



Desire thinking promotes decisions to game: The mediating role between gaming urges and everyday decision-making in recreational gamers



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ABSTRACT

Introduction: Desire thinking is a voluntary cognitive process that involves the imaginal forecast of a desired activity and the verbal perseveration with plans and good reasons for engaging in it. Considering theoretical models arguing that specific decision-making processes may be involved in the development of gaming disorder, we hypothesized that an initial urge to game might be accelerated by desire thinking, leading to the decision to game in an everyday setting although the gaming behavior may conflict with another activity or certain other goals.

Methods: A pre-study helped developing a catalogue of situations that provides forced-choice scenarios warranting a decision for or against gaming. To explore the postulated sequence of cognitive and affective events, a serial mediation model with urge to game as predictor, decision to game as dependent variable, and imaginal prefiguration and verbal perseveration as mediators was tested in a sample of 118 recreational gamers with varying degrees of gaming intensity.

Results: The pre-study revealed a catalogue of 18 conflicting situations that likely happen in the daily life of gamers, containing conflicting activities such as job/educational performance and meeting friends/family/acquaintances. In the sequential mediation model, the desire thinking facets imaginal prefiguration and verbal perseveration fully mediated the relation between an initial urge and the decision to game.

Conclusions: The mediation model emphasizes the serial ordinance of desire thinking facets and their role in motivating decisions to game after an initial urge has been experienced. Results may indicate that desire thinking plays a considerable role in problematic gaming tendencies.

1. Introduction

Videogames are developed to serve a variety of needs of their users, such as the need to escape from or discover another fantastic reality, to relax after a long day, to socialize online or improve one's own handling of the game mechanics (Demetrovics et al., 2011). Some games are equipped with strong rewarding and immersive features in order to ensure that gamers keep on playing, which shapes the potentially addictive nature of videogames. The one-year prevalence of gaming disorder as a disorder due to addictive behaviors (World-Health-Organization, 2018) is estimated to approximate 3.5% among German adolescents (Wartberg, Kriston, & Thomasius, 2020), indicating that a substantial part of gamers experiences a considerable level of problems related to their gaming behaviors. Besides the motivational aspects and structural characteristics of a game, the psychological characteristics essentially determine if a gamer actually develops addictive behaviors (Király, Griffiths, & Demetrovics, 2015). Accordingly,

what keeps research busy since the first reports of exceptional gaming behaviors in the early 1980s (e.g., Ross, Finestone, & Lavin, 1982; Soper & Miller, 1983) is the question which psychological processes are involved in the development and maintenance of problematic gaming.

Considering the willpower that is necessary in order to resist temptations in our everyday life, the process of decision-making has been put into spotlight in addiction research (Bechara, 2003, 2005). Regarding the cognitive mechanisms underlying decisions, dual-process and tripartite models of addictions assume that an interaction of reward anticipation and top-down control mechanisms becomes progressively imbalanced (Bechara, 2005; Everitt & Robbins, 2005, 2016). Consequently, behaviors can change from being initially impulsive to more habitual behaviors, mainly driven by a sensitization of the reward system (Berridge & Robinson, 2016; Robinson & Berridge, 2008). Decision-making processes are considered relevant across a range of addictive behaviors (Brevers & Noël, 2013) including problematic gaming (Dong, Li, Wang, & Potenza, 2017) and are integrated

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into prevailing neurocognitive models describing the development and persistence of gaming disorder (e.g., Brand et al., 2019; Dong & Potenza, 2014; Wei, Zhang, Turel, Bechara, & He, 2017). One of these models is the I-PACE model (Brand, Wegmann, et al., 2019; Brand, Young, Laier, Wöfling, & Potenza, 2016) which emphasizes the role of a variety of cognitive and affective processes that may directly or interactively influence repeated decisions to game despite the occurrence of negative consequences in the long run. More specifically, the updated version of the I-PACE model (Brand, Wegmann, et al., 2019) differentiates between early and later stages in the development and maintenance of addictive behaviors. Accordingly, a mild urge to game might initially be experienced in the early stages which leads to intentional decisions to game (Brand, Wegmann, et al., 2019). Throughout the later stages, reinforcing learning mechanisms and neural sensitization (Berridge & Robinson, 2016; Robinson & Berridge, 1993) might cause reductions in inhibitory control and executive functions (Argyriou, Davison, & Lee, 2017; Weinstein, 2017), an attentional bias towards gaming-associated cues (Jeromin, Nyenhuis, & Barke, 2016; Zhou, Yuan, & Yao, 2012), enhanced reward sensitivity (Dong, DeVito, Huang, & Du, 2012; Liu et al., 2017; Lorenz et al., 2013), and the occurrence of cravings to game (Dong et al., 2020; Ko et al., 2013). An interplay of these mechanisms is thought to progressively reduce willpower to resist playing videogames and cause more seemingly habitual and dysfunctional gaming patterns (Brand, Rumpf, et al., 2019; Brand, Wegmann, et al., 2019). Thus, whereas researching the later stages is important to understand maintaining forces of addictive behaviors, depicting cognitive processes that lead to initial decisions to game in the early stages are just as relevant for explaining the development of problematic gaming.

