AMERICAN PSYCHOLOGICAL ASSOCIATION

Technology, Mind, and Behavior

ISSN: 2689-0208

https://doi.org/10.1037/tmb0000152

REVIEW

How Do Video Games Affect Mental Health? A Narrative Review of 13 Proposed Mechanisms

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Researchers have proposed a variety of mechanisms through which playing video games might affect mental health by displacing more psychosocially beneficial activities, satisfying or frustrating basic psychological needs, relieving stress, and many more. However, these mechanisms and their underlying causal structures are rarely made explicit. Here, we review 13 proposed effects of gaming on mental health. For each, we specify a counterfactual—that is, what concrete aspect of gaming should be changed in a hypothetical alternative universe to produce the effect of interest—and illustrate these with example directed acyclic graphs. In doing so, we hope to encourage more focused efforts to propose, falsify, and iterate on (causal) theories using well-established formal methods of causal inference. Only in doing so can the field realize its potential to inform clinical interventions, regulation, game design, and the behavior of players and parents.

Keywords: video games, causal inference, narrative review, well-being, mental health

With the rise of video gaming as one of the world's foremost hobbies—with an estimated 3 billion players and almost US$200b in yearly revenue as of 2023 (Newzoo, 2023)—there has been intense research, policy, and media attention on the question of how video games affect mental health, both positively and negatively. Gaming can, for example, support positive emotions (Jones et al., 2014), develop social capital (Mandryk et al., 2020), and help users actively cope with or manage difficult life circumstances and stress (e.g., Iacovides & Mekler, 2019; Kowert, 2020; Reinecke & Eden, 2017). So too can gaming have negative effects: most commonly, research has focused on (internet) gaming disorder as a proposed psychopathological condition (Karhulahti et al., 2022; Király et al., 2023; Przybylski & Weinstein, 2019), but gaming can also displace other important activities (Drummond & Sauer, 2020); expose players to toxicity, harassment, or extremism (Kordyaka et al., 2020; Kowert et al., 2022); or prey on vulnerable user's finances (Petrovskaya & Zendle, 2021), among others. However, despite numerous examples that gaming *can* affect mental health, recent evidence from our group and others suggests that average relationships between simple time spent playing games and mental health are very small (Johannes et al., 2021; Larrieu et al., 2023; Vuorre et al., 2022).

Action Editor: C. Shawn Green was the action editor for this article.

ORCID iDs: Nick Ballou https://orcid.org/0000-0003-4126-0696; Andrew K. Przybylski https://orcid.org/0000-0001-5547-2185.

Funding: This research was supported by Huo Family Foundation to Andrew K. Przybylski. Kristoffer Magnusson was supported by Forskningsrådet för hälsa, arbetsliv och välfärd (Grant 2021-01284). The funders and these organizations had no role in study design, data collection and analysis, decision to publish, or preparation of the article. This research was funded in whole, or in part, by the U.K. Research and Innovation (includes Economic and Social Research Council; Grant ES/W012626/1). For the purpose of open access, the author has applied a CC BY public copyright license to any Author Accepted Manuscript version arising from this submission.

Disclosures: Matti Vuorre is or has been funded in the past by Tilburg University, the Economic and Social Research Council, and the University of Oxford's John Fell Fund and has provided in-kind consultations and served as a nonpaid panel member for Meta and K-Games. There were no financial products or benefits resulting from these consultations. The authors have no conflicts of interest to report.

Author Contributions: Nick Ballou contributed to conceptualization, visualization, writing–original draft, and writing–review and editing. Thomas Hakman contributed to conceptualization, visualization, writing–original draft, and writing–review and editing. Matti Vuorre contributed to funding acquisition, supervision, and writing–review and editing. Kristoffer Magnusson contributed to funding acquisition and writing–review and editing. Andrew K. Przybylski contributed to conceptualization, funding acquisition, project administration, supervision, and writing–review and editing. Nick Ballou and Thomas Hakman contributed equally to this work.

Data Availability: No data or other reusable materials were used in the preparation of this article. This work has been made available as a preprint on PsyArxiv (https://osf.io/preprints/psyarxiv/q2kxg) but has not been published nor submitted for review at any other venue.

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In recent years, it has become increasingly clear that the central challenge for this research area is to take scattered evidence about how gaming *can* affect mental health and generate strong predictions of when and why gaming *will* affect players—that is, causal theories. Unfortunately, methods and practices are often misaligned with this goal. Although methodological transparency and rigor have been improving, researchers frequently use the euphemistic language of associations even when their interests are causal in nature (Haber et al., 2022; Hernán, 2018). Important questions regarding the conditions under which gaming might shape player mental health are hinted at in many studies, but the cross-sectional analyses, bivariate relationships, and statistical tests of moderation and mediation fall well short of what is needed to make meaningful progress. As a result, the literature on gaming and mental health—like many other areas of the social sciences—is rich with associations, proposed effects, and verbal theory, but poorer in terms of theory specified with adequate formalism to allow severe testing (Ballou, 2023; Rohrer, 2018).

Changing this state of affairs will be difficult but necessary to address long-standing questions about digital play. Parents are looking for actionable guidance about how to manage children's play (Lieberoth & Fiskaali, 2021) and players themselves seek ways to monitor and regulate their own play behavior (evidenced by the growth of tracking platforms such as Exophase https://www.exophase.com and Playstation Timetracker https://ps-timetracker.com). Those who make games want guidelines for producing engaging experiences without using so-called dark patterns that may harm players (Aagaard et al., 2022), and policymakers are looking to enact evidence-based regulation of technology companies—in some cases even governing whether gaming should be restricted entirely (Colder Carras et al., 2021). Likewise, with internet gaming disorder now a prominent proposed diagnostic condition (American Psychiatric Association, 2013; World Health Organization, 2018), clinicians seek ways to recognize problematic gaming and treat it effectively without stigmatizing healthy players (Aarseth et al., 2017; Greenfield, 2018).

What is needed, then, are clearly formulated and empirically testable models of how gaming affects well-being and mental health—supported by both experiments (which have excellent causal validity, but may not generalize to real-world play) and observational data (which can capture holistic effects of gaming, but only with appropriate causal models, which to date research has largely lacked). Such models can address psychiatrists' calls to better understand psychological mechanisms of treatment (Holmes et al., 2018) and broaden clinical perspectives beyond gaming disorder as the primary way that gaming influences mental health (Cekic et al., 2024).

In this article, we present concrete examples of various proposed causal effects. For each topic, we propose an explicit counterfactual: what aspect of gaming needs to be manipulated ("switched on or off" or increased/decreased) to change the relevant mental health outcome? We formulate these as directed acyclic graphs (DAGs; Pearl, 1995; Rohrer, 2018), which encode relationships among constructs and dictate what factors must be controlled for to estimate the causal effect. This approach accomplishes three goals:

1. *Provide an overview of the field*: This article presents a bird's-eye perspective of the ways gaming might affect mental health. Previous reviews are outdated (e.g., Granic et al., 2014), focused on just a few positive *or* negative mechanisms (e.g., Halbrook et al., 2019), and/or do not directly address causality (e.g., Hartanto et al., 2021). Providing umbrella labels encourages systematic progression toward well-specified and predictive causal theory.
2. *Differentiate game-related exposures*: Exposures in gaming can exist at various analysis levels: in-game content, mechanics or features, and player experience factors. We develop a framework that taxonomizes these levels and their constituent exposures, clarifying study communication and identifying natural groupings of widely studied effects.
3. *Promote formalized theory by making counterfactuals explicit*: Using DAGs and the exposures framework, we suggest explicit counterfactuals to clarify how causal effects may be tested. Our use of DAGs, a principle causal inference tool for social science (Rohrer, 2018), provides a template for researchers to design studies and analysis plans and a starting point for rigorous falsification of theoretical models within each research topic.

Below, we first develop a conceptual framework of the different *exposures* inherent to gaming. This critical first step is necessary to go beyond discussing "the effects of game play" and to more directly answer questions related to harms or benefits *compared to what* (Magnusson et al., 2024). In the remainder, we will then use this framework of exposures to define their effects through DAGs.

Heterogeneous Exposures in Games Research

Video game play is not a one-dimensional construct—it is not just the fact that a player has played any game that determines outcomes but the specifics of who, what, when, why, and how much (Hartanto et al., 2021). In causal inference, this would be described as a heterogeneity of *exposures*: the specific factor, treatment, or intervention that is being studied to determine its effect on some outcome (Magnusson et al., 2024).

