Trait and state impulsivity in males with tendency towards Internet-pornography-use disorder

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HIGHLIGHTS

- Modified stop-signal task with pornographic pictures and informative cues
- Involvement of trait and state impulsivity in Internet-pornography-use disorder
- Results may be indicative of an imbalance between dual systems

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ABSTRACT

Introduction: Impulsivity has been identified to be involved in the development and maintenance of specific Internet-use disorders (IUD). It can be differentiated between relatively stable trait impulsivity and state impulsivity which is dependent on environmental and affective factors such as craving. Following the I-PACE (Interaction of Person-Affect-Cognition-Execution) model, both trait and state impulsivity may play an interactive role in IUD. The present study aimed to investigate the relationship between trait and state impulsivity and symptom severity of Internet-pornography-use disorder (IPD) as one form of IUD.
Methods: Fifty heterosexual males participated in this study. State impulsivity was measured with reaction times in a modified stop-signal task. Each participant conducted two blocks of this task which included neutral and pornographic pictures. Moreover, current subjective craving, trait impulsivity, and symptom severity of IPD were assessed using several questionnaires.
Results: Results indicate that trait impulsivity was associated with higher symptom severity of IPD. Especially those males with higher trait impulsivity and state impulsivity in the pornographic condition of the stop-signal task as well as those with high craving reactions showed severe symptoms of IPD.
Conclusion: The results indicate that both trait and state impulsivity play a crucial role in the development of IPD. In accordance with dual-process models of addiction, the results may be indicative of an imbalance between the impulsive and reflective systems which might be triggered by pornographic material. This may result in loss of control over the Internet-pornography use albeit experiencing negative consequences.

1. Introduction

While most people use the Internet in a functional and healthy way, there are some individuals who experience loss of control over their Internet (e.g. Internet-pornography) use, leading to negative consequences in psychological, social, and work domains (Brand, Young, & Laier, 2014; Young, 1998). This phenomenon is called Internet-use disorder (IUD; Brand, Young, Laier, Wölfling, & Potenza, 2016). The term Internet-pornography-use disorder (IPD) is used for a specific type of IUD which is characterized by a loss of control with respect to the consume of pornography on the Internet (Brand et al., 2016).

Current research indicates etiological similarities between specific IUDs and substance-use disorders (Brand et al., 2016). A shared vulnerability factor is impulsivity (Brand et al., 2014; Verdejo-Garcia, Lawrence, & Clark, 2008). Impulsivity is a multidimensional construct which refers to the tendency to act prematurely and without foresight (Dalley, Everitt, & Robbins, 2011). It can be differentiated between trait and state impulsivity (Wiers, Ames, Hofmann, Krank, & Stacy, 2010; Wingrove & Bond, 1997). Trait impulsivity is a stable personality characteristic which is mostly assessed by self-report questionnaires.

State impulsivity is rather determined by environmental variables and is generally assessed with psychological tasks which measure inhibitory control such as the go/no-go or stop-signal task (SST) (Bari & Robbins, 2013).

Brand et al. (2016) developed a model of specific IUDs, called I-PACE (Interaction of Person-Affect-Cognition-Execution) model. According to this model the development and maintenance of a specific IUD result from relatively stable predisposing factors, affective and cognitive responses in a certain situation which can lead to the loss of control over the Internet use (Brand et al., 2016). In this context, trait impulsivity has been identified as an important predisposing factor of IUD (Cao, Su, Liu, & Gao, 2007; Choi, Park, et al., 2014; Lee et al., 2012) and of Internet-gaming disorder in particular (Choi, Kim, et al., 2014; Ding et al., 2014; Metcalf & Pammer, 2014; Nuyens et al., 2016).

Affective and cognitive responses may influence state impulsivity especially in situations in which addiction-related cues are present. Due to associative learning processes, these cues become more salient and trigger a craving response, which is the irresistible urge to consume a substance (Breiner, Stritzke, & Lang, 1999; Wiers et al., 2010). This cue-reactivity mechanism is, moreover, associated with an imbalance between the automatic, impulsive system and the controlled, reflective system (Bechara, 2005; Schiebener & Brand, 2015). Responses on addiction-related cues are assumed to increase the activity of the impulsive system and may cause impulsive action tendencies (Volkow, Wang, Tomasi, & Baler, 2013; Wiers et al., 2010). A functional reflective system could inhibit impulsive action tendencies by inhibitory control. Accordingly, reduced inhibitory control abilities or higher impulsive action tendencies might lead to impulsive behavior, substance use, and relapse.

It has been shown that craving reactions due to cue-reactivity also exist in IPD (e.g. Laier, Pawlikowski, Pekal, Schulte, & Brand, 2013) and in other specific IUDs (e.g. Ko et al., 2013; Trotzke, Starcke, Müller, & Brand, 2015). Studies which investigated state impulsivity in Internet users and Internet gamers with problematic behavior using inhibitory control tasks, have obtained mixed results (Choi et al., 2013; Choi, Park, et al., 2014; Dong, Zhou, & Zhao, 2010, 2011; Irvine et al., 2013; B. Li et al., 2014; Li et al., 2016; Lim et al., 2016; van Holst et al., 2012). For instance, some found significantly higher stop and go error rates during a SST in individuals with a general IUD and Internet-gaming disorder compared to healthy controls (Choi et al., 2013; Choi, Park, et al., 2014; Lim et al., 2016). However, with respect to the stop-signal reaction time (SSRT), a measure for inhibitory control ability, only Li et al. (2016) reported slower SSRTs for problematic Internet users compared to healthy controls.