A voluntary cognitive process which is thought to foster the enactment of a desired activity is desire thinking (Caselli & Spada, 2011, 2015; Kavanagh, May, & Andrade, 2009). Deriving from the Elaborated Intrusion (EI) theory of desire (Kavanagh, Andrade, & May, 2005; Kavanagh et al., 2009; May, Andrade, Panabokke, & Kavanagh, 2004), desire thinking is the conscious cognitive elaboration of spontaneous and automatic associations that contain information and memories about a desired object or activity, and which have intruded into awareness. Desire thinking is thought to be a multi-dimensional concept including a first imaginal prefiguration of a desired activity which leads to a verbal perseveration with desire-related content (Caselli & Spada, 2011, 2015). An imaginal elaboration of positive target-related associations is characterized by the prefiguration of multi-sensory images or recall of memories that form around the desired target (Kavanagh et al., 2009). Future forecasts may involve scenarios where an individual sees itself engaging in the desired activity and imagines how good this could possibly feel, which may possibly be present in recreational gamers (Brandtner, Pekal, & Brand, 2020). The elaboration of the desired target at a verbal level is characterized by repetitive self-talk that involves content including the evaluation of good reasons to engage in the desired activity and planning how to do so (Caselli & Spada, 2015). On a conceptual level, desire thinking is assumed to be closely related to craving (Green, Rogers, & Elliman, 2000; Tiffany & Drobles, 1990), yet distinct from it as craving is more likely considered a motivational and/or emotional state (Cox & Klinger, 2002; Tiffany & Wray, 2009). However, being a super-ordinate cognitive process it is assumed to be operating during craving

episodes (Caselli & Spada, 2015). Moreover, the persistence and escalation of craving seems to be dependent on the strength of desire thoughts that are activated during the craving experience (Green, Rogers, & Elliman, 2000; Kavanagh, May, & Andrade, 2009; Tiffany & Drobles, 1990). Desire thinking therefore determines the prolongation and increase of craving until a relieve from a sense of deficit or an increasing urge may only be achieved by engaging in the desired activity (Caselli & Spada, 2011, 2015). To date, research has addressed the role of desire thinking in the inducement of craving (Allen, Kannis-Dyand, & Katsikitis, 2017; Caselli, Manfredi, Ferraris, Vinciullo, & Spada, 2015; Caselli, Soliani, & Spada, 2013; Chakroun-Baggioni, Corman, Spada, Caselli, & Gierski, 2017) and in predicting the extent of symptom severity of the addictive or problematic behaviors (Fernie et al., 2014; Marino et al., 2019; Martino et al., 2017; Spada, Langston, Nikčević, & Moneta, 2008). More specifically and in the context of addictive behaviors, desire thinking has been investigated as a predictor of pathologic gambling (Fernie et al., 2014), problematic Internet use (Spada, Caselli, Slaifer, Nikčević, & Sassaroli, 2013), problematic Facebook use (Marino et al., 2019), and problematic pornography use (Allen et al., 2017). For a recent review on desire thinking across addictive behaviors, see Mansueto et al. (2019).

According to the theoretical considerations in the I-PACE model (Brand, Wegmann, et al., 2019), an initial urge to game can approach a level of strength that leads to the actual decision to play. This process is not considered isolated, but in interaction with reinforcing mechanisms one of which is thought to be desire thinking. Integrating it into the I-PACE model and considering the early stages of the addiction process, desire thinking might also determine the prolongation of an initial urge to play that has intruded into awareness in the same way that it leads to the escalation of craving (Caselli & Spada, 2015). An imaginal prefiguration of gaming and a verbal preoccupation with good reasons for gaming and planning how to do so might accelerate this initial urge until it is strong enough to cause the actual decision to game. Researching this chain of affective and cognitive events contributes to understanding which processes are involved in decisions to game. Moreover, with respect to the dimensional nature of urges and desire thinking, and although researched in a sample of recreational gamers, the results may give indication if and how desire thinking is possibly involved in the development of problematic gaming behavior. However, and to our best knowledge, the expediting effects of desire thinking in the sense that it promotes the actual decision to play has not been investigated. The main study (Study 2) therefore aims at evaluating a hypothesized serial mediation model where desire thinking in its two sub-components imaginal prefiguration and verbal perseveration is investigated as a mediator between an initial urge to game and the actual decision to play (see Fig. 1). Decision-making is a theoretical consideration throughout prevailing models that describe the development and persistence of disordered gaming behavior (e.g., Brand et al., 2019; Dong & Potenza, 2014; Wei, Zhang, Turel, Bechara, & He, 2017). However, actual decisions to game in the context that they are made, namely in the daily life of gamers, have not been researched so far although this kind of assessment would provide a high degree of external validity. Therefore, a pre-study (Study 1) aims at exploring how conflicting decisional situations look like in the daily life of gamers. On the basis of the pre-study, a catalogue of conflicting

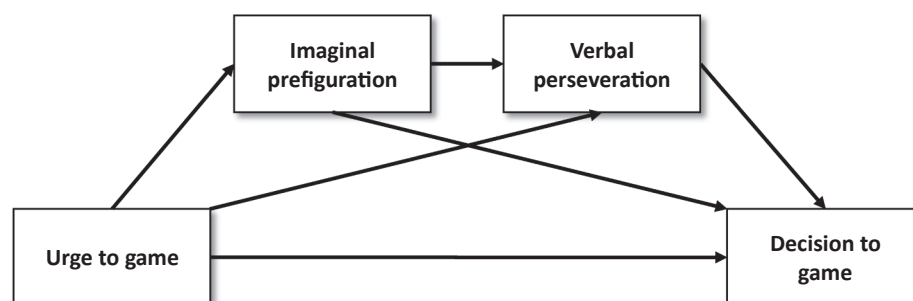


Fig. 1. Theoretically hypothesized sequential mediation model of the mediating effect of desire thinking between urge and decisions to game in everyday life.

situations was developed and used to measure everyday-life decisions for or against gaming. This measure was used in the sequential mediation model and was further put in relation with the symptom severity of the recreational gamers in this sample in order to test for the theoretical consideration that more decisions for gaming might be associated with the experience of more negative consequences due to gaming.

2. Study 1

The first part is a focus group that was conducted to explore conflicting situations in daily life, wherein gamers have or want to decide whether to game or not. The aim here was to detect activities that are most commonly in conflict with gaming. Ethical proposals were made distinctively for the focus group and the online survey. Both gained a positive vote of the local ethics committee of the University Duisburg-Essen, Germany.