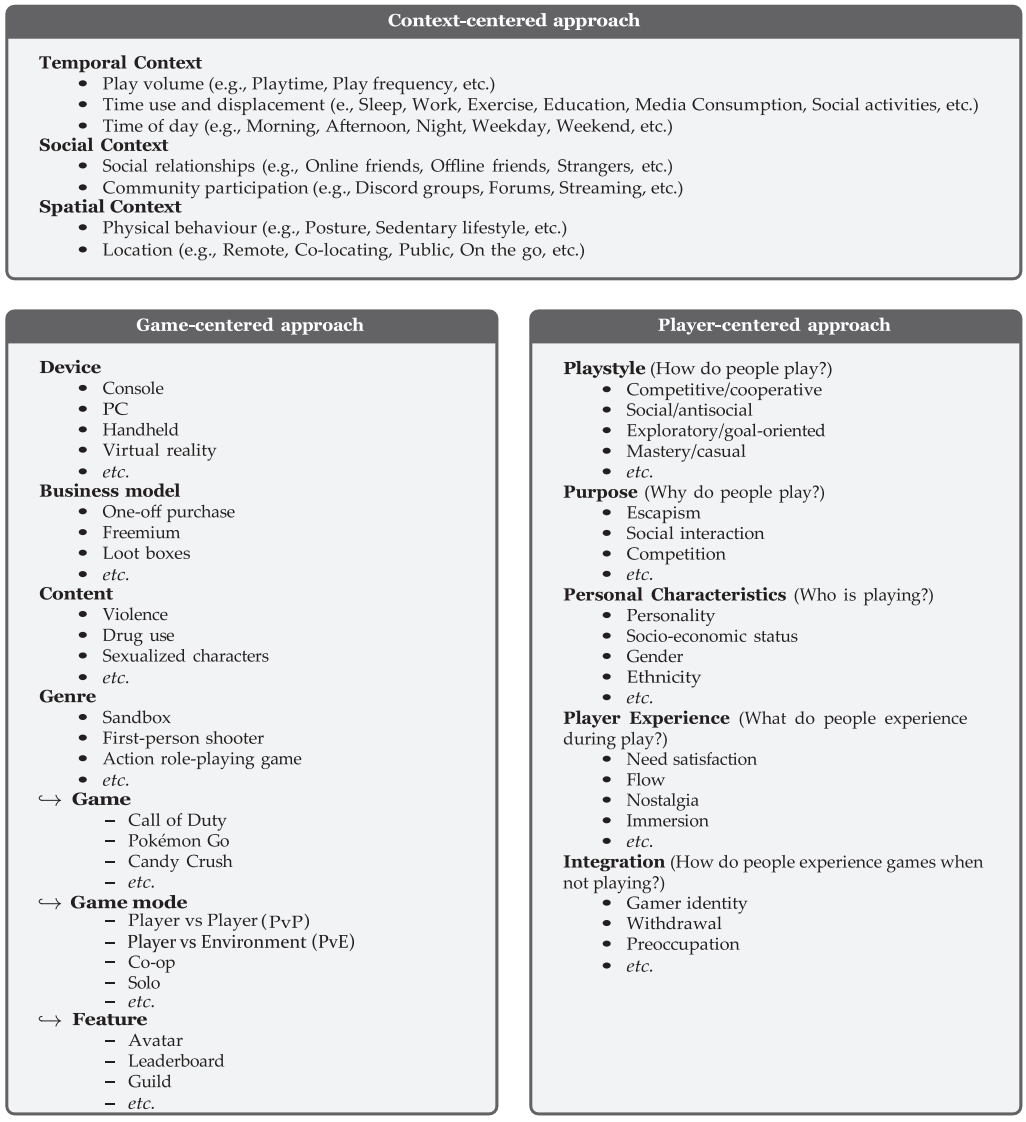
Our approach is inspired by a taxonomy of computer-mediated communication (Meier & Reinecke, 2021), which outlines aspects of online communication affecting outcomes, from broad (e.g., the device) to specific (e.g., message persistence). We similarly use concept mapping (Booth, 2016) to organize elements of video game play into three high-level approaches: context-centered, game-centered, and player-centered (Figure 1). Within each approach are levels of analysis (e.g., the device level), and within each level, we list specific exposures (e.g., playing on PC vs. console).

The *context-centered approach* focuses on the temporal, social, or spatial configurations of gaming that impact mental health. Context-centered levels of analysis are external to gameplay, focusing on the setting such as when, how long, with whom, and where people play. These exposures can be observed but are typically self-reported.

The *game-centered approach* examines aspects of video games themselves that may affect mental health, adopting a techno-deterministic framing. Game-centered levels of analysis include specific games and game-design elements that can be observed (e.g., digitally tracked) or classified (e.g., genre). These levels can be hierarchically nested (e.g., genres contain games, which contain

Figure 1

Approaches (Boxes) and Levels of Analysis (Bold Terms) at Which Exposures Can Be Defined in Video Games Research



Note. For each level of analysis, we list possible exposures (nonexhaustive). co-op = cooperative.

game modes and features). Example exposures include a business model (freemium vs. one-off purchase), specific games (e.g., *Candy Crush* vs. *Brawl Stars*), or features (e.g., playing before or after a leaderboard patch).

The *player-centered approach* describes exposures related to player characteristics. Player-centered levels of analysis are psychological constructs and demographic variables that describe *who* is playing, *why* they are playing, *how* they are playing, and *what* they are experiencing both during play and when play has finished. Exposures may therefore include playing for escapism versus playing the same game without escapist motivation. Some of these can be observed, but most can only be measured via self-reports.

Viewing game effects in these terms highlights the challenge researchers face and the resulting causal fuzziness. Studies asking "how does gaming affect mental health?" cover varied exposures (e.g., playtime, genres, enjoyment, violent content, loot boxes, action mechanics, social interaction) at distinct levels of analysis. A study on "Action mechanics in *Call of Duty: Modern Warfare III* on Xbox" involves a specific feature, game, and device, raising questions about whether effects are due to action mechanics, the game itself, or the device. This heterogeneity of exposures likely contributes to varied research findings, even within ostensibly similar studies. Complicating things further, these factors may operate in conjunction, with some acting as moderators of others

(e.g., if certain personality types are more susceptible to the effects of gambling elements in games; Larche et al., 2023).

Taxonomizing exposures, even imperfectly, helps researchers specify, communicate, and design studies targeting a given exposure (Hernán, 2016). Our framework offers an incomplete but necessary simplification of video game exposures, acknowledging that other play dimensions will be identified with scientific progress and technological change (Granic et al., 2014).

Counterfactuals and Causality

Our interest is a counterfactual, defined using the potential outcomes framework (Rubin, 1974). Under this framework, a counterfactual defines the two alternative scenarios that the causal estimand (Lundberg et al., 2021) of interest contrasts. This framework allows us to conceptualize and quantify causal effects by comparing the observed outcome under one scenario to the hypothetical outcome in an alternative universe where the scenario differed.

For example, consider Bukayo, a teenager who regularly plays multiplayer sports games on Xbox. To understand how his playtime affects him, we track his playtime for a week and then ask about his stress levels. Our interest is a counterfactual, defined using the potential outcomes framework (Rubin, 1974): we know how Bukayo feels after gaming (Y^{games}), but we want to know how he *would have* felt in an alternate scenario where everything else is the same except he spent that time reading a book instead (Y^{book}). The difference in exposure (gaming vs. reading) between the actual and hypothetical universes forms a causal contrast. The difference in outcome (how Bukayo feels) between these scenarios is our causal effect, defined as $Y^{\text{games}}_{\text{Bukayo}} - Y^{\text{book}}_{\text{Bukayo}}$.

Of course, we cannot observe two universes. Instead, we attempt to construct groups of players that are *exchangeable*: we try to sample a group of people who are otherwise identical to Bukayo, but happen to either play games or read for an hour during the observation period. Comparing these two groups allows researchers to estimate what *would have* happened to Bukayo—or any individual in the sample—had they played versus read a book. Formally, exchangeability means that given the observed variables, the assignment of treatment (gaming) is independent of potential outcomes (stress). While we can never know the individual causal effect for Bukayo, we instead estimate the *average causal effect*: the difference in stress among the exchangeable units who happened to play games and those who happened to read, $\bar{Y}^{\text{games}} - \bar{Y}^{\text{book}}$.

In observational studies and those where the exposure is a psychological construct, defining counterfactuals is even more challenging. An observational study estimating an effect one additional hour of video game play (e.g., Burke & Lucier-Greer, 2021) conflates the effect of playtime replacing time spent taking care of children and playtime replacing time spent watching Netflix. A study targeting the effect of basic psychological need satisfaction in games—a latent psychological construct—(Ballou et al., 2023; Johnson et al., 2022; Pusey et al., 2022) might consider the exposure to be the presence or absence of (a) a gaming feature that supports, for example, autonomy (Peng et al., 2012); (b) a motivational disposition toward seeking out need satisfaction (Poeller et al., 2021); (c) a quasirandom manifestation of a need-satisfying player experience in one particular session but not another (Vella et al., 2013) or something else entirely. Greater use of DAGs, and the transparency they enforce for counterfactuals and mechanisms, can accelerate progress on these questions.

Directed Acyclic Graphs

Often, we cannot randomize exchangeable groups to play games or read books and instead simply observe people doing so. In observational research, the exposure and outcome are likely to be confounded: other factors affect both a person's likelihood of playing a game versus reading and their stress. For example, people with limited access to the internet may be more likely to read and to feel more stressed.

In such situations, one powerful tool is the DAG (Pearl, 1995), which can be used to visualize and analyze the (causal) relationships between variables. A causal DAG is a graph that consists of nodes, representing variables such as psychological traits or environmental factors, connected by arrows, which signify directional causal effects. These graphs are "acyclic," such that causality flows in one direction only. Using DAGs, researchers can formally encode their causal assumptions or evidence and in turn select the right combination of variables needed to generate exchangeable groups. They provide a visual and formal method to distinguish between spurious associations and genuine causal effects, reducing the risk of biased conclusions (Dablander, 2020; Rohrer, 2018). For this article, we refer only to DAGs explicitly used for causal reasoning, ignoring noncausal DAGs used for representations of, for example, information flows.

