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

Annika Brandtnera, Elisa Wegmannb, Matthias Branda,b,*

a University of Duisburg-Essen, Department of General Psychology: Cognition and Center for Behavioral Addiction Research (CeBAR), Duisburg, Germany
b Erwin L. Hahn Institute for Magnetic Resonance Imaging, Essen, Germany

ARTICLE INFO

Keywords:
Gaming
Urge
Desire thinking
Decision-making
Conflicting situations

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 (Warberg, 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 (Brevers & Noël, 2013) including problematic gaming (Dong, Li, Wang, & Potenza, 2017) and are integrated...
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, Wölfling, & 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, Nynhuys, & 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 multisensory 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 & Drobes, 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 superordinate 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 & Drobes, 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-Dymand, & 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 subcomponents 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
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.

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.

Table 1

| Exemplary scenarios representing a decisional conflict between gaming and another activity with percentage values of their occurrence. |
|---|---|---|---|---|
| (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.
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 perseverance; 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 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).

3.1.2.4. 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. For this study, 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 perseverance) 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) depicted 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     | 1     | 1     | 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 (Ti) and the Variance Inflation Factor (VIF) were calculated to examine multicollinearity of independent variables. A value over 0.02 for Ti 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 (Ti = 0.94; VIF = 1.07), age (Ti = 0.92; VIF = 1.09), urge to game (Ti = 0.68; VIF = 1.43), DTQimaginal (Ti = 0.30; VIF = 3.35), and DTQverbal (Ti = 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.

3.2.2. 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 (β = 0.16, SE = 0.06, p = .007), whereas the indirect pathways urge, imaginal prefiguration, decisions to game (β = 0.01, SE = 0.07, p = .938) and urge, verbal perseveration, decisions to game (β = 0.02, SE = 0.03, p = .567) are not significant. The direct effect of urge to game on everyday decision-making was not significant (β = 0.17, SE = 0.09, p = .070). The covariates age and gender did neither show significant effects on decisions to game (age: β = −0.40, p = .623; gender: β = 0.04, p = .589), nor on imaginal prefiguration (age: β = −0.11, p = .167; gender: β = 0.01, p = .870), nor on verbal perseveration (age: β = −0.02, p = .763; gender: β = −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 gaming; 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
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, Vincisoli, & 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 gaming 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.

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.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or non-profit sectors.

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.
Your current activity is to finish a game before going to sleep. You have a choice to continue playing or to turn off the computer. What action do you take?

A. Turn off the computer now.
B. Continue playing.

Your current activity is to tidy up your apartment. You have a choice to continue cleaning or to stop. What action do you take?

A. Continue cleaning.
B. Stop cleaning.

Your current activity is to continue playing a game. You have a choice to continue playing or to turn off the computer. What action do you take?

A. Turn off the computer now.
B. Continue playing.

Your current activity is to prepare for an appointment. You have a choice to continue preparing or to stop. What action do you take?

A. Continue preparing.
B. Stop preparing.

Your current activity is to attend an important meeting. You have a choice to continue attending or to leave. What action do you take?

A. Continue attending.
B. Leave the meeting.

Your current activity is to continue playing a game. You have a choice to continue playing or to turn off the computer. What action do you take?

A. Turn off the computer now.
B. Continue playing.

Your current activity is to prepare for an appointment. You have a choice to continue preparing or to stop. What action do you take?

A. Continue preparing.
B. Stop preparing.

Your current activity is to continue playing a game. You have a choice to continue playing or to turn off the computer. What action do you take?

A. Turn off the computer now.
B. Continue playing.

Your current activity is to prepare for an appointment. You have a choice to continue preparing or to stop. What action do you take?

A. Continue preparing.
B. Stop preparing.
Martino, F., Caselli, G., Felicetti, F., Rampioni, M., Romanelli, P., Troiani, L., ... Spada, M. M. (2017). Desire thinking as a predictor of craving and binge drinking: A longitudinal study. *Addictive Behaviors, 64, 118–122.* https://doi.org/10.1016/j.addbeh.2016.08.046.