2.1. Method

2.1.1. Participants

A focus group with $N = 6$ gamers (3 female) that met the inclusion criterion of a weekly playtime of at least 14 h was conducted at University Duisburg-Essen. The mean age of participants was 28.17 ($SD = 6.01$), ranging from 18 to 34, who played averagely 29.17 h per week ($SD = 13.2$). Among the played genres were massively multiplayer online role-playing games, first person shooter, multiplayer online battle arenas, other action and adventure games, real-time tactics, and side-scroller.

2.1.2. Procedure

The discussion consisted of four phases, (1) an introduction to the topic, (2) a single work, (3) a subgroup work and (4) a re-assembly of the whole group with a final discussion. During the single work, participants were asked to think of situations that force them to decide whether they now start or quit gaming, or do another activity that is experienced as conflicting. They were instructed to write down as many situations as they could think of on flashcards, and to make detailed descriptions of the conflicting situations. They wrote down the exact same scenario twice on two different flashcards whereupon the group was divided into two subgroups of three individuals each. Each subgroup now worked with a similar set of the flashcards and was instructed to sort the scenarios by frequency of occurrence in daily life. In the re-assembly phase, the whole group was asked to reflect on all situations they had created and to consider, if there were any common situations missing. Each participant was then asked to indicate with stickers the three most frequently occurring situations.

Table 1

Exemplary scenarios representing a decisional conflict between gaming and another activity with percentage values of their occurrence.

Examples of the Conflicting Situations Catalogue for Gaming (CSC-G)	(0)	(1)	(2)	(3)	(4)
Your friends ask if you would like to meet up with them. The activity they propose sounds fun. You think for a moment – actually you wanted to play right now. What do you do?	9.3%	25.4%	44.1%	16.1%	5.1%
The laundry heap in your room that has accumulated needs to be done. To make sure that the laundry is dry again in time so that you have fresh clothes, you have to finish your game now. However, you would like to continue playing. What do you do?	11%	24.6%	36.4%	17.8%	10.2%
It is already late and tomorrow is a usual day at work/training/university with nothing special scheduled. You should turn off your computer soon in order to be well rested. However, you would like to continue playing right now. What do you do?	5.9%	19.5%	33.1%	25.4%	16.1%
You come home and realize that you should tidy up. It will take some time to bring order into the most important things in your apartment. Actually, you would rather like to play right now. What do you do?	2.5%	15.3%	39%	31.4%	11.9%
You come home in the evening after a long day and could take a shower, shave and cut your nails. You know you won't get around to that today if you don't do it now. However, you would rather like to play right now. What do you do?	17.8%	22%	28%	19.5%	12.7%
In order to be better prepared for next week, you want to sort some important documents. You only have time for this today and need to quit your game in order to get it done. But you would actually like to continue playing right now. What do you do?	10.2%	30.5%	32.2%	16.9%	10.2%

Note. $N = 118$; (0) = never, (1) = seldom, (2) = sometimes, (3) = often, (4) = very often; percentage values are calculated on the basis of Study 2; see Appendix for English and German versions of all 18 scenarios.

2.1.3. Results

Resulting from the second phase, participants produced a total number of 17 scenarios that oppose the option to game with another activity. With some situations being redundant, this phase resulted in conflicting activities that were thematically classified in (1) academic/job performance (e.g., meeting a deadline, learning for an exam), (2) meeting friends/family/acquaintances (e.g., a party, spontaneous invitation), (3) self-care (e.g., eating, sleeping, body hygiene), (4) housekeeping (e.g., laundry, cleaning), (5) other hobbies (e.g., sport). Situations that were rated to happen most frequently in both subgroups during the third phase were conflicts between gaming and academic/job performance. Activities conflicting with gaming that were rated to occur most frequently in the last re-assembly phase with stickers were sleeping (5 points), housekeeping (3 points), academic/job performance (3 points), meeting friends offline (3 points), and preparing a meal (2 points). The other scenarios gained one or zero points.

2.1.4. Development of the conflicting situations catalogue for gaming

On the basis of the first evaluation of conflicting activities and focus group discussions, an initial pool of 36 hypothetically conflicting situations that likely occur in the daily lives of gamers was created on the basis of consideration. For the purpose of comparability, each scenario follows a three-sentence structure (cf., Singer, Kreuzpointner, Sommer, Wüst, & Kudielka, 2019) and contains two forced-choice options (gaming vs. conflicting activity). It was made sure that frequently occurring conflicting activities are represented by several scenarios in the catalogue. Moreover, the number of situations wherein a decision against gaming meant to quit or to not start gaming was systematically varied. For exemplary scenarios, see Table 1.

3. Study 2

The second part of the study was a mere online-survey. It comprised self-report questionnaires as well as the catalogue of 36 conflicting situations that was previously developed on the basis of the focus group.

3.1. Method

3.1.1. Participants

A total number of $N = 118$ gamers (53 female) who indicated to play videogames at least 7 h per week fulfilled the requirements of a minimum age of 18 years. Participants averagely played 3.2 h ($SD = 1.9$) on weekdays and 4.0 h ($SD = 2.8$) during days on the weekend, resulting in a mean of 21.4 h ($SD = 14.6$) per week. The mean age for this German sample was 34.1 years ($SD = 9.7$), ranging from 18 to 56.

3.1.2. Self-report measures

3.1.2.1. *Urge to game.* The urge to game was measured using a Visual Analogue Scale (VAS) asking for the experience of a momentary state of urge to play videogames (“How strong is your urge to play videogames right now?”). Anchors ranged from 0 = *not strong at all* to 100 = *very strong*.

