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More than loot boxes: the role of video game streams and gambling-like elements in the gaming-gambling connection among adolescents

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Abstract: The intertwining of video games and gambling, known as simulated gambling, has prompted concerns about the potential influence of simulated gambling as a stepping stone towards monetary gambling. Previous studies tend to focus overwhelmingly on loot boxes, which are video game packages where the randomized content is hidden until opening them. The current study broadens this horizon by mapping the relationships between various gambling-like elements within the video gaming ecosystem, and monetary gambling. Applying the Theory of Reasoned Action, the study considered attitude, perceived normative pressure, and intention alongside monetary gambling behavior. In winter 2021 and early 2022, 1472 Flemish adolescents (mean age = 14.02, 47.5% female) took part in a survey on simulated and monetary gambling. Respondents had participated in simulated (75.3%) and monetary gambling (60.4%) in the past year. Bivariate correlations revealed that gambling-like activities were positively correlated ($p < .001$) with monetary gambling. Hierarchical multiple regression analyses indicated that watching gambling streams, spinning prize wheels, and spending money in social casino games predict monetary gambling ($p < .001$). Adding loot boxes and other gambling-like elements explained extra variance on top of gender and age ($p < .001$). Structural equation modelling suggested a pathway model from simulated gambling to monetary gambling attitude, normative pressure, intention, and behavior. This study underscores the importance of considering diverse gambling-like elements in research on the relationship between simulated and monetary gambling, next to the applicability of the Theory of Reasoned Action.

Keywords: Adolescents, Pathway Model, Gambling-like Elements, Video Gaming, Loot Boxes, Theory of Reasoned Action.

Introduction

Most jurisdictions aim to safeguard minors from participating in monetary gambling activities. Nevertheless, adolescents report taking part in such activities (Andrie et al., 2019; Bradt et al., 2023; Molinaro et al., 2018). A meta-analysis has shown that between 0.2 and 12.3% of adolescents in Europe even show signs of problem gambling (Calado et al., 2017). Problem gambling affects adolescents' lives in various negative ways, such as reporting increased feelings of depression and anxiety (Andrie et al., 2019), problems in their social and school life (Andrie et al., 2019; Livazović & Bojčić, 2019; Yip et al., 2011), and increased substance use (Molinaro et al., 2018).

As the online touchpoints with gambling opportunities have been increasing due to the digitalisation process of the gambling ecosystem and the associated changing business models, adolescents are progressively exposed to games of chance (Delfabbro et al., 2016). Next to possible exposure to genuine gambling content, nowadays, adolescents are even more likely to encounter gambling-like elements within video games, a trend that is often referred to as "simulated gambling". While there is no conclusive definition of simulated gambling, we will refer to King et al. who have defined simulated gambling as "a digitally simulated interactive gambling activity that does not directly involve monetary gain but is otherwise structurally identical to the standard format of a gambling activity due to its wagering features and chance-determined outcomes of play" (2014, p. 305). In other words, simulated gambling pertains to the blurring of lines between playing video games and monetary gambling.

Because of its resemblance to monetary gambling, it is no surprise that there has been growing concern that simulated gambling could act as a stepping stone towards monetary gambling, a hypothesis often referred to as the gateway hypothesis (Hayer et al., 2018). Previous studies have found significant positive correlations between the interaction with these elements and participation in monetary gambling in adolescents (Zendle et al., 2019). As new types of gambling-like elements are expected to be launched in the future (Johnson & Brock, 2020), there is a need to continue researching and incorporating various gambling-like elements.

Previous research has mainly focused on loot boxes, mainly due to their immense popularity and high visibility, which is to be explained by their economic impact, generating an estimated 15 billion US dollars in 2020 (Statista, 2021), as well as by their media and policy attention. While this study takes loot boxes as a starting point, it does not approach it as the end point, as we will account for a wide range of gambling-like elements. Some of these elements are located within video games, such as loot boxes and prize wheels. Some elements are nested within video game genres, such as social casino games. Other elements even appear outside of video games, within video game streams, such as loot box unboxing videos and gambling streams. Considering that research on player's interactions with gambling-

like elements amongst adolescents is scarce and called upon (Armstrong et al., 2018; Gainsbury et al., 2015; Garea et al., 2021; Zendle et al., 2019), our study set out to conduct a large-scale panel study amongst adolescents led by the following research question: how do gambling-like activities (more specifically: loot boxes, prize wheels, social casino games, loot box openings, and gambling streams) relate to adolescents' monetary gambling attitude, perceived normative pressure, intention, and behavior? In doing so, we will employ the Theory of Reasoned Action, looking at the link between simulated gambling behavior, monetary gambling attitude, perceived normative pressure regarding monetary gambling, monetary gambling intention, and monetary gambling behavior.

Literature review

Research has shown that adolescents are regularly exposed to and participate in simulated gambling activities, such as playing social casino games or opening loot boxes (Carran & Griffiths, 2015; Hayer et al., 2018; King et al., 2014; Kristiansen & Severin, 2020; Veselka et al., 2018). Although these gambling-like elements often do not result in direct financial payouts, they contain an element of surprise and do offer in-game prizes. These prizes, such as coins, skins, or weapons, can act as non-monetary incentives and hold value within or outside of the video game (Armstrong et al., 2018; De Cock et al., 2018). Gambling-like elements are often portrayed as colorful and childlike, and players are likely to perceive them as safe and less harmful than monetary gambling (Carran & Griffiths, 2015; Gainsbury et al., 2015) or a perfect way to practice gambling without the risk of losing real money (Hayer et al., 2018). Simulated gambling thus shows similarities with monetary gambling, making it difficult for video game players to distinguish between different forms of gambling (Kristiansen et al., 2018), particularly for more vulnerable groups such as pathological gamblers, children, and adolescents.

Because of their similarities, concerns about a stepping stone effect from simulated to monetary gambling have been voiced in academia, resulting in the so-called gateway hypothesis (Hayer et al., 2018). This gateway hypothesis manifests itself in multiple ways. Simulated gambling often presents gambling as an everyday practice, contributing to its normalization. It promotes gambling beliefs by using inflated payout rates, misrepresenting the true chances of winning (Frahn et al., 2015; Gainsbury et al., 2015). Simulated gambling games often use in-game currency (such as chips) or introduce obfuscating trading systems, possibly adding to the desensitization of the value of real-world money (Armstrong et al., 2018; Drummond & Sauer, 2018; Gainsbury et al., 2015). Next, simulated gambling games are typically offered as a free, demo version of real gambling, enabling practicing monetary gambling without the risk of losing real money (Derevensky & Gainsbury, 2016; Gainsbury et al., 2016). Gambling-like elements can familiarize players with the mechanics of gambling, smoothening the transition to monetary gambling (Carran &

Griffiths, 2015; King et al., 2014; Kristiansen et al., 2018). Age verification for these simulated gambling practices is weak, easily circumvented, or even totally absent, allowing minors access to these otherwise "adult" activities (Armstrong et al., 2018). Moreover, it can provide players with an early big win, which is often correlated with a higher likelihood of developing problem gambling behavior later in life (Armstrong et al., 2018; King & Delfabbro, 2016). Lastly, simulated gambling usually occurs within a context where gaming skills are relevant, whereas monetary gambling is generally not associated with any particular skills (with some exceptions, like poker). Simulated gambling games are therefore often seen as a perfect training ground for monetary gambling, possibly resulting in an overconfidence in one's skills (Armstrong et al., 2018; Gainsbury et al., 2016; Kristiansen et al., 2018), a false perception of chance and probability (King & Delfabbro, 2016), and so-called magic thinking (De Cock et al., 2018).