An Example: Violent Video Games

An example from the field's history is illustrative. Theories such as the general aggression model predicted that exposure to violent game content would result in higher aggressive attitudes, among other aggression outcomes, visualized as a simple DAG in Figure 2 Panel A with two nodes (frequency of violent video game play and aggressive behavior) and one causal path between them (the arrow).[1]

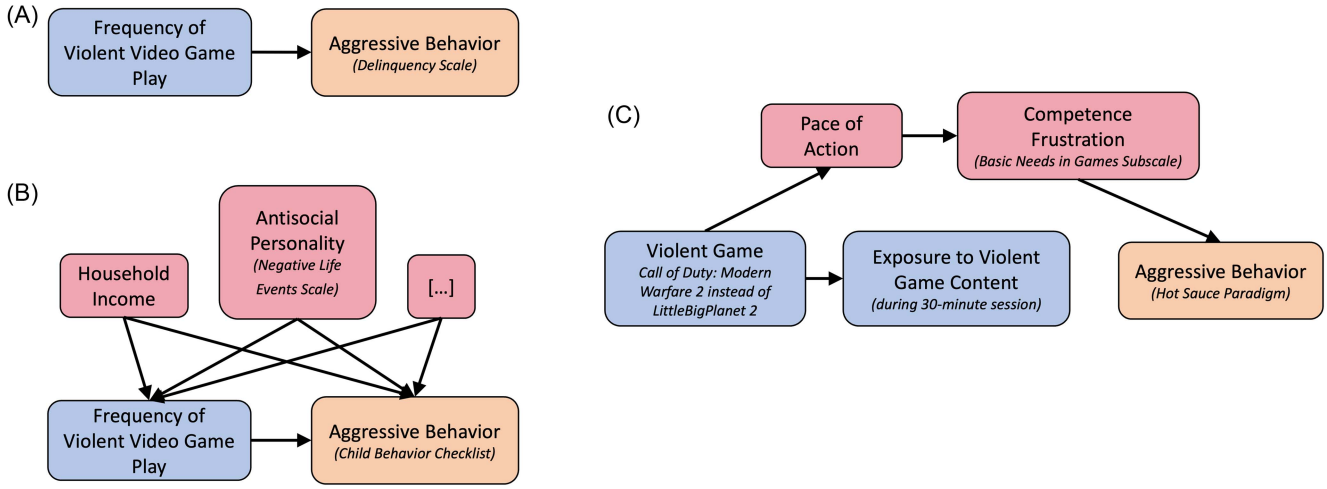
One way of testing this model is with observational data. For observational data to yield an unbiased estimate of the true causal effect, however, we need a complete understanding of the system. This prominently includes (but is not limited to) potential confounders: factors that influence both the likelihood of someone playing violent games and their aggressive attitudes, such as socioeconomic status or trait impulsivity (Hilgard et al., 2017; Figure 2, Panel B). Potential confounds are numerous, and reaching consensus what the confounds for any given effect has been close to impossible for the field—leaving ample opportunity for critics of a particular result to argue that either confounds are missing or that the estimate inappropriately adjusts for too many factors such that effects are artificially attenuated (Hollingdale & Greitemeyer, 2014).

Alternatively, we can try to intervene on exposure to violent media content in an experiment. This too can be fraught: Rather than intervening on exposure to violent media content directly, early experimental work on violent video games often intervened on the game as a whole by comparing a game with violent content to one without (e.g., Anderson & Dill, 2000). These games inevitably differed in more ways than just violent content (e.g., one could be more competitive or fast-paced; Adachi & Willoughby, 2011),

[1] In Figure 2, we list particular measures for each node to emphasize that DAGs should be as specific as possible to maximize testability. In the examples to come, however, we specify only constructs to minimize cognitive load for readers. In principle, those examples should equally be specified at the level of a particular measure of the exposure and outcome.

Figure 2

Example Directed Acyclic Graphs for the Effect of Violent Game Content on Aggression



Note. Panel A (left) shows the simplest version, a direct effect of frequent violent video game play on aggressive behavior. Panel B shows how this effect might be estimable with observational data by controlling for relevant confounds such as antisocial personality. Panel C shows an example of inadvertently intervening on the wrong exposure—the game, rather than specifically the violent content—which can open new causal pathways to the outcome.

opening up other pathways through which a violent game—but not the violent content itself—might influence aggression (Figure 2, Panel C). While experimental violent games research has since largely used two modified versions of a game differing only in violent content (e.g., Hilgard, Engelhardt, et al., 2019), other research topics still face similar challenges.

In either case, we can see how (a) thinking carefully about the specific counterfactual of interest and (b) reasoning about the causal system using DAGs allows us to more clearly understand and communicate which variables are needed to estimate causal effects—even when these variables are in principle unobserved.

The Present Work

Below, we briefly overview 13 distinct ways gaming might affect mental health. For each, we attempt to construct an illustrative causal model. This is an ambitious endeavor, and one where we will inevitably fall, owing to (at least) three key limitations.

Caveat 1: Comprehensiveness

It is impractical to summarize the vast literature on video games and mental health—a February 2024 Web of Science search for "(gami* OR game*) AND (social)" returns over 8,000 results, which is just one of the 13 research topics discussed below. Instead of conducting a systematic review, we rely on the authors' collective knowledge to narratively review 13 proposed effects we identified. These are not the only studied or possible effects but represent as complete a summary as we could generate, and we hope future research will address any omissions.

Caveat 2: Causal Accuracy

Our attempts to explicate causal models from previous work will inevitably be crude. The literature often neglects to specify hypothesized causal structures, and our expertise varies across these areas. We aim to develop plausible example models at a high level of abstraction, necessarily omitting potential confounds that might bias the exposure–outcome relationship where randomization is not possible. We include a placeholder C in each model to symbolize potential confounds and invite readers to speculate on what factors C might include.

Caveat 3: Simplified Mental Health

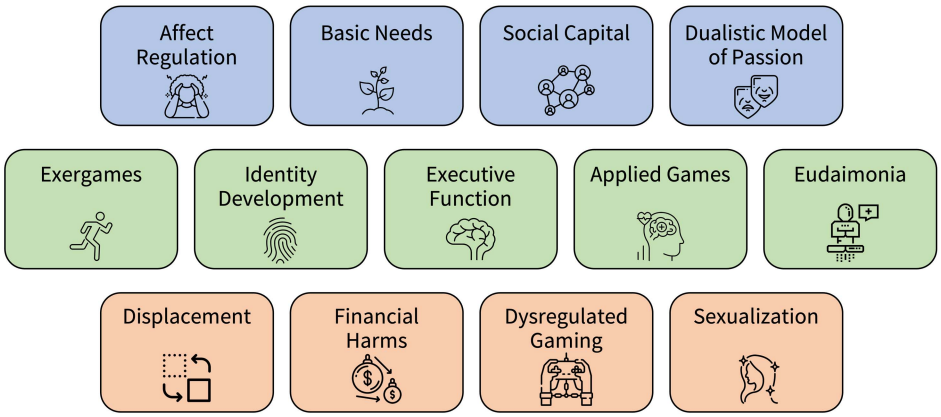
Mental health is an umbrella term that describes a wide range of experiences, orientations, and abilities (Huta, 2016). We follow the World Health Organization (2022) definition and understand mental health as "a state of mental well-being that enables people to cope with the stresses of life, to realize their abilities, to learn well and work well, and to contribute to their communities" (p. 8), incorporating elements of hedonia, eudaimonia, and the absence of psychopathology (Martela & Sheldon, 2019; Meier & Reinecke, 2021). For clarity, we constrain example models to one mental health construct common to that topic but acknowledge that many other aspects might also be affected. Teasing these apart is another important challenge for the field.

13 Ways Gaming Might Affect Mental Health

With those caveats in mind, we move on to 13 research topics that describe how game play and mental health relate (Figure 3). We divide our review into three sections: topics with proposed (a) positive and negative effects; (b) solely positive effects; and (c) solely negative effects.

For each topic, we develop an illustrative causal DAG, which identifies an exposure, possible mechanistic mediators or other relevant variables, and a mental health outcome. Each of these describes one way that an exposure, or set of exposures, might influence mental health. Because researcher and public interest

Figure 3
Overview of the 13 Research Topics



Note. Blue topics propose pathways to both positive and negative effects; green topics propose positive effects; and orange topics propose negative effects.

often extends beyond the estimate of a causal effect to understanding *why* that effect materializes, our DAGs include proposed causal *mechanisms* (Elster, 1989)—for example, by including relevant mediators, as indicated by prior research—even though effects can often be estimated without these.