3.1.2.2. *Desire thinking.* The Desire Thinking Questionnaire (DTQ; Caselli & Spada, 2011) is a 10-item self-report measure to assess levels of trait desire thinking modified for online gaming (e.g., “I mentally repeat to myself that I need to play videogames.”). The measure includes two sub-scales of 5 items each. The first subscale depicts the tendency to envisage imagery of gaming-related content (imaginal prefiguration; DTQimaginal). The second subscale refers to the perseveration of verbal thoughts about gaming-related content and experiences (verbal perseveration; DTQverbal). Items are rated on a 4-point Likert Scale ranging from 1 = *almost never* to 4 = *almost always*. Due to the lack of a validated German version, the DTQ was translated and re-translated twice by four independent researchers of the department who were blind to the respective previous versions. In this sample, the DTQ showed good internal consistency (Cronbach’s alpha in the current sample = 0.94).

3.1.2.3. *Conflicting situations catalogue for gaming.* The initial Conflicting Situations Catalogue for Gaming (CSC-G) consisting of 36 situations was presented to the participants within the online survey in a randomized order. They were instructed to read the scenario and to decide (in a forced-choice format with 1 = *gaming*, 0 = *conflicting activity*) how they would usually decide in this situation (CSC-G decision). If they never experienced such a conflicting situation, they were instructed to imagine how they would most likely decide. Afterwards, participants rated on 5-point Likert scales for each scenario how frequently they experienced this or a similar situation in general (CSC-G frequency), ranging from 1 = *never* to 5 = *very often*; and how much they had thought about their decision as an indicator of gamers’ ability to reflect their decisions (CSC-G reflection), ranging from 1 = *thought only little* to 5 = *thought a lot*. The initial pool of 36 items was reduced before the mediation analyses according to criteria described in Section 3.2.1.

3.1.2.4. *Symptom severity.* The tendency for problematic gaming was measured with the Internet Gaming Disorder Test (IGDT-10; Király et al., 2017) to provide a better sample description. This self-report measurement is constructed on the basis of the DSM-5 criteria of gaming disorder (American-Psychiatric-Association, 2013). According to the authors, the IGDT-10 can be used to assess both online and offline gaming by easily adapting the instruction. In this study, the term video gaming was used to take account of both online and offline gaming and was therefore inserted into the instruction of the IGDT-10. Each DSM-5 criterion is operationalized by one item, except for one criterion (i.e., “jeopardy or losing a significant relationship, job, or educational or career opportunity because of participation in videogames”), which is

represented by two items due to its complexity. Each item is rated on a 3-point Likert Scale (0 = never, 1 = sometimes, 2 = often), resulting in sum scores ranging from 0 to 20. So far, there is no German validation of the IGDT-10 (Király et al., 2019) wherefore the questionnaire was translated and re-translated by four independent members of the research department. In this sample, the IGDT-10 showed good internal consistency (Cronbach’s alpha = 0.84).

3.1.2.5. *Statistical analyses.* In a first selection procedure, we identified conflicting situations out of the pool of 36 items that were representative according to specific criteria explained in Section 3.2.1. Afterwards, in order to test if desire thinking promotes the effect of an initial urge to game on the actual decision to do so, a sequential mediation analysis was conducted using MPlus 8. (Muthén & Muthén, 2011). Urge to game was entered as independent variable, the decisions to game, operationalized by the sum score of the variable CSC-G decision (see Sections 3.1.2.3 and 3.2.1) as dependent variable, and the subfacets of desire thinking (imaginal prefiguration and verbal perseveration) were sequentially entered as mediators. As a requirement for mediation analyses (Baron & Kenny, 1986), the independent, mediator, and dependent variables are intercorrelated (see Table 2). Indirect effects were assessed without bootstrapping. Further, age and gender were entered as covariates in order to control for their influence on each variable.

3.2. Results

3.2.1. The conflicting situations catalogue for gaming for further analyses

To identify situations that regularly happen to gamers and in order to gain representative items we used the basis of three criteria: (1) A preferable combination of incidence ratings. On the basis of this criterion, 14 items were rejected, ensuring that 50% of participants experienced a situation at least sometimes. (2) A criterion of preferable item-difficulties led to the exclusion of two further items due to a relatively high percentage of decisions to game (> 0.7) which might be an indication that situations were not experienced as conflicting. (3) Two items were discarded due to a poor discriminatory power (< 0.3), indicating that these items were not prototypical enough for this catalogue. Consequently, 18 scenarios were used for further analyses (for all 18 scenarios, see Appendix). With decisions for gaming being coded with 1, and decisions in favor of the conflicting activity being coded with 0, a higher sum score in the CSC-G (ranging from 0 to 18) depicts a greater tendency to choose the gaming option instead of the conflicting activity. For CSC-G frequency and CSC-G reflection, mean scores were calculated. The CSC-G decision showed good internal consistency in this sample (Cronbach’s alpha = 0.83).

3.2.2. Descriptive statistics and data configuration

In this sample, 6.8% of the participants indicated 5 or more symptoms, 35.6% indicated one to 4 symptoms, and 57.6% reported to not experience a single symptom according to the IGDT-10 (Király et al., 2017). Descriptive

Table 2
Mean, standard deviation, ranges, and two-tailed Pearson correlations of study variables.

	M	SD	Range	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Age	34.1	9.7	18–56	1	–0.26**	–0.23*	–0.21*	–0.17	–0.24**	0.17	–0.32**
(2) Urge to game	60.7	26.2	0–100		1	0.50**	0.46**	0.36**	0.38**	0.09	0.39**
(3) DTQimaginal	10.6	3.9	5–20			1	0.82**	0.45**	0.57**	0.35**	0.68**
(4) DTQverbal	9.8	4.0	5–20				1	0.51**	0.61**	0.49**	0.74**
(5) CSC-G decision	7.2	4.2	0–18					1	0.52**	0.34**	0.53**
(6) CSC-G frequency	2.9	0.8	1–4.6						1	0.54**	0.56**
(7) CSC-G reflection	2.4	0.8	1–4.3							1	0.38**
(8) IGDT-10	5.6	4.2	0–17								1