More than loot boxes; more than adults

Loot boxes are present in a large part of video games deemed suitable for children and adolescents (Zendle et al., 2020b). Research has pointed to a significant positive correlation between loot box engagement and (problem) gambling amongst both adolescents (Kristiansen & Severin, 2020; Zendle et al., 2019) and adults (Li et al., 2019; Zendle & Cairns, 2018; Zendle & Cairns, 2019; Zendle et al., 2020a), and between risky loot box use and problem gambling amongst adults and undergraduates (Brooks & Clark, 2019). The level of engagement in loot box related behaviors is often of importance, with risky and problem gambling behavior showing a stronger link with paying for loot boxes and selling items from loot boxes than with opening free loot boxes (Kristiansen & Severin, 2020).

Yet, the video game landscape and its monetization features are constantly changing (Johnson & Brock, 2020), with diverse types of gambling-like elements being introduced on a regular basis. Following Zendle, we argue that "the convergence of gaming and gambling is far more complex than simply the existence of loot boxes" (2020, p. 21). In this context, Zendle (2020) has, for instance, established a significant correlation between a variety of simulated gambling activities, such as loot boxes, esports betting, token wagering, and monetary gambling. Considering the limited research on different types of simulated gambling and monetary gambling, and the dynamic simulated gambling landscape, the current study aims to sketch a more complete picture that pays justice to the layered ecosystem in which simulated gambling is manifested. We do so by looking beyond loot boxes only and by including a variety of gambling-like elements next to loot boxes, including gambling-like elements within video games, within video game genres, and outside of video games, in video game streams. Players interact both directly (e.g.: opening loot boxes) and more indirectly (e.g.: watching gambling streams) with these elements.

First, of the category of gamblified in-game elements, loot boxes are the most prominent example. These boxes with hidden contents are offered to players either for free or for a small fee, in hopes of prolonging the players' in-game time and maximizing profits (assuming players keep on playing until they acquire the desired item) (Johnson & Brock, 2020). Although previous research has extensively examined loot boxes, conducting research in Belgium, where the current study takes place, makes for a special case because of the unique legal classification of paid-for loot boxes as gambling and their consequent status as deemed illegal (Belgian Gaming Commission, 2018; Declerck & Feci, 2022). Previous research, however, has indicated that these regulations on the one hand are not always implemented (Xiao, 2023), and that players on the other hand know how to circumvent them (Denoo et al., 2023a). Another popular gamblified video game mechanism is the prize wheel, which allows players to spin a wheel to win a random prize. Players are often gifted free spins on a daily basis, encouraging them to log in every day (Denoo et al., 2023b).

Second, the blurring of lines between video games and gambling is manifested not only in gambling-like elements in video games, but also in the gamblification of entire video games and video game genres. One example is social casino games (SCG), or "games which are based on or interact with social networks and that simulate gambling activities" (Gainsbury et al., 2014, p. 203). Despite what the name suggests, these video games are not limited to the simulation of casino games, but also include simulated versions of lotteries, bingo, and slots. Although these video games do not require any monetary investment, players can often buy new coins once their stock is depleted or purchase items that will upgrade their game experience (the so-called "freemium" model). Social casino game players are often more inclined to take part in monetary gambling and show more signs of problem gambling, compared to non-players. This relationship has been established amongst adults (Gainsbury et al., 2016; Kim et al., 2015), as well as amongst adolescents (Veselka et al., 2018). In-game payments seem to be of importance, with paying social casino game players being more likely to migrate to monetary gambling in comparison to non-paying players (Gainsbury et al., 2016; Kim et al., 2015).

Lastly, gambling-like elements have also found their way beyond the boundaries of video games, forming a video game ecosystem that includes video game streaming. For example, the "slots" category on Twitch, one of the most popular video game streaming platforms, displays streamers playing a myriad of gambling games, and has over one million followers. Another popular type of video is loot box openings, where streamers open loot boxes and show their contents to viewers. Adolescents can watch video game streamers opening loot boxes or playing gambling games, enabling them to share in the otherwise forbidden experiences. According to the Social Learning Theory (Bandura, 1977), which suggests that people can be influenced by watching others perform certain behaviors,

adolescents might be triggered to try out gambling themselves after watching these videos.

Because engagement in these different types of simulated gambling is likely to add to the normalization of gambling, and could even bring along an early big win, it is important to study their effects on adolescents. The justification of this age group also follows from the finding that there is a significant, moderate to large correlation between loot box spending and problematic gambling (Kristiansen & Severin, 2020; Zendle et al., 2019); a link that seems to be stronger in older adolescents than in adults (Zendle et al., 2019). The focus of our current study will therefore focus on a large-scale sample of adolescents. Hereby we also address the explicit call for more research on simulated gambling amongst adolescents, as expressed by researchers such as Garea et al. (2021) and Zendle et al. (2019).

The current study

In filling these two research gaps, namely the need for more research on a variety of gambling like elements besides loot boxes only, and the need to study this in young adolescents, we aim to provide a theory driven understanding informed by the Theory of Reasoned Action (Fishbein & Ajzen, 1975). This theory states that behavior can be predicted by intention. Intention, in its turn, is preceded by both attitude and norms. The Theory of Reasoned Action has proven to be useful in predicting monetary gambling behavior. Previous cross-sectional research amongst college students (Dahl et al., 2018; Lee, 2013) and adults (Dahl et al., 2018) has indicated that both positive attitudes toward, as well as heightened perceived normative pressure regarding monetary gambling can predict monetary gambling intention and past gambling behavior. Intention to gamble has also proven to be a good predictor of future gambling behavior in longitudinal research, alongside past gambling behavior (Dahl et al., 2018). Moreover, exposure to gambling media has shown to be a predictor of casino gambling intention, via attitude and perceived norms (Lee, 2013). Therefore, we will implement the Theory of Reasoned Action by not only looking at monetary gambling behavior, but also at monetary gambling attitude, perceived normative pressure regarding monetary gambling, and monetary gambling intention, next to simulated gambling.

To provide an answer to these research gaps, a large-scale panel study amongst Flemish (= Dutch-speaking part of Belgium) adolescents has been conducted. We aim at answering the following central research questions: (1) How does the engagement with loot boxes relate to adolescents' monetary gambling attitude, norms, intention, and behavior? and (2) What is the contribution of other gambling-like activities to adolescents' monetary gambling attitude, norms, intention, and behavior, next to loot boxes? Previous research has pointed towards gender differences, as for example boys take more often part in loot box related activities (Kristiansen & Severin, 2020), and the link between playing social casino games and monetary gambling is stronger among males (Gainsbury

et al., 2016). Therefore, in answering our central research questions, gender aspects are taken into account.

