

Reciprocal associations between gambling-like elements in the video gaming ecosystem, problematic gaming and online gambling: a longitudinal study among adolescents

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INTRODUCTION

Over the past decade, video games started including elements that resemble gambling. These gambling-like elements can be situated at distinct levels of the video gaming ecosystem (see Grosemans et al. 2024): mechanics *within* video games (loot boxes and prize wheels offering randomised rewards), entire video game *genres* built *around* gambling simulations (social casino games), and activities around video games (watching loot box or gambling livestreams). Academics have argued, on theoretical grounds, that these elements are risky, because they may lower the threshold for underage real-money gambling (Grosemans et al. 2023) and may foster problematic engagement with video games. Cross-sectional research has consistently demonstrated an overlap between engagement with these elements, problematic gaming, and underage gambling (see, e.g., Zendle 2020; Zendle and Cairns 2018; Zendle, Meyer, and Over 2019) but provides little insight into whether one tends to precede the other. While some longitudinal studies exist (see Brooks and Clark 2023; Dussault et al. 2017; Grosemans et al. 2025b), several gaps remain.

First, longitudinal studies have typically examined a single type of gambling-like element (particularly loot boxes) in isolation, leaving open whether elements at different levels of the ecosystem have different implications over time. Second, with few exceptions (Brooks and Clark 2023, among young adults), most existing work has modelled effects in one direction, with engagement predicting later gambling or gaming problems, without testing whether problematic gaming and online gambling reciprocally predict subsequent engagement. This is critical to detect downward cycles of gambling-like engagement and online gambling. Third, prior studies have not always accounted for potential confounders.

The present study addresses these gaps by examining the longitudinal, reciprocal and concurrent associations between engagement with gambling-like elements at different levels of the video gaming ecosystem, problematic gaming and online gambling in a three-wave panel study of Flemish adolescents, while controlling for potential confounders. Engagement with gambling-like elements is disaggregated into elements situated *within* video games (opening free loot boxes, buying loot boxes with real money, selling loot box items, and spinning prize wheels), as entire video game *genres* (spending money in social casino games), and *around* video games (watching loot box and gambling streams). These three dimensions, together with problematic gaming and online gambling, are modelled as influencing one another over time.

Data come from three annual self-report survey waves (baseline winter 2021–2022) of a Flemish secondary school cohort recruited in 12 schools. The analytic sample comprises $N = 1832$ adolescents who participated in at least two waves (M age = 13.64 years, $SD = 1.52$, at baseline; 46% boys). Engagement with gambling-like elements was measured with frequency items for the 7 activities above; problematic gaming with the validated Dutch version of the Gaming Disorder Scale for Adolescents (GADIS-A; Grosemans et al. 2025a; Paschke, Austermann, and Thomasius 2020); and online gambling with a monetary-gambling frequency inventory. Associations were estimated in a latent change model with sociodemographic characteristics and parental mediation of gaming as time-varying controls, in line with earlier work on this cohort (see Bradt et al. 2025); non-significant cross-lagged paths were trimmed in a final model.

The various forms of gambling-like engagement, online gambling, and problematic gaming co-occurred within waves. Over and above this concurrent overlap, the model also revealed small-to-moderate directional effects across waves. The most consistent were the paths from problematic gaming to gambling-like engagement: higher problematic gaming significantly predicted subsequent increases in within-game and

around-game engagement ($\beta = .09-.13$). In the gateway direction, around-game engagement predicted subsequent increases in online gambling ($\beta = .13$). Within-game engagement as a composite score had no significant prospective effect on online gambling or problematic gaming, although buying loot boxes did in supplementary item-level analyses. All paths remained significant after controlling for sociodemographic characteristics and parental mediation of gaming.

Modelling reciprocal change across three waves, with controls for third variables, moves beyond the largely cross-sectional and single-direction evidence available so far. The study thereby offers novel insights relative to prior work and adds a layer to previously published findings from the same data collection (see Bradt et al. 2024, 2025; Geudens et al. 2026; Grosemans et al. 2023, 2024, 2025b). These findings suggest that engagement with gambling-like elements, online gambling and problematic gaming may reinforce one another over time and across different layers of the gaming ecosystem, rather than developing in isolation.

BIO

Lowie Bradt is a postdoctoral researcher in developmental psychology at Ghent University. His work focuses on adolescent media use, the convergence of gaming and gambling, and parenting.

Eva Grosemans is a postdoctoral lecturer and researcher at the Media, Culture & Policy Lab and the Meaningful Interactions Lab (Mintlab), KU Leuven. Her research focuses on the blurring lines between video gaming and gambling among adolescents, and on the effects of persuasive media such as game streaming and gambling advertising.

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ETHICS

Ethical approval for the Gam(e)(a)ble data collection was obtained from the KU Leuven Social and Societal Ethics Committee (SMEC; reference no. G-2021-3439-R2(AMD)m). School principals provided written consent on behalf of their institution; parents or legal guardians were informed and could decline their child's participation (passive consent); and adolescents were informed that participation was

voluntary and that they could discontinue at any time. Responses were pseudonymised after linkage across waves.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest. None of the authors is or has been employed by, holds investments in, or has received research support, gifts, or compensation from the gambling or gaming industry.

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