Note. *p < .05, **p < .01; DTQimaginal = subscale imaginal prefiguration of the Desire Thinking Questionnaire (DTQ), sum score; DTQverbal = subscale verbal perseveration of the DTQ (Caselli & Spada, 2011), sum score; CSC-G decision = number of decisions that were made in favor of gaming in the Conflicting Situations Catalogue for Gaming, sum score; CSC-G frequency = rating of how often these situations happen, mean score; CSC-G reflection = rating of how much was thought about the decisions, mean score; IGDT-10 = Ten-Item Internet Gaming Disorder Test, sum score (Király et al., 2017).

statistics for the variables of interest in this study are presented in Table 2. In preliminary correlation analyses, increasing age in this sample was associated with lower incidence ratings of conflicting situations (see Table 2). Due to a possible confounding effect, age and gender were considered covariates in the mediation analysis in the main study. The presence of multivariate outliers was tested by comparing the distance of Mahalanobis against a chi-square distribution with the same degrees of freedom which did not reveal outliers in the sample. The Tolerance Index (T_i) and the Variance Inflation Factor (VIF) were calculated to examine multicollinearity of independent variables. A value over 0.02 for T_i and a value under 5.0 for VIF are considered reliable indicators for the absence of multicollinearity between independent variables and covariates. This assumption could be verified for gender ($T_i = 0.94$; VIF = 1.07), age ($T_i = 0.92$; VIF = 1.09), urge to game ($T_i = 0.68$; VIF = 1.43), DTQimaginal ($T_i = 0.30$; VIF = 3.35), and DTQverbal ($T_i = 0.31$; VIF = 3.16). An inspection of skewness coefficients indicated rather symmetrical distributions. Lastly, skewness (0.22), kurtosis (0.28), and a Kolmogorov-Smirnov test ($D(118) = 0.06$, $p > .05$) indicated that residuals met the requirement of normality. Additionally, a scatterplot of standardized residuals against predicted values did not reveal heteroscedasticity. The Durbin Watson statistic was 2.16, indicating the absence of autocorrelation in residuals.

3.2.3. Sequential mediation analysis

The mediation analysis confirmed that imaginal prefiguration and verbal perseveration mediated the effect of urge to game on decisions to game in the CSC-G (see Fig. 2). The final equation model accounted for 28.3% of variance ($p < .001$). The only significant indirect path between urge and decisions to game is via imaginal prefiguration and verbal perseveration ($\beta = 0.16$, $SE = 0.06$, $p = .007$), whereas the indirect pathways urge, imaginal prefiguration, decisions to game ($\beta = 0.01$, $SE = 0.07$, $p = .938$) and urge, verbal perseveration, decisions to game ($\beta = 0.02$, $SE = 0.03$, $p = .567$) are not significant. The direct effect of urge to game on everyday decision-making was not significant ($\beta = 0.17$, $SE = 0.09$, $p = .070$). The covariates age and gender did neither show significant effects on decisions to game (age: $\beta = -0.40$, $p = .623$; gender: $\beta = 0.04$, $p = .589$), nor on imaginal prefiguration (age: $\beta = -0.11$, $p = .167$; gender: $\beta = 0.01$, $p = .870$), nor on verbal perseveration (age: $\beta = -0.02$, $p = .763$; gender: $\beta = -0.06$, $p = .303$).

4. Discussion

This bipartite study, consisting of a pre- and a main study, aimed at exploring if desire thinking functions as an accelerating cognitive process in the sense that it mediates the relationship between an initial urge to play videogames and the actual decision to do so in the daily life of recreational gamers. With the help of a focus group, a qualitative pre-study revealed a new assessment tool, the Conflicting Situations Catalogue for Gaming (CSC-G), that is able to measure the tendency to decide in favor of gaming although this conflicts with another activity by providing fictive conflicting situations with bivariate forced-choice options. The CSC-G depicts the realistic nature of gaming-specific conflicting situations close to everyday life and more specifically, which

activities exactly are experienced as being in conflict with gaming.

The focus in the main study of this project was to identify a sequence of affective and cognitive incidents that may contribute to the decision to game in daily life, although a conflicting activity needs or is willed to be done. Results in form of a sequential mediation model tested in this study support the important role of desire thinking as a mediator between an initial urge and deciding to play videogames. Here, the only significant path through this series of affective and cognitive events was the indirect path via imaginal prefiguration and verbal perseveration on decisions to game (see Fig. 2). This finding emphasizes the serial ordinance of desire thinking facets. In accordance with the EI theory (Kavanagh et al., 2005; May et al., 2004), an initial gaming-related association seems to be primarily elaborated by mentally foreseeing and pre-sensing an actual gaming scenario. Not until then, repetitive self-talk including the verbal evaluation of how urgently one wants to engage in gaming with a focus on decision-making (Caselli & Spada, 2016) might lead to the actual decision to do so in daily settings. In the sense that it is not possible to crave less by thinking more about it (Caselli & Spada, 2015), these results support the role of desire thinking being a cognitive response that may become dysfunctional if oriented towards temptations that are being tried to resist (i.e., gaming). Interestingly, the mere imaginal prefiguration of a gaming scenario is not a significant predictor of decisions to game in the sequential mediation model. This is remarkable as research constantly underpins the important property of mental imagery to motivate behavior (e.g., Renner, Murphy, Ji, Manly, & Holmes, 2019). Accordingly, the motivating power of mental imagery is often discussed as due to its capacity to simulate obtaining gratification (Andrade, May, & Kavanagh, 2012). This finding could, however, contribute to this association insofar as the imagination of a gaming situation and the planning to get involved in it seem to be conceptually different processes that take place sequentially. Markedly, desire thinking as a faculty is not per se a clinically relevant issue since it may motivate effort in order to achieve goals and enables to adequately plan behavior by foreseeing its consequences (Caselli & Spada, 2015). However, it can become dysfunctional when the target of desire conflicts with other goals (e.g., quit gaming in order to get work done). Accordingly, the dysfunctional character of desire thinking may be closely related to decision-making processes that are thought to be involved in addictive gaming behaviors (e.g., Brand et al., 2019; Dong & Potenza, 2014; Wei, Zhang, Turel, Bechara, & He, 2017). As a voluntary cognitive process, desire thinking is assumed to contain information about planning how to engage in a desired activity (i.e., gaming; Caselli & Spada, 2015). Hence, the results of this study let assume that in the early stages of developing addictive behavior, finding seemingly good reasons to game may lead to conscious decisions to game in daily life. With this decision-making process being repeated and gratification being experienced through gaming, resulting neural sensitization and aggravated top-down controlling (Berridge & Robinson, 2016; Goldstein & Volkow, 2011; Robinson & Berridge, 1993), that are argued to be transferable to addictive gaming behaviors (Brand, Rumpf, et al., 2019), are thought to facilitate the entry into states of craving. This is supported by several findings in the field of desire thinking that have shown a direct influence on craving (e.g., Caselli & Spada, 2015). With the assumption that addiction-related cognitions become increasingly reflexive and automatic in the