Method

Participants and procedures

Between November 2021 and March 2022, 2289 Flemish adolescents (Flanders is the Dutch speaking northern part of Belgium) of 13 high schools took part in our study. Respondents answered a variety of questions regarding simulated gambling and monetary gambling. Three modalities were offered to participating schools: questionnaires could be distributed online during class hours, online outside of school hours (by sending out the link to the questionnaire to students via mail), or on paper during class hours. We collaborated with multiple schools across Flanders and asked them to include as many of the students as possible. This resulted in a random sample, instead of a convenience sampling method that is often employed in previous research on simulated gambling (see for example Li et al., 2019). This way, we aimed to eliminate self-selection bias and increased the generalization potential of the study. To improve the comprehensibility and flow of the questionnaire, the survey was pretested by adolescents between 11 and 17 years old. Based on the pretest outcome, small changes were made to the final design of the questionnaire to increase the comprehension of the questions, especially for the youngest respondents.

Only participants between the ages of 11 and 17 who answered all questions regarding both simulated gambling and monetary gambling were retained for this study. Maximum age was determined by the legal gambling age in Belgium, which is 18 years old for betting (online and offline), and 21 for casinos and slot machine arcades (online and offline) (Gaming Commission, 2023). A total of 40 participants were omitted from the sample as they did not adhere to the age limit: 20 participants were over the age of 17, one participant was below the age of 11, and nine participants did not indicate their age. A total of 643 respondents did not fill out all questions regarding simulated gambling and monetary gambling and were removed from the sample. Lastly, 144 respondents failed an attention check and were removed from the sample as well. Our final sample consisted of 1472 respondents, with an average age of 14.02 years old (SD = 1.42), and 47.5% identifying themselves as female (50.7% as male, and 1.2% as “other”, 0.6% left the question blank).

Measures

After filling out the informed consent and socio demographic questions (e.g.: gender, age, and education level), respondents answered questions on simulated and monetary gambling. The research instruments were developed as part of a bigger research project. In what follows, we focus on the key measures of simulated gambling and monetary gambling, that were used in the analyses reported in this article.

Simulated gambling

Frequency of participation in seven different simulated gambling activities was measured by a scale that was developed for this study. These activities contained three loot box related activities (opening free loot boxes, paying for loot boxes, and selling items from loot boxes) and four other gambling-like activities (spinning a prize wheel, paying for items in social casino games, watching other players opening loot boxes (so-called "loot box openings", for example on video game stream platforms), and watching gambling streams. A brief description with examples was provided for each activity, in order to improve clarity. Table 1 displays all surveyed simulated gambling activities. Respondents were asked to indicate how often they had participated in each of the proposed activities in the past twelve months, using a seven Likert-type scale, ranging from 1 = "Never", to 7 = "Every day", resulting in an average total score between 1 and 7. By using this frequency measure, we aimed for a granular picture regarding simulated gambling participation (as called upon by Kristiansen & Severin, 2020). Cronbach's alpha was .77 for the total scale. The Likert-scale was recoded to dichotomous 0/1 items, representing (not) participating in each activity.

Monetary gambling attitude, perceived norms, intention, behavior

Monetary gambling attitude was assessed using a seven-item scale, to be answered on a six-point Likert scale (ranging from 1 = "completely disagree" to 6 = "completely agree"). Example items included "Monetary gambling is a fun pastime" and "I think that adults (+18 years) should be allowed to play monetary gambling games". The total scale resulted in an average score between 1 and 6, with higher scores indicating a more positive attitude towards monetary gambling (Cronbach's $\alpha = .82$).

Next, perceived norms regarding monetary gambling were measured by five items, to be answered on a seven-point scale. This scale was used by Dahl et al. (2018). Example items included "Most people who are important to me gamble" (answer options ranging from 1 = "Strongly Disagree" to 7 = "Strongly Agree") and "Most of the people whose opinions I value would approve of me gambling in the next 2 weeks'" (answer options ranging from 1 = "Disapprove" to 7 = "Approve"). Cronbach's alpha was .84 for the total scale. The higher the score, the higher the degree of perceived normative pressure.

Thirdly, monetary gambling intention was measured using a single item, namely: "What is the probability that you will gamble once you are over 18 years old?". Answers ranged from 0 to 10, with higher scores indicating a higher intention to gamble.

Lastly, frequency of participation in thirteen different monetary gambling activities (seven offline activities, six online activities) was measured. This scale was previously used in research amongst Flemish children and their parents (De Cock et al., 2018). Example items included "scratch cards", "online poker for money", and "online sport betting". Table

1 displays all surveyed monetary gambling activities. Like simulated gambling prevalence, respondents were asked to indicate how often they had participated in each of the proposed activities in the past twelve months, using a seven Likert-type scale, ranging from 1 = "Never", to 7 = "Every day". This resulted in an average total score between 1 and 7. Cronbach's alpha was .95 for the total scale. This Likert-scale was recoded to differentiate between respondents who did participate in monetary gambling in the past year, and those who did not.

Table 1: list of surveyed simulated and monetary gambling activities

Simulated gambling	Offline monetary gambling	Online monetary gambling
Loot box related activities ▪ Opening free loot boxes ▪ Paying for loot boxes ▪ Selling items from loot boxes *Other gambling-like activities* ▪ Paying for items in social casino games ▪ Watching loot box openings ▪ Watching gambling streams ▪ Spinning a prize wheel	▪ Scratch cards ▪ Lottery games on paper ▪ Betting amongst friends or in (sports) clubs ▪ Betting in a newsagent shop or in a betting office ▪ Poker amongst friends or family ▪ Gambling games in a café (such as bingo or slots) ▪ Gambling games in a casino	▪ Online betting ▪ Online sports betting ▪ Online games for money ▪ Online poker ▪ Online games, organised by the National Lottery ▪ Online lottery games

Data analysis

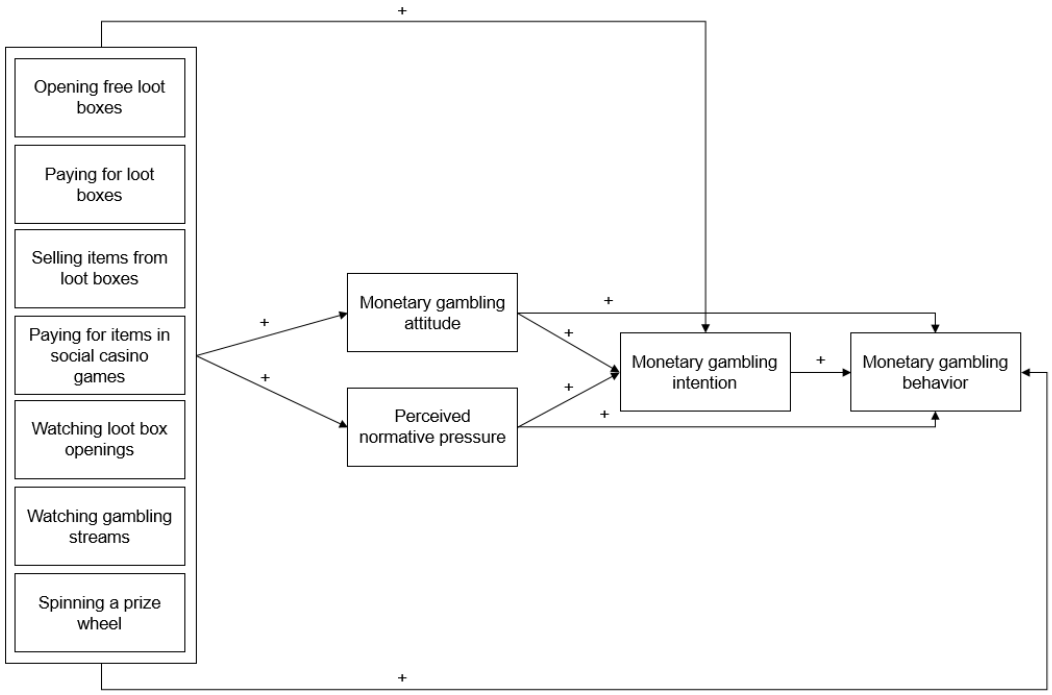
Analyses were performed in SPSS 28. Skewness and kurtosis were computed to test the normality distribution of the data, with absolute values of > 1 (skewness) and > 3 (kurtosis) regarded as abnormal. Frequency of participating in simulated gambling and monetary gambling, perceived normative pressure towards monetary gambling, and monetary gambling intention all violated the normality distribution, while monetary gambling attitude did not. Looking at simulated gambling activities separately, only opening free loot boxes and spinning prize wheels were distributed normally, while the other five activities were not.