We take several liberties in the graphical representation of our DAGs, either for visual clarity or to encode information from the research literature not strictly necessary to define a DAG. These modifications do not alter DAGs' fundamental structure or acyclic nature; rather, they are intended to enhance understanding without compromising their validity as causal models. Specifically, our DAGs include the following:

- *Supernodes:* Groups of related variables assumed to have the same causal arrows, combined into a single box; arrows entering or exiting the outer box share a causal path with all subnodes within that box (Tennant et al., 2019). Additional paths may also enter or exit subnodes directly.
- "Arrow-on-arrow" *notation*: Dotted arrows pointing to arrows indicate effect size modification, also known as moderation (Weinberg, 2007). In traditional DAGs, moderators are separate nodes pointing toward the same outcome, with effect size modification existing only at the separable level of model parameters.
- *Effect direction*: Arrow color indicates the expected positive (black) or negative (red) direction of a causal effect, based on substantial previous evidence or theory. Traditional DAGs encode the existence of a causal relationship without indicating its expected direction.
- *Latent variables*: Using latent variables in DAGs poses challenges, with experts often preferring directly manipulable or observed variables (Pearl, 2013). We nonetheless include them in our models, as psychology is rife with proposal causal explanations that rely on latent psychological variables (e.g., a proposed causal effect of general intelligence on achievement). This requires a realist interpretation of latent variables and the assumption that between-person causal processes are equivalent to within-person ones, positions that are difficult to defend (Borsboom et al., 2003, cf. Weinberger, 2015). Addressing this problem in depth is beyond the scope of this article.

Ambivalent Effects of Gaming on Mental Health

We begin with research topics that outline pathways for both positive and negative effects. Later, we present topics covering positive *or* negative effects.

Affect Regulation

Gaming can help individuals manage emotional states in at least three ways:

- *Coping*: "Thoughts and behaviors used to manage the internal and external demands of situations that are appraised as stressful" (Folkman & Moskowitz, 2004, p. 745).
- *Mood management*: The (re)arrangement of one's environment so as to best accomplish "the termination or diminution of bad moods and the perpetuation or facilitation of good moods" (Zillmann, 1988, p. 328).
- *Emotion regulation*: "The extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features, to accomplish one's goals" (Thompson, 1994, p. 27).

For this article, we focus on coping given extensive reports of people playing games to cope with unemployment (Lee & Chen, 2023), loss of loved ones, loneliness, mental health problems, and more (Iacovides & Mekler, 2019). The transactional model of stress and coping (Lazarus & Folkman, 2015; Wolfers & Schneider, 2021)

differentiates *problem-focused coping* (e.g., searching for further information) from *emotion-focused coping* (dealing with emotions —e.g., by distraction—rather than solving the emotion-evoking problem). The latter further consists of *approach* and *avoidance coping* styles (Compas et al., 2001). Problem- and emotion-focused approaches to coping through media have both been linked to improved mental health outcomes (Nabi et al., 2022; Reinecke, 2009), but regulation strategies can also backfire: Excessive emotion-focused avoidance coping can lead to a dysregulated pattern of play whereby players overrely on gaming to manage short-term emotional states, at the cost of longer term coping and emotion regulation resources (Cheng et al., 2015).

Successful short-term coping can be (in part) explained by mood management theory (Zillmann, 1988), which proposes that gaming supports *homeostatic regulation*—maintaining physiological states in an optimal range—by way of *alliesthesia*; perceiving stimuli as pleasant or unpleasant depending on their contribution to re-balancing moods. Gaming, through this lens, can help counter-balance high arousal states (e.g., stress, anger) by calming, balance low arousal states (e.g., boredom) by exciting, and balance negative emotions by providing positive experiences of pleasure.

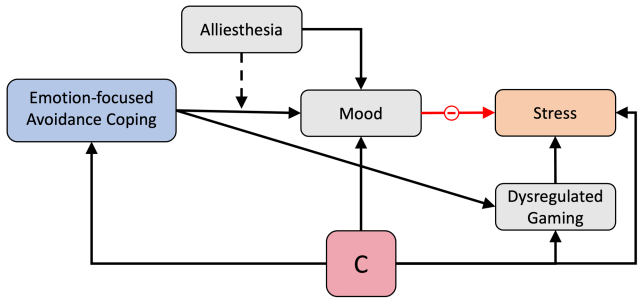
In Figure 4, we sketch a model where gaming for emotion-focused coping causes improvements in mood (i.e., short-term recovery), but only if the experienced gameplay matches the player's current need (alliesthesia; e.g., playing a relaxing game such as *Unpacking* when feeling unpleasant high arousal; Vuorre et al., 2023). Improved mood leads to the development of longer term resilience and emotion regulation capacity, enabling players to manage future unpleasant emotional states better and thereby reducing stress (Reinecke & Rieger, 2021). However, excessive emotion-focused avoidance coping increases the likelihood of dysregulated gaming—that is, players overrelying on gaming to manage short-term emotional states at the cost of longer term coping and emotion regulation resources.

Basic Psychological Needs

Self-determination theory (Ryan & Deci, 2017) argues that humans have three basic psychological needs for *autonomy* (to feel in control over one's life and volitional in one's actions), *competence* (to act effectively and exert mastery in the world), and *relatedness* (to feel valued by others and to value them in return). When satisfied, these basic needs promote positive mental health, but when actively frustrated, they lead to ill-being and psychopathology (Ryan & Deci, 2017). Games can effectively satisfy these needs through structured temporal contexts features like avatar customization for autonomy (Deterding, 2016; Peng et al., 2012), game modes like local multiplayer for relatedness (Tamborini et al., 2010), and player experiences like overcoming challenge (Deterding et al., 2022). The satisfaction readily available in gaming is often used to compensate for deficiencies elsewhere in day-to-day life (Allen & Anderson, 2018; Mills et al., 2018). However, gaming can also frustrate these needs, manifesting as feelings of coercion (autonomy frustration), failure (competence frustration), and loneliness (relatedness frustration), and leading to outcomes such as reduced motivation, enjoyment, and mental health issues (Allen & Anderson, 2018; Kosa & Uysal, 2021). This causal framework informs several models of media use and mental health (Ballou & Deterding, 2023; Reinecke & Rieger, 2021; F. M. Schneider et al., 2022).

Figure 4

Example Directed Acyclic Graph for Affect Regulation



Note. Example counterfactual: Y^0: Stress after gaming for 1 week with X emotion-focused avoidance coping motivation. Y^1: Stress after otherwise identical game behavior with X + 1 emotion-focused avoidance coping motivation. Type of exposure: Player-centered approach > Purpose (why).

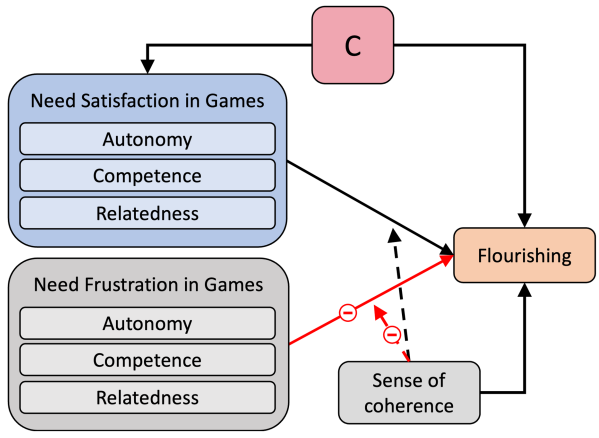
Drawing from the Basic Needs in Games and the Integrative Model of Mobile Media Use and Need Experiences models (F. M. Schneider et al., 2022), we propose an example model in Figure 5. Experiencing greater need satisfaction in gaming over the course of a week, compared to not having those experiences during the same period, positively impacts flourishing—both immediately and through repeated experiences. Conversely, need frustration in games has a negative effect. Following F. M. Schneider et al. (2022), these effects are moderated by sense of coherence—the trait-like global orientation to see life as comprehensible, manageable, and meaningful. The model predicts that people higher in sense of coherence will benefit more from need-satisfying experiences in games and be better buffered against need-frustrating experiences.

Social Gaming

Multiplayer gaming facilitates social interactions integral to well-being by initiating connections between players (Dabbish, 2008;

Figure 5

Example Directed Acyclic Graph for Basic Psychological Needs



Note. Example counterfactual: Y^0: Flourishing after gaming for 1 week with X need satisfaction. Y^1: Flourishing after otherwise identical gaming behavior with X + 1 need satisfaction. Type of exposure: Player-centered approach > Player Experience.

Hernandez et al., 2014), maintaining or enhancing preexisting relationships (Wohn et al., 2011), developing trust and social closeness with strangers (Depping & Mandryk, 2017), and reducing loneliness (Depping et al., 2018). The social capital framework (Putnam, 2000) distinguishes these social connections into bridging ties (tentative relationships that broaden social horizons by exposing players to different opinions and world views) from bonding ties (strong personal relationships in which players feel social and emotional support; Mandryk et al., 2020; D. Williams, 2006). Perry et al. (2018) showed that playing video games with real-life friends was positively associated with bonding capital, playing with strangers was associated with bridging capital, and playing with online-only friends was associated with both. However, the same gaming elements that promote social capital can also give rise to toxicity, harassment, and bullying (Kwak et al., 2015). Toxic behavior in video games thwarts in-game social capital development (Depping et al., 2018), leads to social exclusion or loneliness (Birk et al., 2016), and harms well-being, potentially leading to depression, anxiety, and in extreme cases, suicide (Kwak et al., 2015).

In our example DAG (Figure 6), the exposure is the type of relationship the player has with others in their gaming environment (e.g., teammates, opponents, colocated spectators)—a social context level of analysis. Following the research above, we expect that playing with online-only friends (as opposed to playing solo) causes the development of both bridging and bonding social capital. Playing with strangers, on the other hand, causes only the development of bridging ties but also exposes the player to the possibility of toxicity, which suppresses bridging ties and leads to greater feelings of loneliness. Together, social capital and loneliness affect subjective well-being, for better and worse, respectively.