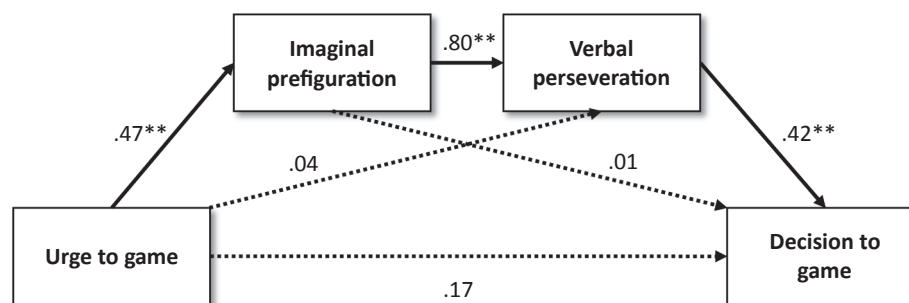


Fig. 2. Conceptual sequential mediation model of the mediating effect of desire thinking between desire/craving and decisions to game in everyday life; effect estimates are standardized coefficients; * $p < .05$, ** $p < .01$; $N = 118$.

maintenance of addictive gaming behaviors (Brand, Rumpf, et al., 2019), the question for further research remains whether or not also the voluntary process of desire thinking becomes less conscious, or whether it becomes more easily accessible or triggered, respectively. Nevertheless, the aggregation of previous findings and results of this study demonstrate the necessity to consider desire thinking when exploring neurocognitive mechanisms in gamers.

Notably, prior research investigated the role of desire thinking in explaining craving (e.g., Caselli, Manfredi, Ferraris, Vinciullo, & Spada, 2015; Caselli, Soliani, & Spada, 2013; Chakroun-Baggioni, Corman, Spada, Caselli, & Gierski, 2017), symptom severity, and problematic behavior patterns (e.g., Caselli, Canfora, et al., 2015; Fernie et al., 2014; Marino et al., 2019; Martino et al., 2017) instead of investigating the urge to game as a predictor of desire thinking. These investigations find their origin in the metacognitive model of desire thinking (Caselli & Spada, 2015) that assumes the development and magnitude of craving experiences due to the perseveration of unregulated desire thinking. However, it is assumed that desire thinking processes might be activated during the experience of urges, desires, or cravings and determine their prolongation, wherefore a model was tested that assumed and depicted the mediating effect of desire thinking between an initial urge and the decision to game.

The decision-making task used in this study forces participants to decide for or against gaming. The decision for gaming always implies the neglect of another activity that needs or is willed to be done. Activities that were commonly reported throughout several genres subsumed job or academic performance (i.e., meeting a deadline or the necessity to learn), cultivating contacts with family and friends (i.e., joining spontaneous or planned activities), and daily obligations or housekeeping (i.e., cleaning the kitchen, doing the laundry). Not surprisingly, the conflicting activities can be found to be involved when individuals with problematic or addictive gaming behaviors report negative consequences due to gaming. That is, common negative consequences due to gaming encompassing the degeneration of academic or job performance, the loss of real-life relationships, the neglect of previously enjoyed activities, and decreased psychological well-being due to gaming (Kuss, 2013) are also mirrored in the catalogue of conflicting situations. A significant relationship between everyday gaming-related decision-making and the severity of gaming disorder symptoms in this sample of recreational gamers (see Table 2) underpins the notion, that decisions to the detriment of jobwise and social obligations are associated with the experience of negative consequences the more the behavior approximates addictive tendencies (Brand, Rumpf, King, Potenza, & Wegmann, 2020). Further, a positive correlation between symptom severity and the reflection about the decisions in the CSC-G was found. Assuming that more habitual behaviors imply less cognitive effort when making decisions, this seemingly contradicts with the theoretical approach in the I-PACE model, stating that a shift from experiencing gratification from gaming to compensating negative consequences due to gaming is determined by increasingly habitual or compulsive behavior patterns (Brand, Wegmann, et al., 2019). Possibly, this association is of methodological origin and rather mirrors the ability to reflect on mental processes and situational circumstances in this sample of recreational gamers. As the item asking for how much participants had thought about their decision requests to become aware of one's own thoughts, it has improbably measured habitual behaviors. More likely, the positive association seems interpretable as a response set of participants in this sample, mirroring that the ability to reflect on gaming-related decisions is closely related to the ability to reflect on gaming-related problems in daily life.