First, descriptive statistics were conducted for each variable. Next, bivariate correlations between the different variables were calculated. Pearson's r was computed when the data was distributed normally, in all other cases we used Spearman's ρ. To test the possible contribution of (1) loot boxes and (2) other gambling-like activities next to loot boxes to monetary gambling attitude, perceived normative pressure, intention, and behavior, hierarchical linear regressions were conducted. Gender and age were entered in the first step, loot box related activities in a second step, and other gambling-like activities in a third step. Lastly, monetary gambling attitude, perceived normative pressure, intention, and behavior were entered

as dependent variables. This way, the predictive value of simulated gambling regarding adolescents' monetary gambling attitude, perceived normative pressure, intention, and behavior was checked.

In a final step, structural equation modelling (SEM) using the maximum likelihood estimator was performed in R lavaan (Rosseel, 2012), in order to test the proposed pathway model. Specifically, the surveyed simulated gambling activities were used as predictors of all monetary gambling variables. Attitude and normative pressure were modeled as predictors of monetary gambling intention, which, in its turn, was modeled to predict monetary gambling behavior. Monetary gambling attitude and normative pressure were allowed to correlate. In order to account for the non-normality of the data, Spearman correlations were used. Figure 1 displays the proposed model. The goodness of fit of the proposed model was evaluated using the following criteria: Comparative Fit Index (CFI) > .90, Roots Mean Square Error of Approximation (RMSEA) < .10, Standard Root Mean Square Residual (SRMR) < .08 for an acceptable fit. A CFI > .95, RMSEA < .08, and SMSR < .06 indicated good fit (Marsh et al., 2004).

Figure 1: proposed pathway model



Notes: paths from all simulated gambling activities to monetary gambling variables are also estimated, but individual arrows are omitted from the model for clarity

Ethics

Parents and legal caretakers of the students in participating schools were informed about the study via mail, prior to the start of the survey, and

gave their passive consent for their child's participation. Only students who were not deregistered by their parents or legal caretakers were presented with the survey. Respondents themselves were asked to agree to an informed consent before they could continue with the survey. This informed consent stated that participation was completely voluntary, and that all responses remained confidential. Respondents were able to stop their participation, without negative consequences, at all times. The procedure received ethical approval (G-2021-3439-R2(AMD), date of approval: 25/10/2021) by the Social and Societal Ethics Committee of the KU Leuven. Committee approval is in accordance with ethical guidelines detailed in the 1964 Helsinki Declaration or any of its succeeding amendments.

Results

Descriptives

Simulated gambling

Three out of four respondents (75.3%) indicated to have taken part in at least one of the seven surveyed simulated gambling activities in the past twelve months, with spinning a prize wheel (done by 59.2% of respondents) and opening free loot boxes (51.9%) being the most popular ones. Average frequency of participation was 1.86 (out of a score between 1 = "Never" and 7 = "Every day"; SD = 0.94). Table 2 describes the prevalence and average frequency of participation for all different simulated gambling activities. The participation rate for all seven activities in total and separately was significantly higher for boys than for girls. For example, 85.5% of boys had participated in at least one simulated gambling activity in the past twelve months, while 63.5% of girls had done so (Chi-square = 97.14, $p < .001$). Boys ($M = 2.20$, $SD = 1.02$) took significantly more often part in simulated gambling than girls ($M = 1.48$, $SD = 0.66$) ($t(1287.087) = 15.990$, $p < .001$; Cohen's $d = .831$). Age was not significantly correlated with frequency of participation in simulated gambling activities ($p = .636$).

Table 2: simulated gambling prevalence

Activity	Participation rate	Frequency of participation* (SD)
Loot box related activities		
Opening free loot boxes	51.9%	2.73 (2.07)
Paying for loot boxes	23.3%	1.46 (1.04)
Selling items from loot boxes	13.1%	1.32 (0.98)
Other gambling-like activities		
Paying for items in social casino games	7.3%	1.20 (0.84)
Watching loot box openings	42.7%	2.14 (1.66)
Watching gambling streams	21.0%	1.50 (1.18)
Spinning a prize wheel	59.2%	2.66 (1.87)

*On average, ranging from 1: "never" to 7: "every day"

Monetary gambling attitude, perceived norms, intention and behavior

Respondents' attitude towards monetary gambling was rather negative (mean = 2.15 out of 1-6, SD = 0.90), with girls' attitude (M = 2.09, SD = 0.84) being significantly more negative than boys' attitude (M = 2.20, SD = 0.93) ($t(1439.807 = 2.272$, $p < .05$; Cohen's $d = .119$). Age was significantly positively correlated with monetary gambling attitude ($r = .053$, $p < .05$), indicating that the older one gets, the more positive one is towards monetary gambling.

Average perceived normative pressure towards monetary gambling was 1.33 out of 1-7 (SD = .72). Boys perceived significantly more normative pressure (mean = 1.40, SD = .80) than girls (mean = 1.25, SD = .60) ($t(1368.522 = 3.986$, $p < .001$; Cohen's $d = .208$). Again, age was significantly correlated with perceived normative pressure ($\rho = .051$, $p < .05$). This means that the older one gets, the more normative pressure towards monetary gambling one perceives.

Average intention to gamble was 2.32 on a 0-10 scale (SD = 2.57), with intention of boys (M = 2.59, SD = 2.69) being significantly higher than that of girls (M = 2.02, SD = 2.39) ($t(1438.328) = 4.201$, $p < .001$; Cohen's $d = .220$). Age was significantly correlated with intention ($\rho = .055$, $p < .05$), indicating that older adolescents show a higher intention to gamble in the future than younger respondents.

Lastly, regarding monetary gambling behavior, our findings show that 60.4% of respondents had tried out at least one of the thirteen surveyed monetary gambling activities. Scratch cards and betting amongst friends were the most popular activities, with one in three participants taking part in it during the past twelve months. The average frequency of participation in monetary gambling activities was 1.25 (out of a score between 1 = "Never" to 7 = "Every day"; SD = .65), meaning respondents, on average, took part in monetary gambling less than a few times a year. The prevalence rate and average frequency of participation of all monetary gambling activities can be found in table 3. The participation rate of monetary gambling in total did not differ between boys and girls ($p = .604$). There were, however, some gender differences noticeable when looking at the activities separately. For example, while more girls had participated in offline lottery games, more boys had participated in, amongst others, poker (both online and offline) and online (sports) betting. Boys (M = 1.32, SD = .79) participated significantly more often in monetary gambling than girls (M = 1.17, SD = 0.43) ($t(1159.894) = 4.409$, $p < .001$; Cohen's $d = .228$). Age was not significantly correlated with gambling frequency ($p = .773$).