Harmonious and Obsessive Passion

Passion is conceptualized as a strong inclination toward a valued activity, eventually becoming adopted as part of one's identity (e.g., being a "gamer"; Vallerand et al., 2003). The Dualistic Model of Passion distinguishes harmonious passion, characterized by a positive, balanced, and meaningful relationship with the beloved activity, and obsessive passion, characterized by uncontrollable urges, preoccupation, and inflexible persistence (Vallerand et al., 2007). While harmonious passion in gaming correlates with positive outcomes like relaxation and creativity (Johnson et al., 2022; Mandryk et al., 2020; Przybylski et al., 2009; Tóth-Király et al., 2019), obsessive passion is linked to negative effects such as procrastination and tension (Johnson et al., 2022; Mandryk et al., 2020). Obsessive passion may result from using games to compensate for preexisting social difficulties in daily life, exacerbating mental health in a negative feedback loop (Johnson et al., 2022; Kowert et al., 2015).

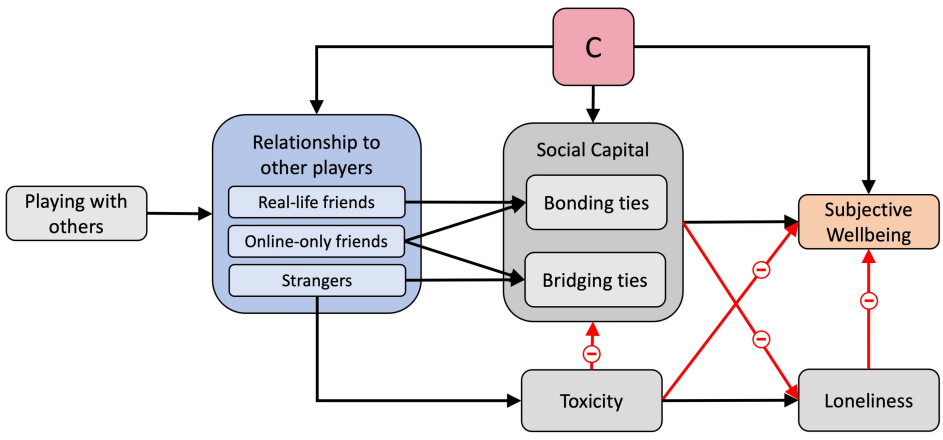
Recent adaptations of this model propose a quadripartite framework (Curran et al., 2015; Schellenberg et al., 2019), allowing for coexisting passion: pure harmonious passion, mixed passion no passion, and pure obsessive passion (Schellenberg et al., 2019). This framework argues that pure harmonious passion and mixed passion enhance mental health, whereas pure obsessive passion detracts from it and has seen support in research on games (Johnson et al., 2022).

Our example causal model (Figure 7) depicts relationships between passion, compensatory behaviors, and subjective meaning in life. Here, harmonious passion is expected to positively impact the person's experience of meaning in their life. On the other hand, obsessive passion—which is produced by a feeling of unmet needs elsewhere in daily life—is proposed to negatively affect meaning. The model therefore implicitly encodes the interaction between harmonious and obsessive passion proposed by the quadripartite model, meaning will be best supported by harmonious passion in the absence of obsessive passion and most harmed by obsessive passion in the absence of harmonious passion.

Positive Effects of Gaming on Mental Health

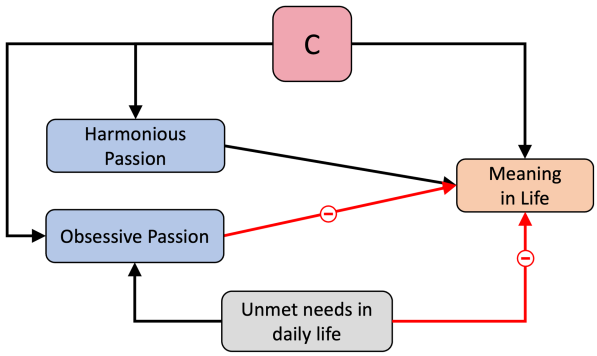
We now move on to positive hypothesized effects of gaming and mental health, which include eudaimonic experiences, exergaming, identity development, executive function, and applied gaming.

Figure 6
Example Directed Acyclic Graph for Social Capital



Note. Example counterfactual: Y^0: Subjective well-being after a 60-min solo gaming session. Y^1: Subjective well-being after an otherwise identical game session played with online-only friends. Type of exposure: Context-centered approach > Social context.

Figure 7
Example Directed Acyclic Graph for Passion



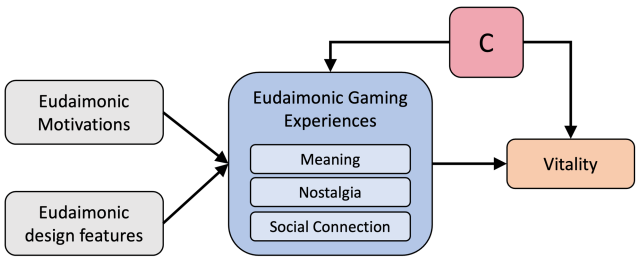
Note. Example counterfactual: Y^0: Self-reported meaning in life after gaming for 1 month with X1 harmonious passion and X2 obsessive passion. Y^1: Self-reported meaning in life after otherwise identical game behavior with X1 − 1 harmonious passion and X2 + 1 obsessive passion. Type of exposure: Player-centered approach > Purpose.

Eudaimonia

A growing body of work has explored eudaimonic play experiences, which diverge from hedonic experiences of pleasure and enjoyment by focusing on feelings of meaning or self-actualization. Despite sometimes being characterized as thoughtless and vapid entertainment, video games are adept at fostering such deeper experiences (Daneels et al., 2023). Eudaimonia in games can manifest as feelings of meaning or appreciation (Oliver et al., 2016), close emotional connection to characters or other players (Colder Carras et al., 2018), perspective change (Whitby et al., 2019), flow (Vella et al., 2013), nostalgia (Wulf & Baldwin, 2020), and more.

Our proposed model (Figure 8) depicts a theory in which eudaimonic motivations for play and eudaimonia-supportive design features (say, the presence of moral choices in a game) lead players to have different degrees of eudaimonic gaming experiences, the exposure. Here, eudaimonic experiences in games comprised several subaspects, including meaning, nostalgia, and social connectedness (eudaimonic experience is thus envisioned here as a formative, rather than reflexive, construct; e.g., A. J. van Rooij et al., 2017). The experience of eudaimonia in games then contributes to vitality—a common measure of eudaimonic well-being (e.g., Schnall et al., 2010; Tyack & Wyeth, 2021).

Figure 8
Example Directed Acyclic Graph for Eudaimonia



Note. Example counterfactual: Y^0: Vitality after a 2-hr gaming session with X self-reported nostalgia. Y^1: Vitality after an otherwise identical game session with X + 1 self-reported nostalgia. Type of exposure: Player-centered approach > Player experience.

Exergames and Physical Activity

Exergames—video games that incorporate physical activity—can enhance mental health due to the benefits of exercise (Mikkelsen et al., 2017). Examples like *Ring Fit Adventure* and *Dance Dance Revolution* can boost physical activity and potentially reduce depression and anxiety symptoms (J. Li et al., 2016; Viana et al., 2020). Despite these benefits, evidence comparing exergames to other interventions is mixed, highlighting the need for further high-quality trials (Rahmani & Boren, 2012). As various game types can be made into exergames (e.g., role-playing games, puzzle games), the exposure is feature: the presence of movement controls or body tracking that encourages or requires physical activity.

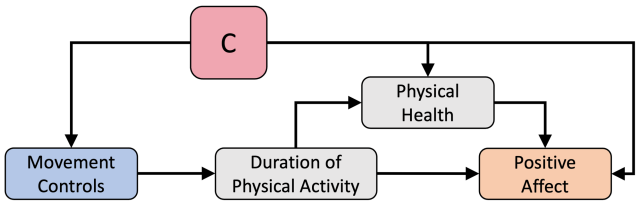
We present an abstracted causal model in Figure 9, where the exposure is playing a game with movement controls versus playing the same game without movement controls. We predict that movement controls lead to greater duration of physical activity, producing short-term positive affect consistent with previous exercise research (Hogan et al., 2013). Longer term, greater physical activity also leads to improved physical health, which further enhances positive affect (Cadenas-Sanchez et al., 2021).

Identity Development

Especially in adolescence, but throughout one's lifespan, people engage in identity construction—answering the question "who am I?" Following Granic et al. (2020), gaming and other media use can support this process both intrapersonally (by supporting agency and communion) and interpersonally (by supporting *elaboration*, *high-quality listening*, and *time and space* to grapple with identity paradoxes). For parsimony and because gaming is increasingly multiplayer, we focus here on the interpersonal factors. Elaboration—being asked probing questions and receiving evaluative comments—can be supported in discussions with other players, for example, when being asked about one's unique perspective on what changes the developers should make in a future update. Gaming spaces support high-quality listening by giving players a low-stakes, shared locus of attention and an opportunity to connect with teammates more cohesively than in less structured interactions (Ballou et al., 2022; Deterding, 2009). Gaming affords time and space to experiment with different identity and personality characteristics (e.g., gender-bending, playing more assertively, as a caretaker). This might be especially important for marginalized players, for example, children with attention-deficit/hyperactivity disorder or autism playing games to support social development and school performance (Bassiouni & Hackley, 2016; Zolyomi & Schmalz, 2017). Designing games that best support neurodivergent players' needs remains an ongoing challenge (Spiel & Gerling, 2021).