In the light of practical implications on the basis of these results, it might be mentionable how the discovered chain of affective and cognitive events might be interrupted in case it is aimed at preventing the decision to game. Regarding the occurrence of urges, the metaphor or surfing one's urges exists in the context of mindfulness approaches that educate in perceiving and accepting the peak and descend of urges and cravings (Baer, 2003; Tapper, 2018). This aligns with the notion of Caselli and Spada (2015) who deduce from their findings that desires are not the problem themselves, but that the way of thinking about them is relevant. Hence, strengthening mindfulness and self-regulatory faculties could be beneficial for becoming more aware of

urges in order to deal with them (Caselli & Spada, 2015; Chakroun-Baggioni et al., 2017). Additionally, as desire thinking shares facets with other extended perseverative thinking styles such as ruminating and worry (Caselli & Spada, 2016), techniques that directly address the modification of perseverative thinking such as training to refocus situational attention and detached mindfulness (Caselli & Spada, 2015) might be profitable in terms of metacognitive techniques to address extended thinking. Moreover, the efficacy of Metacognitive Therapy (Wells, 2009) addressing these thinking styles has proven to be successful among patients with alcohol-use disorder (Caselli, Martino, Spada, & Wells, 2018), paving the way for a closer investigation of corresponding techniques also in the field of behavioral addictions. Regarding the component of decision-making, the fact whether or not gamers show impairments in the behavioral inhibition of impulses is controversially discussed due to diverging results regarding beneficial training effects of some genres (Bavelier & Green, 2019; Hilgard, Sala, Boot, & Simons, 2019; Steenbergen, Sellaro, Stock, Beste, & Colzato, 2015). However, a greater preference for immediate rewards in gamers in the sense of decisional impulsivity might be addressed with a combined intervention of reality therapy and mindfulness meditation (Yao et al., 2017).

Notably, some limitations have to be mentioned with regard to this study. Due to a subclinical sample of mainly recreational gamers, states of clinically relevant urges/craving and dysfunctional desire thoughts could only be approximated. Further, it might be valuable to consider comparing the mediation models between pathological and recreational gamers, as this would give further insight into potentially different characters of desire thinking when investigated according to symptom severity. However, as this sample only consists of undiagnosed regular gamers who were not seeking treatment, an artificial classification of the sample leads to sample sizes that might be too small for sequential mediation analyses. Therefore, we recommend investigating different effects of desire thinking between healthy and treatment-seeking participants in future studies. Further, given the cross-sectional design of this study, causal interferences from the sequential mediation model can only be deduced with caution.

5. Conclusion

The results of this study emphasize the prominent role of desire thinking in the elaboration of an initial urge to play videogames. That is, the proposed and statistically validated chain of affective and cognitive events tends to explain how actual decisions to game in daily settings are promoted. However, due a cross-sectional design and a non-clinical sample, results need to be interpreted with caution.

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CRedit authorship contribution statement

AB conducted literature research, designed the studies, and was responsible for data management. EW and MB supervised these processes and provided crucial advice. AB and EW ran statistical analyses and interpreted the results. AB conceptualized and wrote the first version of the manuscript. MB finalized the manuscript. All authors contributed to and have approved the final manuscript. AB: Conceptualization, Data curation, Investigation, Writing – original draft. EW: Supervision, Methodology, Writing – review & editing. MB: Supervision, Writing – review & editing.

Declaration of Competing Interest

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

Appendix

See [Table A1](#).

Table A1

Everyday conflicting situations of the CSC-G in English and German.