Table 3: monetary gambling prevalence

Activity	Participation rate	Frequency of participation* (SD)
Offline monetary gambling		
Scratch cards	33.6%	1.50 (0.91)
Lottery games on paper	22.6%	1.37 (0.89)
Betting amongst friends or in (sports) clubs	35.1%	1.61 (1.07)
Betting in a newsagent shop or in a betting office	6.0%	1.16 (0.74)
Poker amongst friends or family	10.7%	1.23 (0.83)
Gambling games in a café (such as bingo or slots)	8.8%	1.18 (0.73)
Gambling games in a casino	4.2%	1.12 (0.67)
Online monetary gambling		
Online betting	8.8%	1.20 (0.78)
Online sports betting	6.7%	1.19 (0.85)
Online games for money	10.7%	1.26 (0.91)
Online poker	3.7%	1.12 (0.69)
Online games, organised by the National Lottery	5.7%	1.14 (0.68)
Online lottery games	8.0%	1.18 (0.75)

*On average, ranging from 1: “never” to 7: “every day”

Bivariate correlations

Simulated gambling behavior was significantly positively correlated with monetary gambling attitude ($\rho = .28$), perceived normative pressure regarding monetary gambling ($\rho = .29$), monetary gambling intention ($\rho = .29$), and monetary gambling behavior ($\rho = .30$) (all $p < .001$). On top of that, participation in each of the surveyed simulated gambling activities on its own showed a significant positive correlation with monetary gambling attitude, perceived normative pressure, intention, and behavior (all $p < .001$). In most cases, correlations were stronger between non-loot box related activities and monetary gambling, than between loot box related activities and monetary gambling. For example, the correlation between watching gambling streams and all monetary gambling variables was stronger than the correlation between loot box related variables and all monetary gambling variables. This is a first hint towards the importance of including other gambling-like elements, next to loot boxes. Moreover, it points to the fact that even somewhat more passive activities (e.g., watching gambling streams instead of actively interacting with gambling-like elements) could play a part in monetary gambling. Lastly, all monetary gambling items (attitude, norms, intention, and behavior) were significantly correlated to each other (all $p < .001$). Table 4 presents a detailed overview of all scores.

Table 4: bivariate correlations (ρ) amongst simulated gambling and monetary gambling

	Monetary gambling attitude	**Perceived normative pressure towards monetary gambling**	**Monetary gambling intention**	**Monetary gambling behavior**
Simulated gambling behavior	**.276*** **	**.294*** **	**.288*** **	**.296*** **
Opening free loot boxes	.162*** ®	.180***	.197***	.155***
Paying for loot boxes	.141***	.191***	.147***	.233***
Selling items from loot boxes	.162***	.193***	.149***	.248***
Paying for items in social casino games	.167***	.242***	.116***	.283***
Watching loot box openings	.205***	.208***	.184***	.203***
Watching gambling streams	.244***	.281***	.265***	.300***
Spinning a prize wheel	.226*** ®	.239***	.255***	.280***
Zero-order correlations				
Perceived normative pressure towards monetary gambling	.416***	-	-	-
Monetary gambling intention	.461***	.431***	-	-
Monetary gambling behavior	.337***	.352***	.380***	-

*** $p < .001$

Note: ® denotes the use of Pearson correlations

Hierarchical multiple regression analyses

Monetary gambling attitude

In the first model, monetary gambling attitude was entered as a dependent variable. Both adding loot boxes (increase of 6.1% in R^2), as well as adding other gambling-like activities (increase of 5.0% in R^2) significantly improved the explained variance of the first model with only gender and age ($p < .001$). The total model with gender, age, loot box related activities, and other simulated gambling activities explained 11.4% of the total variance in monetary gambling attitude. Watching gambling streams ($\beta = .14$), spinning prize wheels ($\beta = .12$), and buying items in social casino games ($\beta = .10$), all significantly predicted attitude towards monetary gambling ($p < .01$), with the former having the largest predictive value. Although all three loot box related activities significantly predicted monetary gambling attitude in the second step, these activities lost their predictive value when adding other gambling-like activities. Table 5 offers a detailed overview of all entered variables and the steps of the presented model.

Table 5: Hierarchical multiple regression analysis predicting monetary gambling attitude

	F	p	R^2	B	SE B	BETA	SIG	95% CI
STEP 1	2.87	.057	.003					
Constant				1.750	.246		< .001	1.268, 2.232
Gender				-.051	.045	-.030	.260	-.139, .037
Age				.034	.017	.054	.039	.002, .067
STEP 2	20.91	<.001	.064					
Constant				1.089	.248		< .001	.602, 1.576
Gender				.096	.047	.056	.041	.004, .188
Age				.036	.016	.057	.025	.005, .068
Opening free loot boxes				.042	.012	.097	<.001	.018, .067
Paying for loot boxes				.104	.027	.121	<.001	.051, .158
Selling items from loot boxes				.111	.029	.121	< .001	.055, .167
STEP 3	21.76	<.001	.114					
Constant				.966	.244		<.001	.487, 1.445
Gender				.100	.047	.058	.033	.008, .192
Age				.030	.016	.048	.053	.000, .061
Opening free loot boxes				.009	.014	.020	.523	-.018, .035
Paying for loot boxes				.035	.028	.040	.221	-.021, .090
Selling items from loot boxes				.030	.030	.033	.306	-.028, .088
Buying items in social casino games				.105	.034	.099	.002	.039, .171
Watching loot box openings				.026	.018	.049	.141	-.009, .061
Watching gambling streams				.107	.025	.140	< .001	.059, .155
Spinning a prize wheel				.058	.014	.121	< .001	.031, .085

Notes: dependent variable = monetary gambling attitude; n = 1457; R^2 = adjusted R^2

Perceived normative pressure towards monetary gambling

Next, perceived normative pressure towards monetary gambling was assessed. Again, the model with only gender and age as predictors significantly improved when loot boxes were added (increase of 18.7% in R^2, $p < .001$). What is especially notable is that the explained variance rises with 8.7% when, next to loot boxes, other gambling-like elements are incorporated in the model ($p < .001$). The total model with gender, age, loot box related activities, and other simulated gambling activities explained 28.0% of variance in perceived normative pressure towards monetary gambling. Buying items in social casino games ($\beta = .27$), buying loot boxes ($\beta = .19$), watching gambling streams ($\beta = .16$) and selling items from loot boxes ($\beta = .08$) all significantly predicted the level of perceived normative pressure ($p < .01$). Buying items in social casino games had the largest predictive value. Details on this model can be found in table 6.