May, J., Andrade, J., Panabokke, N., & Kavanagh, D. J. (2004). Images of desire: Cognitive models of craving. *Memory, 12*(4), 447–461. https://doi.org/10.1080/0965821044400061.

Muthén, L. K., & Muthén, B. O. (2011). *MPlus.* Los Angeles, CA: Muthén & Muthén.

Renner, F., Murphy, F. C., Ji, J. L., Manly, T., & Holmes, E. A. (2019). Mental imagery as a “motivational amplifier” to promote activities. *Behaviour Research and Therapy, 114,* 51–59. https://doi.org/10.1016/j.brat.2019.02.002.

Robinson, T. E., & Berridge, K. C. (1993). The neural basis of drug craving: An incentive-sensitization theory of addiction. *Brain Research Reviews, 18*(3), 247–291. https://doi.org/10.1016/0165-0173(93)90013-P.

Robinson, T. E., & Berridge, K. C. (2008). The incentive sensitization theory of addiction: Some current issues. *Philosophical Transactions of the Royal Society B: Biological Sciences, 363*(1507), 3137–3146. https://doi.org/10.1098/rstb.2008.0093.

Ross, D. R., Finestone, D. H., & Lavin, G. K. (1982). Space invaders obsession. *JAMA, 248*(10), 1177. https://doi.org/10.1001/jama.1982.03330100017009.

Singer, N., Kreuzpointner, L., Sommer, M., Wüst, S., & Kudielka, B. M. (2019). Decision-making in everyday moral conflict situations: Development and validation of a new measure. *PloS One, 14*(4), https://doi.org/10.1371/journal.pone.0214747.

Steenbergen, L., Sellaro, R., Stock, A.-K., Beste, C., & Colzato, L. S. (2015). Action video gaming and cognitive control: Playing first person shooter games is associated with improved action cascading but not inhibition. *PloS One, 10*(12), Article e0144364. https://doi.org/10.1371/journal.pone.0144364.

Spada, M. M., Langston, B., Nikčević, A. V., & Moneta, G. B. (2008). The role of metacognitions in problematic Internet use. *Computers in Human Behavior, 24*(5), 2325–2335. https://doi.org/10.1016/j.chb.2007.12.002.

Spada, M. M., Sellaro, R., Stock, A.-K., Beste, C., & Colzato, L. S. (2015). Action video gaming and cognitive control: Playing first person shooter games is associated with improved action cascading but not inhibition. *PloS One, 10*(12), Article e0144364. https://doi.org/10.1371/journal.pone.0144364.

Tapp, K. (2018). Mindfulness and craving: Effects and mechanisms. *Clinical Psychology Review, 59,* 101–117. https://doi.org/10.1016/j.cpr.2017.11.003.

Tiffany, S. T., & Drobes, D. J. (1990). Imagery and smoking urges: The manipulation of affective content. *Addictive Behaviors, 15*(6), 531–539. https://doi.org/10.1016/0306-4603(90)90055-x.

Tiffany, S. T., & Wray, J. (2009). The continuing conundrum of craving. *Addiction, 104*(10), 1618–1619. https://doi.org/10.1111/j.1360-0443.2009.02588.x.

Wartberg, L., Kriston, L., & Thomastin, R. (2020). Internet gaming disorder and problematic social media use in a representative sample of German adolescents: Prevalence estimates, comorbid depressive symptoms and related psychosocial aspects. *Computers in Human Behavior, 103,* 31–36. https://doi.org/10.1016/j.chb.2019.09.014.

Wei, L., Zhang, S., Turel, O., Bechara, A., & He, Q. (2017). A tripartite neurocognitive model of Internet gaming disorder. *Frontiers in Psychiatry, 8,* 285. https://doi.org/10.3389/fpsyt.2017.00285.

Weinstein, A. M. (2017). An Update Overview on Brain Imaging Studies of Internet Gaming Disorder. *Frontiers in Psychiatry, 8,* 185. https://doi.org/10.3389/fpsyt.2017.00185.

Wells, A. (2009). *Metacognitive therapy for anxiety and depression.* London, UK: Guilford Press.

World-Health-Organization (2018). International statistical classification of diseases and related health problems (11th Revision).