- You're home, and the dinner table's been set. In order to eat with the others, you must finish your game now. But you are in the middle of the game and would like to continue playing. What do you do?**
Du bist zu Hause und der Abendbrottisch wurde gedeckt. Um mit den Anderen gemeinsam zu essen, musst Du jetzt Dein Spiel beenden. Du bist aber mitten im Spiel und möchtest gerade eigentlich gerne weiterspielen. Was tust Du?
- In a couple of days, you will take an important exam/attend an important meeting. In order to be well prepared you want to finish some things off today. Before you begin you notice that you would rather like to play. What do you do?**
Dir steht in wenigen Tagen eine wichtige Prüfung/Besprechung bevor. Um gut vorbereitet zu sein, möchtest Du heute noch ein paar Dinge dafür erledigen. Bevor du beginnst merkst Du, dass Du gerade eigentlich gerne spielen möchtest. Was tust Du?
- Your acquaintances spontaneously ask you if you want to do something with them. The activity they suggest sounds quite OK. You think for a moment - actually you just wanted to start playing. What do you do?**
Deine Bekannten fragen Dich spontan, ob Du etwas mit ihnen unternehmen möchtest. Die Unternehmung, die sie vorschlagen, klingt ganz OK. Du überlegst kurz – eigentlich wolltest Du gerade beginnen zu spielen. Was tust Du?
- You just walked in the door hungry after a long day. You look into the fridge and realize that you have nothing left to eat at home. So you have to set off again, although you actually would like to play right now. What do you do?**
Du bist nach einem langen Tag gerade hungrig zur Tür reingekommen. Du schaust in den Kühlschrank und merkst, dass Du nichts mehr zu essen zu Hause hast. Du musst also nochmal los, obwohl Du jetzt eigentlich gerne spielen möchtest. Was tust Du?
- You come home and realize that you should tidy up. It will take some time to bring order into the most important things in your apartment. Actually, you would rather like to play right now. What do you do?**
Du kommst nach Hause und bemerkst, dass Du mal wieder Ordnung in Deiner Wohnung schaffen solltest. Das Wichtigste aufzuräumen wird einige Zeit in Anspruch nehmen. Allerdings wolltest Du eigentlich gerade gerne spielen. Was tust Du?
- The laundry heap in your room that has accumulated needs to be done. To make sure that the laundry is dry again in time so that you have fresh clothes, you have to finish your game now. However, you would like to continue playing. What do you do?**
In Deinem Zimmer hat sich ein Wäschehaufen angesammelt, der mal wieder gewaschen werden muss. Damit die Wäsche rechtzeitig wieder trocken ist und Du frische Kleidung hast, musst Du jetzt Dein Spiel beenden. Allerdings möchtest Du gerade eigentlich gerne weiterspielen. Was tust Du?
- You are at home and just in the middle of the game when you remember that you are about to meet friends. You will certainly enjoy the activity. To keep your appointment, you have to finish your game and get on your way, even though you would like to continue playing. What do you do?**
Du bist zu Hause und gerade mitten im Spiel als Dir einfällt, dass Du gleich mit Freunden verabredet bist. Die Unternehmung wird Dir sicher Spaß machen. Um die Verabredung einzuhalten, musst Du Dein Spiel beenden und Dich auf den Weg machen, obwohl Du gerade eigentlich gerne weiterspielen möchtest. Was tust Du?
- You come home late in the evening and tomorrow is an ordinary day at work/training/university. You know that if you start now, you will play for a long time and have little time to sleep. However, you would like to play right now. What do you do?**
Du kommst abends spät nach Hause und für Dich steht morgen ein gewöhnlicher Arbeitstag/Tag bei der Ausbildung/in der Uni an. Du weißt, dass Du lange spielen und wenig Zeit zum Schlafen haben wirst, wenn Du jetzt anfängst. Allerdings möchtest Du gerade gerne spielen. Was tust Du?
- You are invited to a friend's birthday party today. You probably don't know many people at the birthday party, but your friend will be happy if you come. To be on time, you have to finish your game and set off, although you would like to continue playing. What do you do?**
*Du bist heute auf dem Geburtstag eines*r Bekannten eingeladen. Du kennst auf dem Geburtstag wahrscheinlich wenig Leute, aber Dein*e Bekannte*r wird sich freuen, wenn Du kommst. Um pünktlich zu sein, musst Du Dein Spiel beenden und Dich auf den Weg machen, obwohl Du eigentlich gerne weiterspielen möchtest. Was tust Du?*
- You come home in the evening after a long day and you need to take a shower, shave and cut your nails. You know you won't get around to that today if you don't do it now. However, you would rather like to play right now. What do you do?**
Du kommst abends nach einem langen Tag nach Hause und könntest mal wieder eine Dusche nehmen, Dich rasieren und Nägel schneiden. Du weißt, dass Du dazu heute nicht mehr kommen wirst, wenn Du es nicht sofort tust. Allerdings möchtest Du gerade eigentlich gerne spielen. Was tust Du?
- Tomorrow you have a day off and there are only a few hours left until sunrise. You know you'll be playing for a long time if you don't turn off your PC soon and finish your game. But you would like to continue playing right now. What do you do?**
Morgen hast Du frei und es sind nur noch wenige Stunden bis zum Sonnenaufgang. Du weißt, dass Du noch lange Spielen wirst, wenn Du nicht bald den PC ausmachst und Dein Spiel beendest. Du möchtest aber gerade eigentlich gerne weiterspielen. Was tust Du?
- You recently arranged with your parents that you would visit them today. They don't live far, but to meet them, you have to set off and finish your game now. However, you would like to continue playing right now. What do you do?**
Du hast neulich mit Deinen Eltern vereinbart, dass Du sie heute besuchen kommst. Sie wohnen nicht weit, aber um sie zu treffen, musst Du jetzt los und Dein Spiel beenden. Allerdings möchtest Du gerade eigentlich gerne weiterspielen. Was tust Du?
- In order to be better prepared for next week, you want to sort some important documents. You only have time for this today and need to quit your game in order to get it done. But you would actually like to continue playing right now. What do you do?**
Um für die nächste Woche besser vorbereitet zu sein, willst Du dieses Wochenende wichtige Unterlagen sortieren. Du hast nur noch heute dafür Zeit und musst dafür jetzt Dein Spiel beenden. Du möchtest aber eigentlich gerade gerne weiterspielen. Was tust Du?
- Your friends ask you spontaneously if you want to do something with them. The activity they suggest sounds quite OK. You think about it for a moment - actually you just wanted to play. What do you do?**
Deine Freunde fragen Dich spontan, ob Du etwas mit ihnen unternehmen möchtest. Die Unternehmung, die sie vorschlagen, klingt ganz OK. Du überlegst kurz – eigentlich wolltest Du gerade gerne spielen. Was tust Du?
- You come home in the evening after a long day and the kitchen should be cleaned and tidied up. You know that you will be too lazy for that later if you don't do it now. However, you would rather like to play right now. What do you do?**
Du kommst abends nach einem langen Tag nach Hause und die Küche sollte mal wieder aufgeräumt und geputzt werden. Du weißt, dass Du später zu faul dafür sein wirst, wenn Du es nicht direkt machst. Allerdings möchtest Du gerade eigentlich gerne spielen. Was tust du?
- You have a date with your friends tonight. You decide spontaneously what you want to do. To get there on time, you have to finish your game now and get going. However, you would like to continue playing right now. What do you do?**
Du bist heute Abend mit Deinen Freunden verabredet. Was ihr machen wollt, entscheidet ihr spontan. Um rechtzeitig da zu sein, musst Du jetzt Dein Spiel beenden und Dich auf den Weg machen. Allerdings möchtest Du eigentlich gerade gerne weiterspielen. Was tust Du?
- It is already late and tomorrow is a usual day at work/training/university with nothing special scheduled. You should turn off your computer soon in order to be well rested. However, you would like to continue playing right now. What do you do?**
Es ist schon ziemlich spät und morgen ist ein gewöhnlicher Tag auf der Arbeit/bei der Ausbildung/in der Uni, für den nichts Besonderes ansteht. Du solltest langsam den PC ausmachen, um ausgeschlafen zu sein. Allerdings möchtest Du gerade eigentlich gerade gerne weiterspielen. Was tust Du?
- Your friends ask if you would like to meet up with them. The activity they propose sounds fun. You think for a moment – actually you wanted to play right now. What do you do?**
Deine Freunde fragen Dich, ob Du etwas mit ihnen unternehmen möchtest. Die Unternehmung, die sie vorschlagen, klingt Spaßig. Du überlegst kurz – eigentlich wolltest Du gerade gerne spielen. Was tust Du?

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