Some studies investigated how state impulsivity is biased by Internet-related cues in the context of Internet-gaming disorder in contrast to neutral cues (Liu et al., 2014; van Holst, van Holstein, van den Brink, Veltman, & Goudriaan, 2012; Yao et al., 2015). Only in the Internet-gaming-related cue conditions and not in neutral conditions, individuals with Internet-gaming disorder showed higher deficits in response inhibition compared to a control group (Liu et al., 2014; van Holst et al., 2012).

To the best of our knowledge, there is no study which investigated trait and state impulsivity in individuals with tendency towards IPD. Studies which investigated impulsivity in hypersexual individuals reported higher trait impulsivity compared to controls (Raymond, Coleman, & Miner, 2003; Rettenberger, Klein, & Briken, 2016) and, similarly to specific IUDs, mixed results were found for state impulsivity (Miner, Raymond, Mueller, Lloyd, & Lim, 2009; Reid, Garos, Carpenter, & Coleman, 2011). Few studies examined the effects of Internet-pornographic-cues on individuals with IPD tendencies. When participants were confronted with pornographic-cues, symptom severity of IPD was associated with reduced executive functioning (Schiebener, Laier, & Brand, 2015), higher approach and avoidance tendencies (Snagowski & Brand, 2015), and positive emotional implicit associations (Snagowski, Wegmann, Pekal, Laier, & Brand, 2015). Those action tendencies have

also been associated with imbalances concerning dual processing (Wiers et al., 2010).

The aim of the current study is to explore how trait and state impulsivity are related to IPD. To understand the factors involved in the development of IPD, it is especially relevant to investigate individuals with varying degrees in symptom severity of IPD (Abramowitz et al., 2014). Following prior studies, which investigated trait and state impulsivity in other specific IUDs, we expected symptom severity of IPD in an analogue sample to be associated with trait and state impulsivity (increased impulsive action tendencies and reduced inhibitory control ability). We assume that especially when individuals are confronted with pornographic material, state impulsivity would be related to IPD because of craving responses. Based on the I-PACE model, we further hypothesized that individuals with higher trait impulsivity combined with increased state impulsivity should suffer from more symptoms of IPD.

2. Methods

2.1. Participants

Fifty male pornography users (age $M = 23.30$, $SD = 4.08$, range: 18–40; pornography use in h/week $M = 1.67$, $SD = 1.28$), who stated to be heterosexual and to prefer pornography which displays heterosexual sex, were examined. Participants were recruited through local advertisements at the University Duisburg-Essen and online advertisement in the university's internal networks. The advertisement explicated that the study is about Internet-pornography use and that explicit pornographic material will be presented during the examination. Written informed consent was obtained from all participants after a complete description of the study. Participants could collect credits or received a monetary incentive of €15 in return of the 1.5 h lasting study. The study protocol was approved by the local ethics committee.

2.2. Measures

2.2.1. Stop-signal task (SST)

A modified version of the stop-signal task (Chikazoe et al., 2009; Pawliczek et al., 2013) was used to measure inhibitory control ability and impulsive action tendency. To differentiate between affective states, each participant randomly conducted two SST blocks, one with pornographic and one with neutral pictures. The pornographic pictures showed scenes of sexual vaginal and oral intercourse between male and female (Laier, Pawlikowski, & Brand, 2014; Schiebener et al., 2015). In the study by Laier et al. (2014) those pictures were rated with respect to subjective sexual arousal (1 = not sexually arousing; 5 = very sexually arousing), $M = 3.31$, $SD = 0.78$. Neutral pictures were taken from the International Affective Picture System and showed individuals in everyday life situations (Lang, Bradley, & Cuthbert, 2008). We chose neutral pictures which were rated in the study by Lang et al. (2008) with mean ratings (1 = unhappy/calm); 9 = happy/excited) for pleasure ($M = 5.41$, $SD = 0.85$) and arousal ($M = 4.32$, $SD = 0.62$).

Each trial was initiated by the presentation of a picture (neutral or pornographic) which was shown until the end of the trial. Cues in form of frames informed the participant whether this trial would be a certain or uncertain go-trial. In certain go-trials, a green dashed frame informed the participant that in this trial no stop-signal would appear. In uncertain go-trials a red dashed frame indicated that it is uncertain whether a stop-signal would appear and whether participants would have to inhibit their go-response or not. After the cue presentation, the go-signal (green solid frame) was presented in each trial after a variable inter-stimulus interval. Participants had to respond as fast as possible with their index-finger upon the go-signal. In one third of all uncertain go-trials, the go-signal was followed by a stop-signal (red solid frame) after a variable stop-signal-delay (SSD). In case of a stop-signal, participants had to inhibit the already initiated go-response (see Fig. 1). The