In our proposed model (Figure 10), we thus predict that playing alongside other players who exhibit high-quality listening, as compared to otherwise identical solo gaming behavior, will support narrative coherence—one way previous studies have operationalized identity development based on the stories people tell about themselves (Adler, 2012). This is, therefore, an exposure at the player experience and social context levels. Greater narrative coherence is predicted to result in reduced suicidal ideation, an

Figure 9
Example Directed Acyclic Graph for Exergames



Note. Example counterfactual: Compared to playing an otherwise identically designed game, the addition of movement controls. Example counterfactual: Y^0: Positive affect after playing 2 hr of a puzzle game per week for 4 weeks with handheld controls. Y^1: Positive affect playing an otherwise identical game for the same period with movement controls. Type of exposure: Game-centered approach > Feature.

especially salient issue for people with marginalized identity characteristics (Busby et al., 2020).

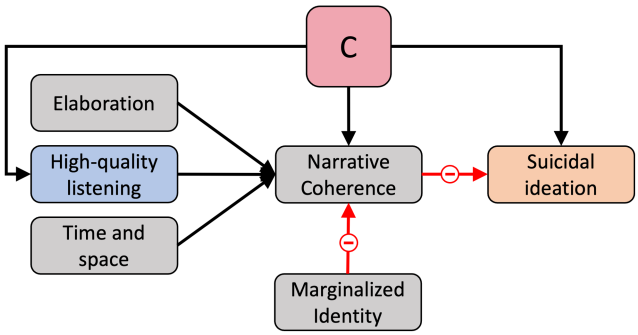
Executive Function/Cognitive Benefits

A large (but mixed) body of work has investigated whether playing video games can improve cognitive and perceptual abilities (Bediou et al., 2018; Hilgard, Sala, et al., 2019). Focus has largely been on games with action mechanics, characterized by intense temporal processing demands, simultaneous attention to task-relevant items in both focal and peripheral areas, presence of visual clutter, and complex motor response demands (Green et al., 2016). Some research indicates that regular (action) game players better integrate multiple sources of sensory information, process stimuli more quickly, and more selectively attend to relevant stimuli (see, e.g., Green et al., 2016, for a review). However, a reanalysis found evidence for publication bias and called into question the size of any such effects (Hilgard, Sala, et al., 2019).

Improved executive function through gaming might benefit mental health across the lifespan (P. G. Williams et al., 2017). Greater executive function predicts decreased symptoms of psychopathology 2 years later (Halse et al., 2022; Letkiewicz et al., 2014), protects against overeating and substance use disorders (P. G. Williams et al., 2017), and aids in stress management and recovery (P. G. Williams et al., 2017). Hemenover and Bowman (2018) connect these dots, positing a process whereby gaming leads to improved executive function and thereby improved emotion regulation.

Our proposed model is presented in Figure 11. Here, the exposure is playing a video game with action mechanics, causally contrasted with playing an otherwise identical game with no action mechanics—a contrast thus at the level of analysis of game feature(s). Exposure to action mechanics is predicted to lead to improved executive function in the form of working memory and attention control, which in turn causes the person to better deal with stress (P. G. Williams et al., 2009).

Figure 10
Example Directed Acyclic Graph for Identity Development



Note. Example counterfactual: Y^0: Suicidal ideation after playing games solo for 6 months. Y^1: Suicidal ideation after otherwise identical gaming behavior played with others who demonstrate high-quality listening. Type of exposure: Context-centered approach > Social context.

Applied Games for Therapeutic Benefits

This review focuses on commercial games. However, we would be remiss not to mention *applied* games designed with a specific (mental health) goal in mind. Applied games have been used to administer anxiety interventions (M. van Rooij et al., 2016), exposure therapy for phobias (P. Lindner, Miloff, et al., 2020), cognitive behavioral therapy for depression (Roepke et al., 2015), and attention-deficit/hyperactivity disorder (Kollins et al., 2020)—though not without controversy (Evans et al., 2021). A recent review of randomized controlled trials with applied games found benefits for social skills, memory, anxiety, depression and attention-deficit/hyperactivity disorder, and other outcomes (Wols et al., 2024).

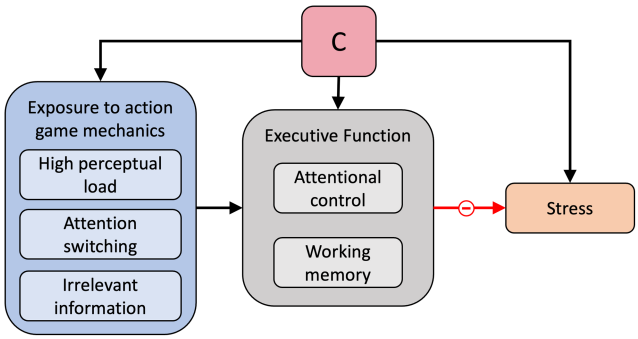
In contrast to commercial games, where mental health benefits may be largely incidental relative to the designers' intentions, applied games must carefully avoid "chocolate covered broccoli" (Bruckmann, 1999) or a superficial layer of gamified elements around the primary applied goal. As such, not all applied games will be effective. Nonetheless, well-designed applied games are poised to become an effective and increasingly common medium for therapeutic interventions (Fleming et al., 2017).

Our simplified causal model (Figure 12) shows mediation via motivation and treatment adherence. The core idea is that having a gamified (vs. a nongamified) treatment makes it easier and/or more enjoyable to persist with the treatment, thereby increasing motivation to engage with it. Using a gamified cognitive behavioral therapy treatment for depression, the model indicates that people who received the gamified treatment are more intrinsically and extrinsically motivated to persist with the therapy, have greater treatment adherence, and ultimately experience reduced depression symptoms relative to the alternative universe where they were given the nongamified treatment. We include an additional mediated path through knowledge growth; many applied games focus on educational outcomes (e.g., understanding of one's cancer; Kato et al., 2008) that many ultimately support mental health as well.

Negative Effects of Gaming on Mental Health

In this last section, we discuss research topics that hypothesize negative effects.

Figure 11
Example Directed Acyclic Graph for Executive Function



Note. Example counterfactual: Y^0: Stress after playing a game assessed by expert designers to be low cognitive demand 60 min/week for 3 months. Y^1: Stress after playing an otherwise identically designed game assessed by experts as high-cognitive demand for the same period. Type of exposure: Game-centered approach > Feature.

Displacement

The *displacement hypothesis* posits that time spent on a media activity zero-sum displaces other, more psychosocially beneficial activities. The displacement hypothesis targets the temporal context level of analysis: the counterfactual of *any* gaming as compared to time spent doing a nongaming activity. Commonly cited displaced activities include gaming leading to lost sleep (Guo et al., 2022), less physical activity (Kohorst et al., 2018), lower performance at work or school (Drummond & Sauer, 2020), or failure to maintain social relationships (Kowert et al., 2014). In the most extreme examples, gaming can displace all other life activities to the point of player death after multiple days of uninterrupted gaming (Kuperczko et al., 2022). Prominent critiques of the displacement hypothesis include that people's time budgets are flexible; that activities typically "displace" similar activities that serve the same psychosocial functions; or that displacement reflects adults' normative views on the activities they believe young people *should* undertake, regardless of actual developmental suitability or psychosocial benefits (Mutz et al., 1993).

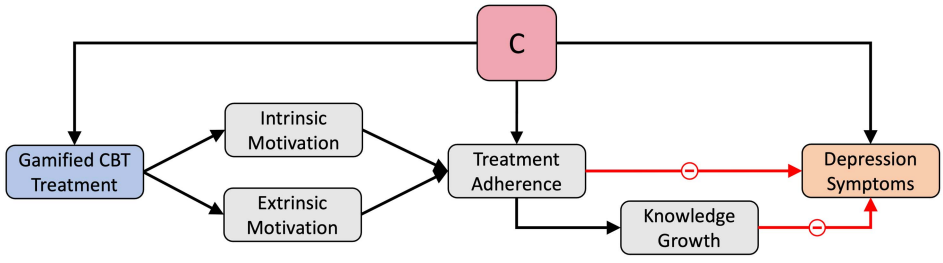
Our example causal model Figure 13 reflects recent distinctions drawn between the harmful displacement of health-relevant life domains, as opposed to the benign displacement of other leisure domains (Ballou & Deterding, 2023). The model proposes that greater playtime reduces the time spent maintaining one or more other health-relevant life domains: work or school performance, physical health and sleep, and/or social relationships. Spending less time in these areas results in diminished functioning, characterized by feelings of guilt (given poor work or school performance), loneliness (given deteriorating social relationships), and greater fatigue (given less focus on health behaviors). Together, this impaired functioning causes lower life satisfaction.

We emphasize that we do not think this model is a good one—evidence indicates that the majority of players do not seem to suffer as a result of increased playtime (Ballou et al., 2024; Vuorre et al., 2022). To understand any effects, it is thus critical to understand what other activities the person *would have* engaged in—what other life domains is playtime (at this moment, for this person) displacing (Magnusson et al., 2024)? Little is known about patterns of specific displaced activities; further research using, for example, time-use diaries, interviews, and ecological analyses can help shed light (Orben, 2022). How much people play games, how much time they spend on other activities, and their mental health are confounded by factors such as income, care responsibilities, disabilities, and so on. Without comprehensively identifying and controlling for these, estimating a causal effect of playtime on well-being is fruitless.