Table 6: Hierarchical multiple regression analysis predicting perceived normative pressure towards monetary gambling

	F	p	R^2	B	SE B	BETA	SIG	95% CI
STEP 1	5.14	.006	.005					
Constant				1.384	.197		< .001	.998, 1.771
Gender				-.113	.036	-.082	.002	-.183, -.042
Age				.008	.013	.016	.550	-.018, .034
STEP 2	70.63	<.001	.193					
Constant				.620	.185		< .001	.257, .983
Gender				.029	.036	.021	.412	-.040, .098
Age				.012	.012	.025	.297	-.011, .036
Opening free loot boxes				-.007	.009	-.019	.468	-.025, .012
Paying for loot boxes				.210	.020	.304	<.001	.170, .250
Selling items from loot boxes				.153	.021	.207	< .001	.111, .194
STEP 3	63.70	<.001	.280					
Constant				.531	.177		.003	.184, .878
Gender				.009	.034	.006	.803	-.058, .075
Age				.008	.011	.018	.433	-.013, .031
Opening free loot boxes				-.012	.010	-.034	.227	-.031, .007
Paying for loot boxes				.128	.020	.186	< .001	.088, .169
Selling items from loot boxes				.056	.021	.076	.009	.014, .098
Buying items in social casino games				.227	.024	.266	<.001	.179, .275
Watching loot box openings				-.015	.013	-.034	.251	-.040, .010
Watching gambling streams				.098	.018	.160	< .001	.063, .133
Spinning a prize wheel				.016	.010	.041	.112	-.004, .035

Notes: dependent variable = perceived normative pressure towards monetary gambling attitude; n = 1455; R^2 = adjusted R^2

Monetary gambling intention

In a next round of analyses, monetary gambling intention was assessed. Adding loot box related activities (increase of 2.4% in R^2, $p < .001$) and other gambling-like activities (increase of 4.9% in R^2, $p < .001$) significantly improved the first model only including gender and age ($p < .001$). The total model with gender, age, loot box related activities, and other simulated gambling activities explained 8.4% of variance in monetary gambling intention. Watching gambling streams ($\beta = .20$) and spinning prize wheels ($\beta = .15$) significantly predicted monetary gambling intention ($p < .001$). Also in this analysis, watching gambling streams had the largest predictive value. Opening free loot boxes and selling items from loot boxes significantly predicted monetary gambling intention in the second step of the model, however, both items lost their predictive value when adding other gambling-like activities to the model. The different steps and their contribution to the model can be found in table 7.

Table 7: Hierarchical multiple regression analysis predicting monetary gambling intention

	F	p	R^2	B	SE B	BETA	SIG	95% CI
STEP 1	8.82	<.001	.011					
Constant				1.334	.701		.057	-.041, 2.709
Gender				-.422	.128	-.084	.001	-.674, -.171
Age				.116	.047	.064	.014	.023, .209
STEP 2	11.43	<.001	.035					
Constant				.094	.722		.896	-1.322, 1.511
Gender				-.115	.137	-.023	.401	-.383, .153
Age				.117	.047	.065	.012	.026, .209
Opening free loot boxes				.141	.036	.113	< .001	.070, .213
Paying for loot boxes				.105	.079	.043	.183	-.050, .260
Selling items from loot boxes				.170	.083	.065	.040	.008, .333
STEP 3	15.77	<.001	.084					
Constant				.118	.711		.868	-1.277, 1.514
Gender				-.141	.137	-.029	.301	-.409, .127
Age				.087	.046	.047	.056	-.002, .177
Opening free loot boxes				.050	.040	.040	.207	-.028, .128
Paying for loot boxes				.008	.082	.003	.922	-.153, .169
Selling items from loot boxes				.009	.086	.003	.919	-.161, .178
Buying items in social casino games				-.053	.098	-.017	.590	-.245, .139
Watching loot box openings				-.054	.052	-.035	.295	-.156, .047
Watching gambling streams				.439	.071	.201	< .001	.299, .580
Spinning a prize wheel				.211	.040	.153	< .001	.133, .289

Notes: dependent variable = monetary gambling intention, n = 1457; R^2 = adjusted R^2

Monetary gambling behavior

Lastly, monetary gambling behavior was entered as the dependent variable. Adding loot box related activities (increase of 28.8% in R^2, $p < .001$) and other gambling-like activities (increase of 14.7% in R^2, $p < .001$) both significantly improved the first model only containing gender and age ($p < .001$). The total model, including gender, age, loot box related activities, and other simulated gambling activities, explained 44.2% of variance in monetary gambling behavior. Here, all loot box related activities significantly predicted gambling behavior (β opening free loot boxes = -.07; β paying for loot boxes = .18; β selling items from loot boxes = .14; all $p < .01$). Paying for loot boxes had the largest predictive value towards monetary gambling behavior. Next, buying items within social casino games (β = .41) and watching gambling streams (β = .12) significantly predicted monetary gambling behavior ($p < .001$). Table 8 describes the steps of this model in more detail.

Table 8: Hierarchical multiple regression analysis predicting monetary gambling behavior

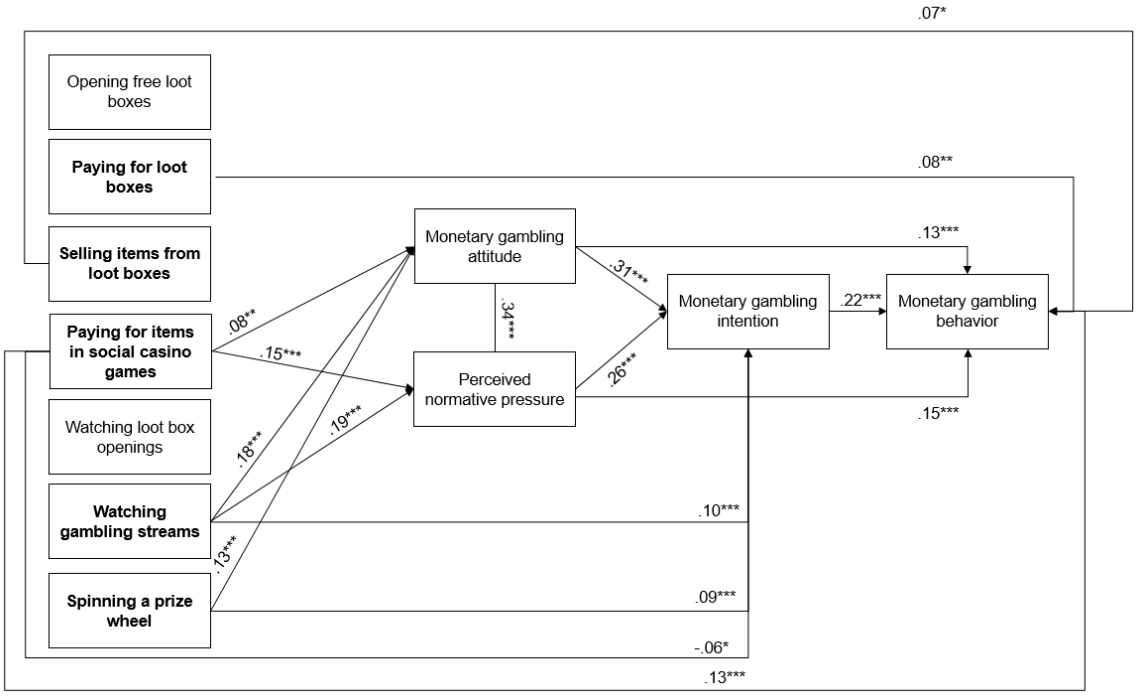
	F	p	R^2	B	SE B	BETA	SIG	95% CI
STEP 1	6.24	.002	.007					
Constant				1.402	.178		< .001	1.053, 1.752
Gender				-.115	.033	-.092	< .001	-.178, -.051
Age				.002	.012	.003	.896	-.022, .025
STEP 2	122.50	<.001	.295					
Constant				.601	.157		< .001	.294, .908
Gender				.027	.030	.022	.359	-.031, .085
Age				.006	.010	.013	.544	-.014, .026
Opening free loot boxes				-.020	.008	-.063	.011	-.036, -.005
Paying for loot boxes				.211	.017	.338	< .001	.178, .245
Selling items from loot boxes				.205	.018	.307	< .001	.169, .240
STEP 3	129.07	<.001	.442					
Constant				.471	.141		<.001	.195, .747
Gender				-.001	.027	-.001	.957	-.055, .052
Age				.005	.009	.011	.579	-.013, .023
Opening free loot boxes				-.021	.008	-.067	.007	-.037, -.006
Paying for loot boxes				.111	.016	.178	< .001	.079, .143
Selling items from loot boxes				.095	.017	.143	< .001	.062, .129
Buying items in social casino games				.317	.019	.410	< .001	.279, .355
Watching loot box openings				-.012	.010	-.029	.262	-.032, .009
Watching gambling streams				.066	.014	.120	< .001	.039, .094
Spinning a prize wheel				.010	.008	.030	.189	-.005, .026

