood as a primary and therefore strong reinforcing stimulus (Georgiadis & Kringelbach, 2012; Janssen, 2011) and against the background of conditioning processes in the context of addiction (Berridge, Robinson, & Aldridge, 2009), it makes sense to assume that sexual arousal can be understood as a unconditioned stimulus which can become associated to external and internal former neutral cues leading to cue-reactivity and resulting craving reactions. This corresponds with studies assessing brain correlates of perceived problems in controlling sexual behaviors which showed that the activity of reward related brain structures and subjectively perceived craving are correlated to the presentation of addiction-related sexual cues (Brand, Snagowski, Laier, & Maderwald, 2016; Voon et al., 2014). So far, the results are in line with the prediction that the dysfunctional use of Internet pornography to cope with depressive mood or stress might be considered as a risk factor for developing an IPD. The results support some main assumptions of theoretical frameworks for Internet-use disorders, but these frameworks need to be specified regarding mechanisms contributing to the development and maintenance of an addictive use of Internet pornography.

4.2. Limitations and future studies

We addressed a clinical hypothesis by investigating a non-clinical sample. Also there was a noteworthy variance in the sample's tendency towards IPD, the results need to be verified in a help-seeking sample. Moreover, since we recruited only individuals who agreed on being investigated right before and after watching Internet pornography at home, a selection bias might have occurred. Although we asked participants whether they live in a relationship, but not whether they live together with their partners. This needs to be controlled for in future studies. Furthermore, potential biases in the private environment could not be controlled. Future studies might address the effects of pornography use on mood in more detail (e.g., with long-term studies) or with respect to female users of Internet pornography.

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