Financial Harms

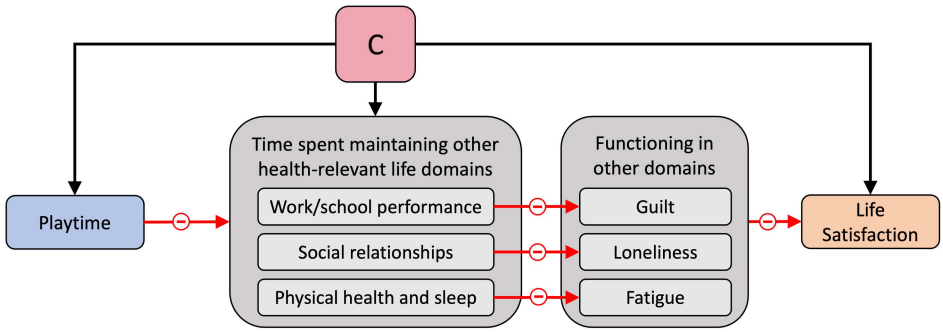
Substantial evidence links certain game features and business models to financial harms and mental health consequences. Broadly, this includes gaming–gambling convergence (Denoo et al., 2023; e.g., the presence of loot boxes, defined in-game items purchasable for real-world currency and whose contents are unknown at the time of purchase) and other (nongambling) predatory monetization strategies such as "pay to win"/"pay to skip" mechanics or layers of virtual currency that disguise the true cost of items (Petrovskaya & Zendle, 2021). Loot boxes in particular have been robustly linked with problem gambling (Zendle & Cairns, 2018, 2019; Zendle et al., 2019), raising concerns that loot boxes either prey on people with

Figure 12
Example Directed Acyclic Graph for Applied Games



Note. Example counterfactual: Y^0: Depression symptoms after 3 months of cognitive behavioral therapy treatment delivered via telehealth. Y^1: Depression symptoms after undertaking an otherwise identical treatment delivered via a digital game. Type of exposure: Game-centered approach > Content. CBT = cognitive behavioral therapy.

Figure 13
Example Directed Acyclic Graph for Displacement



Note. Example counterfactual: Y^0: Life satisfaction after 1 month of 10 hr of gaming per week. Y^1: Life satisfaction after 1 month of 10 hr of reading per week. Type of exposure: Context-centered approach > Temporal context.

gambling problems or cause people to become gamblers—in either case harming mental health.

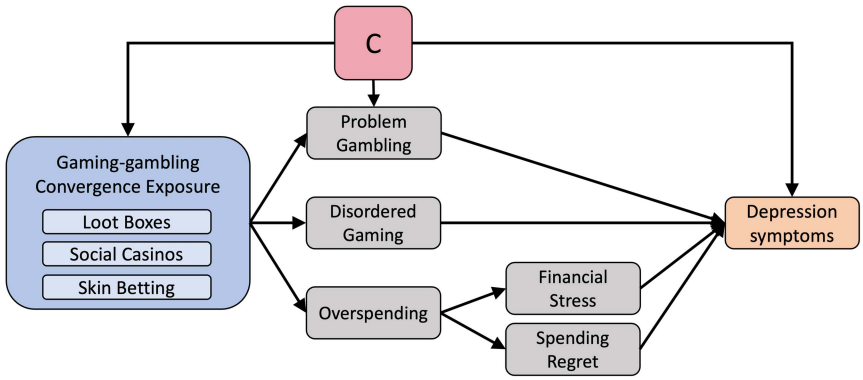
In our proposed causal model (Figure 14), playing a game with gambling-like features (e.g., loot boxes or skin betting options) versus playing the same game with no gambling-like features leads to higher likelihood of (a) developing symptoms of problem gambling, (b) playing in a dysregulated manner, and (c) spending beyond their means or intention (overspending). Each of these is expected to cause greater depressive symptoms—in the case of overspending, this might be mediated by financial strain and guilt (cf. Petrovskaya & Zendle, 2023).

Dysregulation

Dysregulated gaming, an umbrella term for situations when a player's inability to control their gaming results in psychological distress and impairment, is formally recognized as "internet gaming disorder" as a *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.) condition for further study (American Psychiatric Association, 2013) and "gaming disorder" in the *International Statistical Classification of Diseases and Related Health Problems* (11th ed.; World Health Organization, 2018). The counterfactual of interest here is play characterized by dysregulation symptoms versus play without such dysregulation symptoms—a contrast that spans the temporal context, purpose, and player experience levels. Certain genres (e.g., Laconi et al., 2017), monetization models (e.g., W. Li et al., 2019), or features (e.g., Flayelle et al., 2023) are more likely to produce dysregulated play.

Dysregulated gaming is linked with skipping school and worse grades (Rehbein et al., 2015), depression and loneliness (Ballou & Zendle, 2022), and social problems (Müller et al., 2015), among other outcomes. While some view dysregulated gaming as symptomatic of underlying issues (Ferguson & Colwell, 2020; A. J. van Rooij et al., 2018), others suggest it may be part of a bidirectional

Figure 14
Example Directed Acyclic Graph for Financial Harms



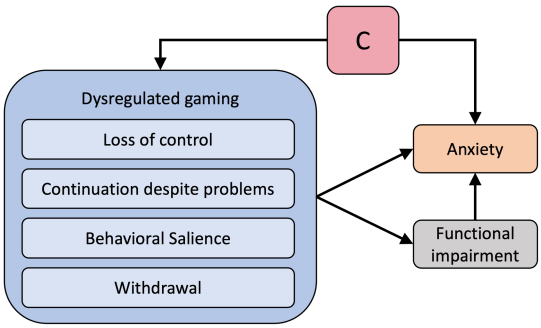
Note. Example counterfactual: Y^0: Depression symptoms after playing a game with no predatory monetization mechanics for 6 months. Y^1: Depression symptoms after playing an otherwise identical game with pay-to-win monetization for the same period. Type of exposure: Game-centered approach > Business model.

relationship with mental health, exacerbating problems like social withdrawal (Przybylski & Weinstein, 2019). Not all highly engaged players exhibit signs of impairment (Deleuze et al., 2018; Griffiths, 2010; A. J. van Rooij et al., 2011), leading to repeated calls for more work on differentiating high-engagement versus disordered patterns of play (Billieux et al., 2019; Deleuze et al., 2017; Ferguson et al., 2011; Karhulahti et al., 2022).

As specifying bidirectional relationships in DAGs is challenge, our abstracted model (Figure 15) depicts a one-directional relationship whereby dysregulated gaming is a formative construct comprised of the *International Statistical Classification of Diseases and Related Health Problems* (11th ed.) criteria: a loss of control over play, continuation of play despite negative consequences, and increasing behavioral salience such that other areas of life suffer (see the Displacement section). This dysregulated play pattern results in both a direct effect on psychological distress, here operationalized as greater anxiety symptoms, as well as a mediated effect whereby gaming interferes with functioning in other life domains and results in increased anxiety symptoms.

Figure 15

Example Directed Acyclic Graph for Dysregulation



Note. Example counterfactual: Y^0: Anxiety after 12 months of experiencing X self-reported withdrawal symptoms when not playing games. Y^1: Anxiety after 12 months of experiencing X + 1 self-reported withdrawal symptoms when not playing games. Type of exposure: Player-centered approach > Integration.

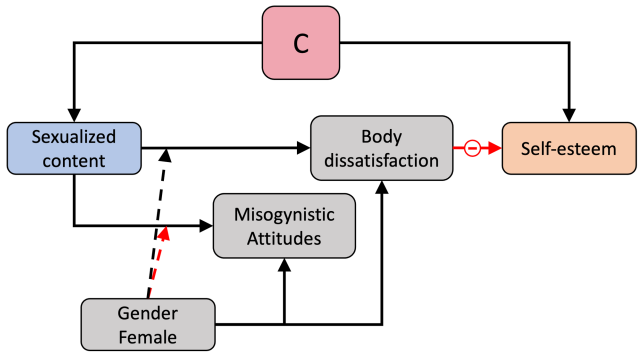
Sexualization

Since the early years of the medium, games—particularly those with more mature ratings—have frequently included sexualized content, especially in the presentation of women and female characters, including tropes such as damsels in distress (e.g., Zelda), scantily clad women in combat situations (e.g., *Mortal Kombat*), and prostitution (e.g., the *Grand Theft Auto* series). Exposure to such sexualized content might result in body dysmorphic disorder (D. Lindner, Trible, et al., 2020; Sylvia et al., 2014) and more misogynistic attitudes (particularly among male players; Yao et al., 2010), although not all studies support this claim (Ferguson et al., 2022; Read et al., 2018; Skowronski et al., 2021). If, however, sexualized content in games has longer term, accumulative effects on body dissatisfaction or body dysmorphic disorder, this would in turn have obvious negative consequences for mental health.