Notes: dependent variable = monetary gambling behavior, n = 1456; R^2 = adjusted R^2

Testing the pathway model

We estimated the proposed structural model with all surveyed simulated gambling activities. Again, gender and age were controlled for. Because we included all variables, we reached a perfect fit. Therefore, in a second model, only the simulated gambling activities that generated significant relationships were included. This model fitted the data well ($\chi 2$ (10) = 75.464, $p < .001$, CFI = .956, RMSEA = .068, SRMR = .028). We found that paying for items in social casino games, watching gambling streams, and spinning a prize wheel significantly increased attitude towards monetary gambling. Moreover, paying for items in social casino games and watching gambling streams significantly increased perceived normative pressure regarding monetary gambling. Watching gambling streams and spinning a prize wheel significantly increased intention, while buying items in social casino games significantly decreased intention. Paying for loot boxes, selling items from loot boxes, and paying for items in social casino games related significantly increased frequency of participating in monetary gambling activities. Next, monetary gambling attitude and perceived normative pressure significantly increased monetary gambling intention and frequency of participation in monetary gambling. Lastly, monetary gambling intention significantly positively related to participation in monetary gambling activities among our young respondents. Again, results pointed toward the importance of including other gambling-like elements, next to loot boxes, and the importance of the inclusion of related activities beyond playing video games, such as watching gambling streams. Figure 2 shows an overview of the modelled results.

Figure 2: tested pathway model



Notes: only significant paths from simulated gambling activities to monetary gambling outcomes are displayed. Simulated gambling activities that related significantly to the outcomes are printed in bold.
*** p < .001, ** p < .01, * p < .05, ns = not significant

Discussion

In the past years, gambling-like elements have entered the world of video games, blurring the lines between video games and monetary gambling - a trend often coined simulated gambling. Concerns have been voiced in fear of these gambling-like elements acting as a stepping stone towards monetary gambling, the so-called gateway hypothesis (Hayer et al., 2018). Especially the use of gambling-like elements among more vulnerable players and adolescents raises questions. Previous research has often focused on only one type of simulated gambling, namely players' engagement with loot boxes. However, the video gaming landscape is constantly evolving, with new gambling-like elements being introduced on a regular basis (Johnson & Brock, 2020; Zendle, 2020). Moreover, the video gaming landscape comprises of an entire ecosystem with gambling-elements present at different levels of this ecosystem, ranging from a presence within video games, a manifestation as video game genres, and a representation within video game streams. Therefore, our current study aimed to sketch out the link between adolescents' engagement with these far less studied gambling-like elements of the video game ecosystem on the one hand and adolescents' attitude, perceived normative pressure, intention and behavior in terms of monetary gambling on the other.

Flemish adolescents between 11 and 17 years old filled out our survey on simulated and monetary gambling. Both types of gambling were present in respondents' lives, consistent with previous studies (Andrie et al., 2019; Carran & Griffiths, 2015; Hayer et al., 2018; King et al., 2014; Kristiansen & Severin, 2020; Molinaro et al., 2018; Veselka et al., 2018). Three out of four respondents had already participated in simulated gambling activities in the past twelve months, the most popular ones being spinning prize wheels, opening free loot boxes, watching loot box openings, and paying for loot boxes. Watching gambling streams (done by one out of five respondents) and buying items within social casino games (done by nearly one out of ten respondents) were clearly not unknown to them. Despite being banned in Belgium (Belgian Gaming Commission, 2018; Declerck & Feci, 2022), almost one in four respondents had paid for loot boxes in the past twelve months. This is congruent with the research of Denoo et al. (2023a) and Xiao (2023) indicating that the Belgian ban on loot boxes is not being effectively enforced and comes with player circumventing practices.

Around 60% of these adolescents, who were all under the legal gambling age, had already taken part in monetary gambling activities. Scratch cards and betting amongst friends or in a (sports) club were the most popular activities, with one in three respondents reporting them in the last twelve months. Frequency of participation, however, was rather low, with most respondents indicating taking part in monetary gambling less than a few times a year. In line with previous research findings (Gainsbury et al., 2016; Kristiansen & Severin, 2020), gender differences could be noted. Boys were significantly more positive and perceived more normative pressure towards monetary gambling, had a higher intention to take part in monetary gambling, and took more frequently part in both simulated and monetary gambling than girls.

Previous research has found significant positive correlations between loot box purchasing and monetary gambling participation (Li et al., 2019), and social casino game play and monetary gambling participation (Gainsbury et al., 2016; Kim et al., 2015; Veselka et al., 2018). Our bivariate correlations indicated that frequency of participation in all simulated gambling activities in total, as well as each activity separately, was positively and significantly correlated with monetary gambling attitude, perceived normative pressure, intention, and behavior. In other words, the more often youngsters take part in simulated gambling activities, the more positive they stand towards monetary gambling, the more normative pressure they perceive, the higher their intention to take part in monetary gambling once reaching the legal gambling age, and the more often they have been taking part in monetary gambling activities already. In most cases, the correlations were stronger for non-loot box related activities (such as interacting with prize wheels and watching gambling streams), highlighting the importance of broadening the strict previous focus on engagement with loot boxes. Lastly, bivariate correlations revealed

significant, positive correlations between monetary gambling attitude, norms, intention, and behavior, pointing towards the applicability of a Theory of Reasoned Action perspective when researching monetary gambling behavior (Dahl et al., 2018; Fishbein & Ajzen, 1975).

In order to assess the predictive value of both loot box engagement and other gambling-like activities, hierarchical multiple regression analyses were performed. Although loot box related activities significantly predicted frequency of participation in monetary gambling activities (opening free loot boxes, paying for loot boxes, and selling items from loot boxes) and perceived normative pressure (selling items from loot boxes), other activities are of greater importance. More specifically, all tested monetary gambling outcomes could be significantly predicted by the viewing of gambling streams - or videos that include gambling behavior. Congruent with Social Learning Theory (Bandura, 1977), seeing other people perform gambling activities thus plays an important role in shaping adolescents' attitude, normative pressure, intention and participation in monetary gambling activities themselves. Thus, interacting with gambling-like elements beyond video games, such as watching gambling streams, could predict monetary gambling.

Lastly, structural equation modelling indicated that a range of simulated gambling activities establish a significant path towards monetary gambling. Almost all simulated gambling activities showed a positive relationship with monetary gambling. Both monetary gambling attitude and perceived normative pressure regarding monetary gambling followed the proposed pathway, with a more positive attitude and increased perceived normative pressure relating to increased intention to participate in monetary gambling, and more frequent participation in monetary gambling activities. A higher intention, on its turn, predicted more frequent participation as well. This is congruent with previous studies (Dahl et al., 2019; Lee, 2013) and reinforces the usefulness of the Theory of Reasoned Action in gambling research.

Some paths did not follow the proposed pathway model. More specifically, paying for items in social casino games significantly decreased intention to participate in monetary gambling activities. It had, however, a positive relationship with all other monetary gambling variables (attitude, norm, and behavior), which is why we argue that social casino games should remain under scrutiny in future studies. Next, both opening free loot boxes and watching loot box openings were not significantly related with any of the monetary gambling variables in our cross-sectional sample. Future research using a longitudinal within-subjects research design can further explore these relationships.

Results of the current study thus clearly indicate that simulated gambling goes beyond loot boxes engagements. To correctly predict a possible gateway hypothesis from video gaming to monetary gambling via simulated gambling, we should steer away from the previous mere focus on loot boxes and include multiple chains in the video gaming ecosystem. This

leads to the inclusion of interactions with a variety of gambling-like elements – from in-game elements, to video game genres, and even related elements outside of video games. Remarkably, it is not necessary for players to directly engage with these elements, for example by opening free loot boxes or paying for items within social casino games. Often, simply viewing these practices, such as watching loot box openings or gambling streams, is intertwined with monetary gambling.

These results have important scientific and societal implications. As for the scientific implications, our study provided empirical evidence for the importance of considering the entire video gaming ecosystem. In terms of the theoretical contribution, our results suggest that the Theory of Reasoned Action is useful in unravelling the relationships between simulated and monetary gambling in adolescents. The current study proved that simulated gambling activities, as well as attitude, perceived normative pressure, and intention towards monetary gambling are of importance when predicting monetary gambling behavior. Relevant to consider the societal implications of our study is the empirical evidence that adolescents do participate in a variety of gambling-like elements, both directly, for example by paying for items in social casino games, and indirectly, such as by watching gambling videos. As this study found that a variety of these elements have a significant relationship with monetary gambling attitude, norms, intention, and behavior, actions must be taken to protect adolescents from the possible pathway model from simulated gambling to monetary gambling. To achieve this, the complete video gaming ecosystem should be taken into account when designing policy measures, prevention tools, and safe gaming and gambling tools. In the case of interventions, our study also showed that changing attitudes, norms, and intention in a desired direction, is likely to go hand in hand with similar changes in people's monetary gambling behavior.

Limitations and future research

Despite the current study's strengths, such as its large sample and inclusion of different simulated and monetary gambling measures, it also contains limitations. First and foremost, this study followed a cross-sectional design, hence making it hard to determine the temporal order of effects. Although there is a significant positive correlation between simulated gambling and monetary gambling, and although simulated gambling explained a very significant part of the variance in monetary gambling, longitudinal research and experimental studies are needed in order to test the pathway model. Therefore, follow-up waves are being conducted by the same research team. Next, the study relied on self-reports, which is subject to response bias. Although by ensuring confidentiality we aimed to avoid this response bias as much as possible, respondents might still have underreported or overreported some behaviors due to social desirability. Lastly, other variables that are not included in the current analyses might be of interest for future research. For example, personality traits such as impulsivity or sensation seeking could play a role in a possible

migration from simulated gambling to monetary gambling. Previous research has already pointed to the importance of including impulsivity and sensation seeking when doing research on simulated and monetary gambling behavior in adolescents and young adults (Hing et al., 2022; Nower et al., 2004). Lastly, the Theory of Reasoned Action in itself comes with some disadvantages. One might argue, for example, that monetary gambling is not fully reasoned and therefore should not be researched using the Theory of Reasoned Action. However, previous research has already pointed towards the applicability of a reasoned action model when studying monetary gambling in adults (Dahl et al., 2018; Lee, 2013), a finding that was reinforced by the current study. We hope that in future research the current study is replicated in order to support or falsify the proposed pathway model.

Conclusion

This study revolved around the question whether simulated gambling acts as a stepping stone between adolescents' engagement in video gaming and monetary gambling, and thus tested the so-called gateway hypothesis in a target group of adolescents that are relatively vulnerable and more at risk than adults. The current study aimed to fill three voids in the literature, by (1) including a variety of simulated gambling behaviors, to step away from the narrow focus on the engagement with loot boxes only; (2) using a more nuanced approach to monetary gambling that accounts for attitude, perceived normative pressure, intention, and behavior; and by (3) focusing on adolescents instead of adults. Therefore, a large-scale panel study amongst Flemish adolescents was conducted.

It is clear that adolescents do take part in both simulated and monetary gambling, with spinning prize wheels and opening free loot boxes (simulated gambling), and scratch cards and betting amongst friends (monetary gambling), being the most reported activities. Our study points towards significant positive correlations between a variety of gambling-like activities and monetary gambling. According to our hierarchical regression analyses, watching others perform gambling activities was the most important predictor for monetary gambling, which could be explained by Bandura's Social Learning Theory (1977). Other gambling-like activities, such as paying for items in social casino games, spinning prize wheels, and paying for loot boxes significantly predict monetary gambling as well. A pathway model from simulated gambling to monetary gambling was confirmed by structural equation modelling. This confirms and extends previous research on the usefulness of the Theory of Reasoned Action in gambling research (Dahl et al., 2018; Lee, 2013). Future research into simulated and monetary gambling should account for a variety of simulated gambling activities next to the engagement with loot boxes, as well as for monetary gambling attitude, norms, and intention next to behavior.

In conclusion, our study both confirms previous research on simulated and monetary gambling (for example by Gainsbury et al., 2016; Li et al., 2019; Zendle et al., 2019), and expands the current research, by

looking beyond the engagement with loot boxes while including monetary gambling attitude, normative pressure, and intention, next to behavior. We showed that the current focus on loot boxes is too narrow, and that it is necessary to study other gambling-like elements as well. The latter elements are part of the larger video gaming ecosystem, and range from in-game items, such as loot boxes and prize wheels, to video game genres, such as social casino games, and gambling within video game streams, such as watching gambling videos or loot box openings. Some of these elements are directly situated within video games, such as buying loot boxes, whereas others are more indirectly related, such as watching gambling videos. Lastly, we argue that the Theory of Reasoned Action (Fishbein, & Ajzen, 1975) can be a useful framework for researching the relationships between simulated and monetary gambling.

Statement of Competing Interests

The authors do not declare any interest.

Ethics Approval

The procedure received ethical approval (G-2021-3439-R2(AMD), date of approval: 25/10/2021) by the Social and Societal Ethics Committee at of the KU Leuven.

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Relative Contributions

All authors conceived of the study. EG and LB conducted the analyses. EG wrote the first draft of the paper. RDC, BZ and LB helped to revise the various iterations of the manuscript. All authors approved of the final version.

Research Promotion

The intertwining of video games and gambling, known as simulated gambling, has prompted concerns about the potential influence of simulated gambling as a stepping stone towards monetary gambling. The current study maps the relationships between various gambling-like elements within the video gaming ecosystem, and monetary gambling. From a large-scale survey in 1472 Flemish adolescents, it is clear that interacting with a variety of gambling-like elements is linked to monetary gambling attitude, norms, intention, and behavior.

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