In our example model (Figure 16), exposure to sexualized game content in the form of a sexualized female main character is

Figure 16

Example Directed Acyclic Graph for Sexualization



Note. Example counterfactual: Y^0: Self-esteem after 50 hr of playing a game with no sexualized content. Y^1: Self-esteem after 50 hr of playing an otherwise identical game with a sexualized female main character. Type of exposure: Game-centered approach > Content.

hypothesized to result in lower body satisfaction and greater misogynistic attitudes. These effects are moderated, such that women experience a stronger effect on body satisfaction, and men experience a stronger effect on misogynistic attitudes. Body dissatisfaction predicts poorer mental health in the form of diminished self-esteem.

Discussion

This overview of 13 research topics connecting video gaming to mental health outcomes points to several important takeaways. First and foremost, we provide an overview of the field, systematizing an often underappreciated diversity of ways gaming can affect people. Second, we show that these effects arise through a wide range of exposures related not just to the game but to the player and the context of play. Third and last, we characterize these possible effects in explicitly causal terms, showing the importance of causal inference methods to collective progress. We discuss each takeaway in turn.

Diversity of Effects

The field has long recognized that the rich diversity of games and players produces a rich diversity of effects on mental health. Potential outcomes range from extremely positive, such as gaming providing a lifeline to grapple with identity challenges in adolescence, to extremely negative, such as the development of problem gambling via engagement with gambling-like mechanics in games. We hope our review concisely illustrated how varied gaming's impacts on player health can be. We build on previous reviews by incorporating more recent evidence into a framework that outlines three distinct levels of possible exposures (context-, game-, and player-centric; cf. Granic et al., 2014) and collate ambivalent, positive and negative effects in one place (cf. Halbrook et al., 2019).

These potential effects extend well beyond gaming disorder, which, due to its diagnostic status, receives disproportionate scientific attention. In treating players presenting with a gaming disorder, it is vital to understand that gaming may simultaneously have both positive and negative effects—for example, that gaming may

be displacing important work/school activities but also providing needed respite from a difficult family environment. To effectively treat such patients, clinicians will need to help ensure that the player has access to other means of achieving any such positive effects while managing the harmful aspects of the person's gaming.

It is worth noting that in nearly all of the above proposed effects, playtime is at best a moderator; almost never is the simple amount of time spent playing the primary exposure of interest. Following Orben's 2021 digital diet metaphor, focusing on playtime is akin to counting calories: it may be able to tell you about extreme overuse but has limited information about the healthiness of the diet. In absence of a theory that predicts direct effects of time spent playing any kind of game by anyone in any context, the frequent use of playtime as one of the main variables in predictive models of mental health is misguided. We recommend that researchers carefully consider the role of playtime in the hypothesized causal structure for their particular topic—as a predictor with a particular mechanism, as a moderator of other effects, or something else entirely—and make this explicit.

Qualitative research is a critical tool for advancing these theories. Players are often capable of describing how gaming affects their mental health (e.g., Iacovides & Mekler, 2019; Karhulahti et al., 2022), and qualitative methods can extract this information for causal models. It also complements limitations of experimental designs, such as observer effects (Klein et al., 2012), ethical constraints in the random assignment of mental health, and challenges in assessing long-term trajectories. We particularly encourage using methods where qualitative evidence directly informs causal, testable outputs, like grounded theory or mixed methods (Humphreys & Jacobs, 2023).

We hope that, in the future, these proposed effects will be integrated within larger theories and frameworks—after all, many factors that influence gaming's effects on people are likely shared with other domains such as nongaming media use, sports, education, and beyond. The multilevel leisure framework (Fancourt et al., 2021) might provide a valuable starting point here: it maps over 600 mechanisms by which leisure activities might affect health, spanning psychological, biological, social, and behavioral domains at individual (micro), group (meso), and societal (macro) levels. For instance, gaming's effect on stress relief might be classified as a micro-level psychological process within the affective states category, including mechanisms like "decreased experience of negative emotions."

Diversity of Exposures

Using the lens of our exposures framework, we highlight that proposed effects span many levels of analysis: sexualization focuses on in-game content, displacement on the temporal context, exergames on a feature, and so on. This underscores the clear responsibility for the field to be specific, in both theory and study design, about the exact aspect of gaming expected to impact mental health.

For researchers, the exposures framework offers a tool for assessing whether different studies are directly comparable—that is, whether they are testing similar exposures (and thereby similar counterfactuals) or are actually testing different underlying exposures (e.g., playtime vs. player experience). This may help resolve the "warring" meta-analyses reaching radically different conclusions across topics such as violent content and aggression (Anderson et al., 2010; Ferguson, 2015; Hilgard et al., 2017) and cognitive benefits of action game play (Bediou et al., 2018; Hilgard, Sala, et al., 2019). While much of the discrepancy in findings might be explainable by factors such as publication bias and methodology, another portion can be attributed to studies ostensibly addressing the same effect but with subtly different exposures and counterfactuals. We hope, therefore, that the exposure framework can act as a communal resource around which games researchers can coordinate their efforts for more systematic progress.

For clinicians and practitioners, this diversity in exposures highlights the importance of assessing games and players holistically: understanding how games affect a particular player involves nuanced knowledge of what the person plays, why they play, what context they play in, and what they experience when playing. Guidance about healthy play will be most effective when grounded in these exposures and that player's situation: for example, for one player it may be "do not play after 10 p.m." (a temporal context exposure, linked to potential displacement of sleep), for another it might be "stop play when you feel anxious about your social relationship with other players" (a player experience exposure, linked to potential social capital), and so forth. Such information can feed back into the theories in the form of moderation as we learn, for example, how individual factors such as age, developmental stage, and socioeconomic context affect susceptibility to these exposures and effects (L. A. Schneider et al., 2017).

Causality at the Forefront

We have highlighted causality by developing potential high-level, necessarily abstracted models of each reviewed topic. In doing so, we hope to encourage other researchers to do the same and align their theoretical frameworks, study designs, and statistical methods with causal interests where applicable.

We echo previous work in calling for studies to address the following three questions as carefully as possible (Lundberg et al., 2021):

1. *Does this study have a causal hypothesis, and if so, what is a best guess at the underlying causal structure of the system?* Many studies specify causal hypotheses (e.g., does increased need satisfaction in games *lead to* improved subjective well-being?). If a study has a causal interest, generating a plausible causal model in the form of a DAG is an invaluable first step. This need not be a perfect representation—none of those we produced above are—but it offers a starting point for connecting theory to data (Lundberg et al., 2021). Descriptive and qualitative research remain valuable for identifying new effects, developing understanding, honing terminology, and fleshing out theory by establishing boundary conditions. However, for research framed as confirmatory and causally oriented, causal inference principles should be followed.

2. *What study designs best facilitate the study of a causal estimand?* Where possible, randomized controlled trials (in conjunction with preregistration) give the best chance at unbiased causal inference—for example, by modifying

a game such that monetization features differ between two versions and assigning players to play one or the other. If this is not possible (e.g., because the exposure is a player experience factor that is difficult to isolate and manipulate), collecting multiple data points can facilitate the study of longitudinal and within-person associations, which are typically more closely related to a causal effect than between-person associations (Rohrer & Murayama, 2021).

3. *Are the statistical models aligned with the conceptual model specified at Step 1?* When one has a causal estimand, the underlying structure of the system directly informs the modeling approach. For example, if trait mindfulness affects both the likelihood of experiencing nostalgia during gameplay and one's mental health, it is a confound that needs to be controlled for or else the estimate of the relationship between nostalgia and mental health will be biased. However, if nostalgic experiences and mental health jointly cause players to feel less stressed during gameplay, stress during play is a collider that should *not* be controlled for. We encourage readers to familiarize themselves with DAGs and other tools for aligning their statistical models with their conceptual models (see, e.g., Rohrer, 2018, for a gentle introduction, and Dablander, 2020, for a more technical one).

In short, we echo previous calls for researchers to run toward causal inference, not away from it (Hernán, 2018). Rather than being a "dirty word" that provokes researchers to hedge (using the language of "associations," "risk factors," and "relationship"), we encourage researchers to make causal ambitions explicit, define specific counterfactuals, estimate causal effects accurately, and report transparently so that the community can collectively design, improve, and test causal models most effectively. Without clear causal definitions, our conclusions may not only be flawed but also so indistinct that they cannot be adequately challenged.

Limitations

As highlighted in the introduction, our list of causal questions surrounding video game play is not and likely can never be complete. There are potential effects we did not identify or include, effects we did identify but whose mechanisms or outcomes we have misspecified, and others we listed that might turn out unsubstantiated. By conducting a narrative review of a vast field, we are biased toward the research topics with which we are most familiar, such as need satisfaction and dysregulation. The evidence we present for each research topic is but a small snapshot, and we invite readers with greater specific expertise to add to, deconstruct, or revise these to more accurately reflect causal processes.

Conclusion

The wide variety of gaming's hypothesized effects on mental health paired with a lack of robust and generalizable evidence necessitates more focus on the clarity of causal models. Addressing the concerns of various stakeholders, including parents, players, game developers, policymakers, and clinicians, requires explicit attention to causality in designing and communicating our research. We argue that a shift toward a formalized approach to causal inference that emphasizes transparency and shared theoretical frameworks can pave the way for much-needed progress in the field. By providing an overview of the diverse ways in which gaming affects mental health, we hope to have mapped the gaming research landscape that encourages collaborative and iterative theory development and ultimately points researchers toward ways to best support players' digital well-being.

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Received June 26, 2024
Revision received November 17, 2024
Accepted November 19, 2024 ■